United States Department of the Interior
BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

In Reply Refer To: GE 1035A

October 31, 2017

Ms. Kimberly M. Bragg
Proteus Oil Pipeline Company, LLC
501 Westlake Park Boulevard, WL1-LR4
Houston, TX 77079

Dear Ms. Bragg:

Reference is made to your request dated December 12, 2016, received by this office on December 21, 2016, with supplemental data submitted on June 14, 2017, and September 15, 2017, to establish, install, operate and maintain a 200-foot wide Right-of-way (ROW). The pipeline ROW application is for Pipeline Segment Number (PSN) 19735, (ROW) OCS-G29368.

For ease of reference, PSN 19735 is described as follows:

| Segment Number | Size (Inches) | Length (feet) | Service | From | To |
|---|---|---|---|---|---|
| 19735 | 4 | 36,778 | Gas | SSTI | Platform E Expansion |
| | | | | West Delta Area | South Pass Area |
| | | | | Block 129 | Block 89 |

Pursuant to 43 U.S.C. 1334(e) and 30 CFR 250.1000(d), your application is hereby approved.

The approval is subject to the following:

1) You shall construct, operate and maintain the pipeline in accordance with the appropriate Department of Transportation (DOT) regulations.

2) In accordance with 30 CFR 250.1008(c), you shall report to the Regional Supervisor when this pipeline is taken out of service. If the period of time in which the pipeline is out of service is greater than 60 days, written confirmation is also required. A pipeline is out of service when it has not been used to transport for more than 30 consecutive days. If the pipeline is out of service for 60 days, you must apply for a temporary cessation of operations if you wish to maintain this pipeline ROW grant. In accordance with 30 CFR 250.1014, a pipeline ROW not being used for the purpose for which the grant was made expires and the purpose for this pipeline ROW grant is to transport gas.

3) In accordance with 30 CFR 250.1008(e), you must notify the Regional Supervisor before the repair of this pipeline or as soon as practical. Your notification must be accompanied by payment of the service fee listed in 30 CFR 250.125. You must submit a detailed report of the repair of to the Regional Supervisor within 30 days after the completion of the repair. In the report you must include a description of the repair, results of the pressure test, and the date the pipeline was returned to service.

| MAOP (psig) | MAOP Determination |
|---|---|
| 1,440 | Hydrostatic Pressure Test, Subsea Tie-in |

The description of Pipeline ROW OCS-G29368 is described as follows:

Pipeline Right-of-way (ROW) OCS-G29368 is a 200-foot wide and approximately 6.97 miles (36,778 feet) long corridor associated with a 4-inch Pipeline Segment Number (PSN) 19735. The purpose of pipeline ROW OCS-G29368 is to install, maintain and operate PSN 19735 and to transport gas originating from a subsea tie in in West Delta Area Block 129 through West Delta Area Block 128, 145 through South Pass Area Blocks 88 terminating at Platform E expansion in South Pass Area Block 89.

Please be reminded that, in accordance with 30 CFR 250.1008(a), you must notify the Regional Supervisor at least 48 hours prior to commencing the installation or relocation of a pipeline or conducting a pressure test on the pipeline. In accordance with 30 CFR 250.1008(b), you are reminded to submit a report to the Regional Supervisor within 90 days after completion of any pipeline construction. Also in accordance with a Letter to Lessees dated April 18, 1991, a copy of the as-built plat(s) must be submitted to the NOAA-National Ocean Service-OCS, Chief, Nautical Data Branch, N/CS261, Sta. 7331, 1315 East-West Highway, Silver Spring, MD, 20910-3282.

Sincerely,

PHILLIP SMITH

Digitally signed by PHILLIP SMITH
Date: 2017.10.31 12:03:38 -05'00'

(for) Bryan A. Domangue
Acting Regional Supervisor
Regional Field Operations

cc: Bill Lowery
US DOT PHMSA
Bill.Lowry@dot.gov

**Proteus Oil Pipeline Company, LLC**
501 Westlake Park Boulevard, WL1-LR4
Houston, Texas 77079

December 12, 2016

Ms. Angie D. Gobert
Pipeline Section Chief
Office of Field Operations
Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Blvd., GE 1035A
New Orleans, Louisiana 70123-2394

**RE: Application for 4-inch Fuel Gas Pipeline, Proposed Length 6.97 Miles, Located in the West Delta and South Pass areas, OCS Federal Waters, Gulf of Mexico**

Ms. Gobert:

Pursuant to the authority granted in Section 5(e) of the Outer Continental Shelf Lands Act (43 U.S.C. 1331 et seq, P.L. 212, 67 Stat. 462), as amended (P.L. 95-372, 92 Sta. 629) and in compliance with regulations contained in Title 30 CFR Part 250, Subpart J, Proteus Oil Pipeline Company, LLC ("Proteus") is filing this application for the construction, maintenance and operation of a 4-inch fuel gas pipeline to be installed in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, all on the Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico (GOM), Offshore Louisiana. The pipeline approximate length will be 36,778 feet (6.97 miles).

The pipeline will be used to transport fuel gas from the Shell Pipeline Company LP 12-Inch pipeline (Segment No.10778) via a hot tap to a new jacket platform located at latitude 28° 41' 48" N and longitude 89° 23' 45" W, in the South Pass Block 89. Water depth along the fuel gas pipeline route is approximately 362-feet at the 12-inch Shell gas pipeline hot tap in WD129 to 395-feet at the new jacket platform in SP89. The entire pipeline is in water depths in excess of 200-feet, and therefore will not be buried. A dive vessel will complete installation of the mats and tie-in spools. The proposed start of construction activities is scheduled to begin in June of 2017.

The pipeline will be regulated by Pipeline Hazardous Materials Administration, Department of Transportation and will comply with 49 CFR, Part 192. The fuel gas pipeline will be operated by BP Pipelines (North America) Inc. ("BP") (GOM Company 0751). The proposed pipeline route crosses the Texas Eastern 20-inch gas pipeline (Segment #6392) in SP88, the Texas Eastern 12-inch gas pipeline (Segment #9597) in SP88, the Energy XXI 12-inch oil pipeline (Segment #6013) in SP89, the Eni US 12-inch oil pipeline (Segment #13317) in SP89, and the Black Elk Energy 6-inch supply umbilical (Segment #10456) in SP89. In accordance with applicable regulations, the applicant has delivered a copy of this application and attachments thereto to each Lessee or Right-of-Way Holder. Copies of the proof of delivery showing date and signature as evidence of service upon Lessees or Right-of-Way Holders will be forwarded to your office upon our receipt. Alternatively, a letter from the Lessee or Right-of-Way Holder expressing no objection to the proposed project will be submitted in lieu of proof of delivery.

In support of this application and for your review and use, please find three (3) hard copies of the permit application along with an electronic copy (USB), plats, and Oceaneering Archaeological, Engineering and Hazard Assessment. Should you have any questions or require additional information please contact Mr. Mark Buteau at 337-735-5303.

Sincerely,

Kimberly M. Bragg

Kimberly M. Bragg
Vice President

| PROPOSED 4.5" OD GAS PIPELINE DATASHEET<br>49 CFR 192, 30 CFR 250 SUBPART J | |
|---|---|
| Date | 30 September 2016 |
| Location From (Area, Block, Lease) | West Delta, Block 129, OCS-G-12070 |
| Location to (Area, Block, Lease) | South Pass, Block 89, OCS-G-01618 |
| Length and Service (Oil Pipeline) | 6.97 miles (36,778 ft) |
| Size, Weight and Grade of Pipeline | 4.5" OD, 0.25" WT, 11.35 lb/ft in air empty, API 5L X65 PSL2 Steel Pipe |
| Products Transported | Fuel gas |
| Maximum Water Depth Traversed | 412 ft |
| Corrosion Protection | See below |
| Anode Type (Pipeline) | Bracelet Anodes; Al/Zn/In Alloy |
| Anode Type (PLET, hot tap) | Flush-mount Anodes; Al/Zn/In Alloy |
| Anode Weigh Required | Pipeline: 91.7 lb total per 1,680 ft<br>PLET, hot tap and tie-in spool: Estimate 80 lb total |
| Anode Weight Provided | Pipeline: 92 lb total per 1,680 ft<br>PLET, hot tap and tie-in spool: Estimate 84 lb total |
| Anode Quantity | Pipeline: 2 - 46 lb per 1,680 ft (total of 22 - 46 lb anodes)<br>PLET, hot tap and tie-in spool: Estimate 1 - 8 lb, 3 - 10 lb, 1 - 46 lb |
| Anode Spacing (Pipeline) | 1,680 ft |
| Anode Life | 30 Years |
| Anode Current Capacity | 1500 A•hr/kg at 140 °F, 2000 A•hr/kg at 40 °F |
| External Coating System (Pipeline) | 97mil 3LPP (field joints FBE, 16 mils) |
| External Coating System (Riser) | 16 mils FBE, 500 mils Splashtron (±15 ft MSL) |
| Internal Coating System (Pipeline & Riser) | None |
| Bulk Specific Gravity of Empty Pipeline | 1.6 in seawater |
| Product Anticipated Density (standard condition of 60°F & 14.69 psi) | Gas density = 0.853 kg/m$^3$<br>Produced water specific gravity = 1.0 |
| Burial Depth of Pipeline | N/A |
| Maximum Source Pressure | Source fuel gas pipeline 1,200 psig (maximum) |
| Pipeline Design Pressure | 1,440 psig @ EL+75 ft |
| Pipeline Design Temperature | -20 °F to 140 °F |
| Flange Pressure Rating | ANSI/ASME B16.5, Class 900, 200 °F at the source<br>ANSI/ASME B16.5, Class 600, 200 °F all other equipment |
| Valve Pressure Rating | 2" ANSI Class 600 ball valve<br>4" ANSI Class 600 ball valve |
| Pipeline MAOP | 1,440 psig @ EL+75 ft |
| Onshore Hydrostatic Test Pressure & Test Duration | Pipeline: 1.25 x MAOP = 1,800psig for 8 hours<br>Riser: 1.5 x MAOP = 2,160psig for 8 hours |
| In-place (Offshore) Hydrostatic Test Pressure & Test Duration | 1.25 x MAOP = 1,800psig (EL+75ft above MSL) for 8 hours |
| Hydrotest Medium | Fresh water for tests conducted onshore<br>Treated seawater for tests conducted in-place (offshore) |
| MAOP of Receiving Facility | 1,440 psig @ EL+75 ft |
| Proposed Date of Commencing Installation | 2Q 2017 |
| Estimated Time of Construction | 1 month (installation spread) |

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**Global Projects Organization**

# SP89E Expansion

## SP89E-B Pipeline Permit Application

| Rev | Reason for Issue | Author | Date | Checker | Date | Approver | Date |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| B01 | Issued for Use | Marcus Marinos | 06-Jun-17 | Aiman Al-showaiter | 06-Jun-17 | Robert Clark | 06-Jun-17 |
| A01 | Issued for Client Review | Marcus Marinos | 23-May-17 | Aiman Al-showaiter | 23-May-17 | Robert Clark | 23-May-17 |
| 01 | Issued for Internal Review | Marcus Marinos | 22-May-17 | Aiman Al-showaiter | 23-May-17 | Robert Clark | 23-May-17 |

WGM Project Number: 106684

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GM020-PL-PRM-226-F14-0001

Rev

B01

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**Revision History**

| Amendment Date | Revision Number | Amender Initials | Amendment |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

**Reviewers**

| Role | Name | Date Reviewed | Signed |
|---|---|---|---|
| Subsea Pipeline Lead | Aiman Al-showaiter | 6 June 2017 | |
| Subsea Project Manager | Robert Clark | 6 June 2017 | |
| | | | |
| | | | |
| | | | |


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# 1 Introduction

## 1.1 Overview

Platform SP89E is an existing unmanned BP hub platform located at latitude 28° 41' 51" N and longitude 89° 23' 45" W. Water depth at the platform is about 400-feet.

The existing platform provides a connection between the incoming 28in Proteus crude pipeline from BP Thunder Horse to the departing 30in Endymion crude pipeline which reaches the shore at Grand Isle, Louisiana, about 54 miles from the existing platform and continues to Clovelly, Louisiana, for a total distance of 89 miles from the existing platform.

The project will also include a new platform (SP89E-B) located at latitude 28° 41' 48" N and longitude 89° 23' 45" W, which will be connected to the existing platform by a short bridge. The new platform will support the topsides facilities required for the SP89E Expansion and provide tie-in points and risers for the Mattox pipeline and a future fuel gas pipeline for power generation. The existing platform will remain operational during the new platform and bridge installation thereby allowing production to continue. This will minimize the shutdown time required for tie-ins.

The future Mattox pipeline is a 24-inch crude pipeline from Shell Appomattox to the Endymion pipeline. The pipeline is approximately 90 miles in length. Shell will have the responsibility for the construction of the pipeline through a double block valve located in the proximity of the new platform. The spool pieces connecting the 24-inch pipeline to the 20.2-inch riser will include the necessary diameter transition. The fuel gas pipeline will be a new 4.5-inch pipeline connected to the existing Shell 12-inch gas line via a subsea hot-tap. The gas will supply fuel for the topside facilities on the new platform.

The crude from the Proteus line will flow up the riser onto the existing platform and then across the bridge to the new platform. The Proteus flow will then be combined with the crude flowing from the Mattox line and the combined flow will flow back across the bridge to the existing platform and depart through the Endymion line.

The overall field layout for the 4.5-inch fuel gas pipeline is shown in Figure 1 below.

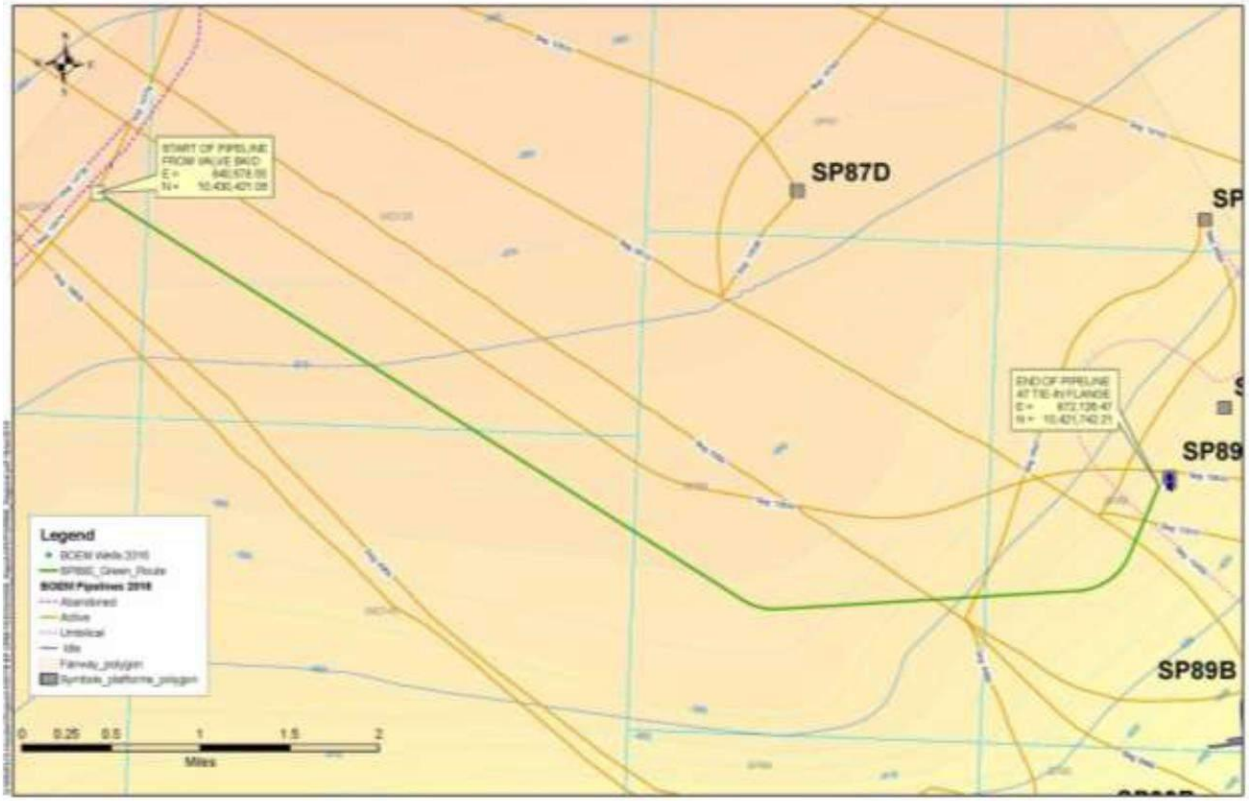


**Figure 1: Overall Field Layout**


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## 1.2 Scope

The SP89E Expansion right-of-way pipeline permit application scope extends from the hot tap piping assembly at the 12-inch Shell line to the pipeline to riser tie-in spool flange at the proposed jacket platform (SP89E-B) located at latitude 28° 41' 48" N and longitude 89° 23' 45" W. The hot tap piping assembly and valve piping assembly are located within WD Block 129 (Lease OCS-G-12070). The proposed pipeline route crosses through (from west to east) WD 129, WD 128, WD 145, SP 88, and terminates at the proposed jacket platform within SP 89 (Lease OCS-G-01618).

Note that the hot tap, riser and riser tie-in spool are not included as a part of this application permit.

# 2 Abbreviations and Definitions

Table 1 lists abbreviations used in this document.

**Table 1: Abbreviations**

| Abbreviation | Phrase |
|---|---|
| AUV | Autonomous Underwater Vehicle |
| BSEE | Bureau of Safety and Environmental Enforcement |
| CD | Compact Disc |
| CFR | Code of Federal Regulations |
| CP | Cathodic Protection |
| DOI | Department of Interior |
| EL | Elevation |
| FIV | Flow Isolation Valve |
| FSV | Flow Safety Valve |
| GoM | Gulf of Mexico |
| HTP | Hydrostatic Test Pressure |
| ID | Inside Diameter |
| ITL | Information to Lessees |
| MAOP | Maximum Allowable Operating Pressure |
| MASP | Maximum Anticipated Surface Pressure |
| MSL | Mean Sea Level |
| MSP | Maximum Source Pressure |
| NTL | Notice to Lessees and Operators |
| OCS | Outer Continental Shelf |
| OD | Outside Diameter |
| PL | Pipeline |
| PLET | Pipeline End Termination |
| PSHL | High- and Low-Pressure Sensors |
| ROV | Remotely Operated Vehicle |
| ROW | Right-of-Way |
| SDV | Shut Down Valve |
| SG | Specific Gravity |
| SMYS | Specified Minimum Yield Strength |
| SP | South Pass |


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| Abbreviation | Phrase |
|---|---|
| VIV | Vortex-induced Vibration |
| WD | West Delta |
| WT | Wall Thickness |

# 3 System Description

## 3.1 Pipeline System Design

Table 2 lists the design information for the SP89E-B pipeline system.

**Table 2: Pipeline System Design Information**

| Property | Value |
|---|---|
| System Design Pressure at +93 ft Elevation above MSL | 1,440 psig |
| Maximum Allowable Operating Pressure (MAOP) at +93 ft Elevation above MSL | 1,440 psig |
| Maximum Source Pressure (MSP) at Hot Tap (12" Shell pipeline, PSN 10778, G-15681) | 1,200 psig |
| Maximum Design Temperature | 140 °F |
| On-bottom Ambient Seawater Temperature | 55.4 °F |
| Maximum Water Depth Along Route | 398.4 ft |
| Maximum Throughput | 7 MMSCFD |
| Sediment and Water Content | 1% |
| Operating Design Life | 30 years |

## 3.2 List of Components

Table 3 presents the SP89E-B pipeline system components. The pipe and non-pipe components of the pipeline system are graphically shown on the SP89E Process Safety Flow Schematic attached in Appendix C.

**Table 3: SP89E Pipeline System Components**

| Components | Water Depth (ft) | Design Pressure (psig) | Design Temperature (°F) | Design Code |
|---|---|---|---|---|
| Hot Tap Piping Assembly[1] | 344 | 1,440 | -20 to +140 | ASME/ANSI B31.8, API Standard 1104, API RP 2201 |
| Valve Piping Assembly | 344 | 1,440 | -20 to +140 | ASME/ANSI B31.8, ANSI/API Spec 6D, API Standard 1104 |
| Pipeline | 344 to 398.4 | 1,440 | -20 to +140 | ASME/ANSI B31.8, API Spec 5L, API Standard 1104, API RP 1111 |
| Riser and Tie-in Spool[1] | 392.4 | 1,440 | -20 to +140 | ASME/ANSI B31.8, API Spec 5L, API Standard 1104 |

Notes:

1. Hot tap, riser and tie-in spool segments are not included in this application permit and presented for reference only.


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## 3.3 Hot Tap Assembly

Fuel gas will be supplied to the proposed jacket platform (SP89E-B) by a hot tap assembly on the 12-inch Shell Gas pipeline (Shell PSN 10778 (G-15681) – WD143A - WD128SSTI). Equipment located on the hot tap piping assembly includes:

- Manual isolation dual ball valve
- Manual bleed ball valve

Note that the hot tap clamp shall be permitted separately from this application.

## 3.4 Pipeline End Termination

Pigging functionality for the SP89E-B pipeline system will be added via a piggable valve piping assembly (PLET) located immediately after the hot tap assembly. Equipment located on the PLET assembly includes:

- Subsea pig launcher (retrievable, temporary)
- Manual isolation ball valve (quantity three)
- Manual bleed ball valve

## 3.5 Pipeline

The proposed 4.5-inch OD pipe has a calculated length of 36,778ft. The hot tap assembly end of the pipe will be terminated with an ANSI class 900 flange and an ANSI class 600 flange at the riser tie-in spool. The proposed pipeline route crosses through (from west to east) WD129, WD128, WD145, SP88, and terminates at the proposed jacket platform within SP89 (Lease OCS-G-01618).

### 3.5.1 Crossings

Crossed pipelines shall be protected with concrete mattresses. At this time, there are no subsea valves, tap, and piping assemblies at any crossings that require protection with sandbags and protection structures. The proposed fuel gas pipeline route crosses the following lines:

- Texas Eastern 20-inch gas pipeline (Segment #6392) in SP88
- Texas Eastern 12-inch gas pipeline (Segment #9597) in SP88
- Energy XXI 12-inch oil pipeline (Segment #6013) in SP89
- Eni US 12-inch oil pipeline (Segment #13317) in SP89
- Black Elk Energy 6-inch supply umbilical (Segment #10456) in SP89

All crossings shall maintain a minimum of 18 inches between the proposed 4.5-inch gas pipeline and the pipelines identified above.

### 3.5.2 Pipeline Spans

Table 4 presents spans along the fuel gas pipeline route (including spans due to crossings). All free spans exceeding the vortex-induced vibration (VIV) allowable span length, excluding crossing spans, have a small gap (less than 0.6 feet). Concrete capping mattresses will be used to mitigate those spans. None of the spans below pose snagging hazards.


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**Table 4: Pipeline Spans**

| Location (Easting, Northing, or KPs) (ft) | Span Number | Span Length (ft) | VIV Mitigation Method |
|---|---|---|---|
| 26262.9 to 26302.2 | 1 | 39 | Capping mattresses |
| 26541.7 to 26577.8 | 2 | 36 | Capping mattresses |
| 27256.9 to 27289.7 | 3 | 33 | Capping mattresses |
| E= 865,496.52; N= 10,418,379.65 | 4 (Crossing 1) | 74 | Strakes |
| | 5 (Crossing 1) | 74 | |
| 28828.2 to 28864.3 | 6 | 36 | Capping mattresses |
| E= 866,710.05; N= 10,418,452.75 | 7 (Crossing 2) | 66 | Strakes |
| | 8 (Crossing 2) | 56 | |
| E= 871,435.52; N= 10,420,116.72 | 9 (Crossing 3) | 52 | Strakes |
| | 10 (Crossing 3) | 56 | |
| E= 871,687.04; N= 10,420,708.43 & E= 871,725.67; N= 10,420.799.30 | 11 (Crossing 4) | 64 | Strakes |
| | 12 (Crossing 4 & 5) | 99 | |
| | 13 (Crossing 5) | 73 | |
| 36327.7 to 36360.5 | 14 | 33 | Capping mattresses |

Notes:

1. Crossings design finalized through detailed design and discussions/consultations with lessees or right-of-way holders.

### 3.5.3 Installation

The pipeline system will be installed using the reel-lay method. Pipeline installation is targeted to commence as early as Q1 2018. The estimated time for construction is approximately 30 days.

## 3.6 Riser and Riser Tie-in Spool

Fuel gas from the proposed 4.5-inch OD pipeline will connect to the topsides of the proposed platform via a 4.5-inch OD fixed riser. The riser will connect to the 4.5-inch OD pipeline via a tie-in spool with ANSI class 600 flanges within SP 89 (Lease OCS-G-01618). The riser bend at seabed will include a non-intrusive, externally mounted corrosion-monitoring device.

The riser and tie-in spool will be permitted separately under an appurtenance to a ROW modification for the SP89E-B facility.


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# 4 §192 Subpart C - Design Requirements for Department of Transportation (DOT) Pipelines

## 4.1 §192.105 Internal Design Pressure

(a) The design pressure for steel pipe is determined in accordance with the following formula:

$$P = \frac{2(S)(t)}{D} * (F)(E)(T)$$

P = Design pressure in pounds per square inch (psi) gauge.

S = Yield strength in pounds per square inch (psi) determined in accordance with § 192.107.

D = Nominal outside diameter of pipe, in inches.

t = Nominal wall thickness, in inches. If this is unknown, it is determined in accordance with §192.109. Additional wall thickness required for concurrent external loads in accordance with §192.103 may not be included in computing design pressure.

F = Design factor determined in accordance with § 192.111.

E = Longitudinal joint factor determined in accordance with § 192.113.

T = Temperature derating factor determined in accordance with § 192.115.

The SP89E-B fuel gas pipeline system consists of a hot tap piping assembly at the 12-inch Shell gas line, a piggable PLET, a 4.5-inch OD pipeline, and a riser and tie-in spool at the proposed jacket platform.

The internal design pressures as calculated using the equation above for pipe elements in the hot tap and PLET valve piping assemblies are summarized in Table 5. Note that the hoop stress design factor for the hot tap assembly, PLET, and pipeline are revised to meet low stress reassessment criteria (according to 49 CFR 192.939). Refer to Section 4.1.1 for further information.

**Table 5: Design Pressures of Pipe Elements**

| Segment | Component | D (in) | t (in) | S (psi) | F[1] | E | T | P (psi) [2] |
|---|---|---|---|---|---|---|---|---|
| Hot Tap Piping Assembly[4] | Pipe | 4.5 | 0.337 | 65,000 | 0.3 | 1.0 | 1.0 | 1,555 |
| PLET | Pipe, Branch | 4.5 | 0.337 | 65,000 | 0.3 | 1.0 | 1.0 | 1,555 |
| | Pipe, Header | 4.5 | 0.25 | 65,000 | 0.3 | 1.0 | 1.0 | 1,825 |
| Pipeline and Tie-in Spool[4] | Pipe | 4.5 | 0.25 | 65,000 | 0.3 | 1.0 | 1.0 | 1,825 |
| Riser[4] | Pipe | 4.5 | 0.337 | 65,000 | 0.3 | 1.0 | 1.0 | 2,579 |
| | 5D radius bend | 4.5 | 0.337 | 65,000 | 0.3 | 1.0 | 1.0 | 2,321[3] |

Notes:

1. Refer to Section 4.1.1 for 49 CFR 192 hoop stress factor modification to 0.3•SMYS.
2. A wall thickness corrosion allowance of 1mm is considered in P calculation for all piggable segments. A wall thickness corrosion allowance of 4mm is considered in P calculation for all non-piggable segments.
3. A 10% wall thinning is considered for induction bends in P calculation.
4. Hot tap, riser and tie-in spool segments are not included in this application permit and presented for reference only.


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Table 6 shows the summary of the design pressure and temperature of each segment of the pipeline system.

**Table 6: Design Pressure and Temperature of Pipeline Segments**

| Segment | Design Pressure (psig @ +93ft MSL) | Design Temperature (°F) |
|---|---|---|
| Hot Tap Piping Assembly[1] | 1,440 | -20 to +140 |
| PLET | 1,440 | -20 to +140 |
| Pipeline | 1,440 | -20 to +140 |
| Riser and Tie-in Spool[1] | 1,440 | -20 to +140 |

Notes:
1. Hot tap, riser and tie-in spool segments are not included in this application permit and presented for reference only.

### 4.1.1 §192.939 (b) Pipelines Operating Below 30% SMYS

In order to comply with low stress reassessment criteria (according to 49 CFR 192.939), hoop stress is limited to 30% of Specified Minimum Yield Strength (SMYS). As such, pipeline reassessments shall be as outlined in 49 CFR 192.941.

## 4.2 §192.107 Yield Strength (S) for Steel Pipe

(a) For pipe that is manufactured in accordance with a specification listed in section I of appendix B of this part, the yield strength to be used in the design formula in § 192.105 is the SMYS stated in the listed specification, if that value is known.

The pipe shall be in accordance with API Spec 5L and shall have an SMYS equal to that listed in Table 5.

## 4.3 §192.111 Design Factor (F) for Steel Pipe

(a) Except as otherwise provided in paragraphs (b), (c), and (d) of this section, the design factor to be used in the design formula in § 192.105 is determined in accordance with the following table:

Class Location Design Factor (F)

1……..0.72

2……...0.60

3……...0.50

4……..0.40

The pipe wall thickness is selected as per §192.105. In order to comply with low stress reassessment criteria (according to 49 CFR 192.939), the design factor is limited to 30% of Specified Minimum Yield Strength (SMYS) for the pipeline segment. As such, pipeline reassessments shall be as outlined in 49 CFR 192.941. Note that the riser design factor to be used in the design formula in §192.105 is 0.5.

## 4.4 §192.113 Longitudinal Joint Factor (E) for Steel Pipe

The longitudinal joint factor to be used in the design formula in § 192.105 is determined in accordance with the following table:

The pipe specification for the proposed pipeline is API 5L, seamless class. Thus, a longitudinal joint factor (E) of 1.0 is used in the design formula in §192.105.

## 4.5 §192.115 Temperature Derating Factor (T) for Steel Pipe

The temperature derating factor to be used in the design formula in § 192.105 is determined as follows:


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The fuel gas system temperature will be below 250 °F, thus a temperature derating factor (T) of 1.0 is used in the design formula in §192.105.

# 5 §192 Subpart D - Design of Pipeline Components

## 5.1 §192.143 General Requirements

(a) Each component of a pipeline must be able to withstand operating pressures and other anticipated loadings without impairment of its serviceability with unit stresses equivalent to those allowed for comparable material in pipe in the same location and kind of service. However, if design based upon unit stresses is impractical for a particular component, design may be based upon a pressure rating established by the manufacturer by pressure testing that component or a prototype of the component.

All components of the proposed fuel gas pipeline system are designed as per the parameters identified in Table 2 through Table 8.

(b) The design and installation of pipeline components and facilities must meet applicable requirements for corrosion control found in subpart I of this part.

All components of the proposed fuel gas pipeline system are designed to meet the corrosion control requirements identified in Subpart I.

## 5.2 §192.145 Valves

(a) Except for cast iron and plastic valves, each valve must meet the minimum requirements of API 6D (incorporated by reference, see § 192.7), or to a national or international standard that provides an equivalent performance level. A valve may not be used under operating conditions that exceed the applicable pressure-temperature ratings contained in those requirements.

Pipeline valves will not be operated at pressures and temperatures that exceed the applicable pressure-temperature ratings contained in their standards. ASME/ANSI B31.8 shall be used in lieu of API 6D, as it has been redacted by API. Table 7 presents the pressure rating of the pipeline valves and the applied design specification.

**Table 7: Rating of Valves**

| Assembly | Valve | Service Water Depth (ft) | Specification | Pressure Class | Temperature Rating (°F) |
|---|---|---|---|---|---|
| Hot tap piping assembly[1] | ROV manually operated dual ball flow isolation valve (FIV) | 344 | ASME/ANSI B31.8 | ANSI 900 | -20 to +140 |
| PLET | ROV manually operated ball FIV | 344 | ASME/ANSI B31.8 | ANSI 600 | -20 to +140 |
| | ROV manually operated dual ball FIV | 344 | ASME/ANSI B31.8 | ANSI 600 | -20 to +140 |

Notes:

1. The hot tap clamp and valves will be ANSI 900 classed components per operator interconnect requirements. Proteus PLET requirements are designed to ANSI class 600 based on fuel gas pipeline MAOP. The hot tap is not included in this application permit and presented for reference only.

## 5.3 §192.147 Flanges and Flange Accessories

(a) Each flange or flange accessory (other than cast iron) must meet the minimum requirements of ASME/ANSI B16.5, MSS SP–44 (incorporated by reference, see §192.7), or the equivalent.

All flanges used in the proposed fuel gas system will be specified using ASME/ANSI B31.8 requirements.


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(b) Each flange assembly must be able to withstand the maximum pressure at which the pipeline is to be operated and to maintain its physical and chemical properties at any temperature to which it is anticipated that it might be subjected in service.

Table 8 presents the pressure ratings of the pipeline flanges, flange accessories, and hubs and connectors.

**Table 8: Ratings of Flanges and Flange Accessories**

| Segment | Flanges and Flange Accessories | Water Depth (ft) | Material Specification | Pressure Rating (psi) | Temperature Rating (°F) |
|---|---|---|---|---|---|
| Hot tap assembly piping[1] | 4in ANSI Flange, Class 900 | 344 | ASTM A694 F65 | 2,500 | -20 to +140 |
| | 4in ANSI Flange, Class 600 | 344 | ASTM A694 F65 | 1,500 | -20 to +140 |
| PLET, PLET tie-in spool | 4in ANSI Flange, Class 600 | 344 | ASTM A694 F65 | 1,500 | -20 to +140 |
| Riser tie-in spool[1]l | 4in ANSI Flange, Class 600 | 392.4 | ASTM A694 F65 | 1,500 | -20 to +140 |
| Riser[1] | 4in ANSI Flange, Class 600 | 392.4 | ASTM A694 F65 | 1,500 | -20 to +140 |

Notes:
1. Hot tap, riser and tie-in spool segments are not included in this application permit and presented for reference only.

(c) Each flange on a flanged joint in cast iron pipe must conform in dimensions, drilling, face and gasket design to ASME/ANSI B16.1 and be cast integrally with the pipe, valve, or fitting.

All flanges used in the proposed fuel gas system will conform to ASME/ANSI B31.8 design requirements.

## 5.4 §192.149 Standard Fittings

(a) The minimum metal thickness of threaded fittings may not be less than specified for the pressures and temperatures in the applicable standards referenced in this part, or their equivalent.

(b) Each steel butt-welding fitting must have pressure and temperature ratings based on stresses for pipe of the same or equivalent material. The actual bursting strength of the fitting must at least equal the computed bursting strength of pipe of the designated material and wall thickness, as determined by a prototype that was tested to at least the pressure required for the pipeline to which it is being added.

All system fittings have an actual bursting strength of at least equal to the computed bursting strength of the pipe of the same or equivalent material.

The hot tap clamp/assembly shall be permitted separately from this application.

## 5.5 §192.151 Tapping

(a) Each mechanical fitting used to make a hot tap must be designed for at least the operating pressure of the pipeline.

(b) Where a ductile iron pipe is tapped, the extent of full-thread engagement and the need for the use of outside-sealing service connections, tapping saddles, or other fixtures must be determined by service conditions.

(c) Where a threaded tap is made in cast iron or ductile iron pipe, the diameter of the tapped hole may not be more than 25 percent of the nominal diameter of the pipe unless the pipe is reinforced, except that:

(1) Existing taps may be used for replacement service, if they are free of cracks and have good threads; and

(2) A 1 1⁄4-inch (32 millimeters) tap may be made in a 4-inch (102 millimeters) cast iron or ductile iron pipe, without reinforcement.


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However, in areas where climate, soil, and service conditions may create unusual external stresses on cast iron pipe, unreinforced taps may be used only on 6-inch (152 millimeters) or larger pipe.

The hot tap clamp assembly (including all fittings) will be designed to meet the same pressure and temperature requirements as the pipeline.

The hot tap clamp/assembly shall be permitted separately from this application.

# 6 §192 Subpart G - General Construction Requirements for Transmission Lines and Mains

## 6.1 §192.317 Protection from Hazards

Pipelines, including pipe risers, on each platform located offshore or in inland navigable waters must be protected from accidental damage by vessels.

The SP89E-B 4.5-inch gas riser shall be located inside the footprint of the jacket platform to provide protection from physical damage to the riser pipe and clamps.

## 6.2 §192.319 Installation of Pipe in a Ditch

(a) The operator must take all practicable steps to protect each transmission line or main from washouts, floods, unstable soil, landslides, or other hazards that may cause the pipeline to move or to sustain abnormal loads. In addition, the operator must take all practicable steps to protect offshore pipelines from damage by mud slides, water currents, hurricanes, ship anchors, and fishing operations..

The proposed pipeline route was selected with consideration to avoid known natural and manmade hazards, seabed obstructions, outcrops, reefs, and depressions. The route also avoids side slope routing across areas with steep slopes. The proposed fuel gas pipeline pipe size is selected to ensure on-bottom stability is maintained throughout the operational life of the system (under 100-year return period storm return criteria).

(c) All offshore pipe in water at least 12 feet (3.7 meters) deep but not more than 200 feet (61 meters) deep, as measured from the mean low tide, except pipe in the Gulf of Mexico and its inlets under 15 feet (4.6 meters) of water, must be installed so that the top of the pipe is below the natural bottom unless the pipe is supported by stanchions, held in place by anchors or heavy concrete coating, or protected by an equivalent means. Pipe in the Gulf of Mexico and its inlets under 15 feet (4.6 meters) of water must be installed so that the top of the pipe is 36 inches (914 millimeters) below the seabed for normal excavation or 18 inches (457 millimeters) for rock excavation.

Not applicable; the proposed gas pipeline will be installed in the Gulf of Mexico in water depths greater than 200 feet.

## 6.3 §250.1003(a) (3) Crossings and Obstructions

In the absence of any separation distance provision in 49 CFR 192, a minimum separation of 18in shall be maintained between the existing pipelines and new fuel gas pipeline as per the requirements of 30 CFR 250:

Pipelines shall be installed with a minimum separation of 18 inches at pipeline crossings and from obstructions.

The proposed fuel gas pipeline route crosses the following lines:

- Texas Eastern 20-inch gas pipeline (Segment #6392) in SP88
- Texas Eastern 12-inch gas pipeline (Segment #9597) in SP88
- Energy XXI 12-inch oil pipeline (Segment #6013) in SP89
- Eni US 12-inch oil pipeline (Segment #13317) in SP89
- Black Elk Energy 6-inch supply umbilical (Segment #10456) in SP89


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Separation shall be achieved using two standard 9-inch thick concrete mattresses for existing rigid pipelines, while a bridge shall be used for any existing flexible pipe, umbilicals and cables.

# 7 §192 Subpart I - Requirements for Corrosion Control

## 7.1 §192.455 External Corrosion Control: Buried or Submerged Pipelines Installed After July 31, 1971

(a) Except as provided in paragraphs (b), (c), and (f) of this section, each buried or submerged pipeline installed after July 31, 1971, must be protected against external corrosion, including the following:

(1) It must have an external protective coating meeting the requirements of § 192.461.

(2) It must have a cathodic protection system designed to protect the pipeline in accordance with this subpart, installed and placed in operation within 1 year after completion of construction.

(d) Notwithstanding the provisions of paragraph (b) or (c) of this section, if a pipeline is externally coated, it must be cathodically protected in accordance with paragraph (a)(2) of this section.

The 4.5-in pipeline will have a minimum 97mil thick 3LPP coating. Pipeline field joints will have a single layer marine epoxy type of coating. The hot tap piping, PLET piping, riser and tie-in spool will have a marine epoxy type of coating for corrosion protection. For reference only, a 0.5-inch thick Splashtron type coating will be applied at the splash zone of the riser pipe (±15-feet from MSL).

Aluminum-zinc-indium sacrificial bracelet anodes will provide CP for the fuel gas pipe system. The minimum design life of the CP system is 30 years. Table 9 shows the CP summary for the pipeline system.

**Table 9: Pipeline CP Summary**

| Protective Coating | Pipe Outside Diameter (in) | Anode Unit Net Weight (lbs) | Average Spacing (ft) | Number of Anodes | Life Expectancy (yrs) |
|---|---|---|---|---|---|
| 97mil 3LPP | 4.5 | 94 | 3,360 | 9 | ≥30.0 |

For the SP89E-B pipeline, the life expectancy of the anodes can be calculated as below:

Number of anodes = 9

Unit anode weight = 94 lbs

Anode utilization = 0.8

Anode Current Capacity = 907 A-hr/lb

CP Current Required = 1.94 A (based on modeled length of 27,538ft)

The modeled length does not include the hot-tap assembly piping, spools and risers, as these have separate CP systems. Thus, the expected CP life for the pipe is:

$$Pipeline\ Anode\ Life\ Expectancy\ (Years) = \frac{9 * 94 * 0.8 * 907}{1.94} = 55.3\ years$$

# 8 §192 Subpart J - Test Requirements

## 8.1 §192.501 Pressure Testing

(a) No person may operate a new segment of pipeline, or return to service a segment of pipeline that has been relocated or replaced, until—

(1) It has been tested in accordance with this subpart and § 192.619 to substantiate the maximum allowable operating pressure; and

(2) Each potentially hazardous leak has been located and eliminated.

(b) The test medium must be liquid, air, natural gas, or inert gas that is—

(1) Compatible with the material of which the pipeline is constructed;

(2) Relatively free of sedimentary materials; and


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(3) Except for natural gas, nonflammable.

An offshore hydrostatic pressure test of the SP89E-B fuel gas pipeline system, isolated from the 12-inch Shell gas pipeline source, will be conducted with treated water. The treated water mixture is commonly used and compatible with the API 5L X65 material selected for the proposed pipeline.

Prior to testing, the pipeline will be cleaned of debris (sedimentary materials) through use of a pig.

## 8.2 §192.507 Test Requirements for Pipelines to Operate at a Hoop Stress Less than 30% of SMYS and at or Above 100 p.s.i.g.

Except for service lines and plastic pipelines, each segment of a pipeline that is to be operated at a hoop stress less than 30 percent of SMYS and at or above 100 p.s.i. (689 kPa) gage must be tested in accordance with the following:

(a) The pipeline operator must use a test procedure that will ensure discovery of all potentially hazardous leaks in the segment being tested.

(b) If, during the test, the segment is to be stressed to 20 percent or more of SMYS and natural gas, inert gas, or air is the test medium—

(1) A leak test must be made at a pressure between 100 p.s.i. (689 kPa) gage and the pressure required to produce a hoop stress of 20 percent of SMYS; or

(2) The line must be walked to check for leaks while the hoop stress is held at approximately 20 percent of SMYS.

(c) The pressure must be maintained at or above the test pressure for at least 1 hour.

The offshore hydrostatic pressure test of the SP89E-B fuel gas pipeline system, isolated from the 12-inch Shell gas pipeline source, will be conducted for at least eight (8) hours at a stabilized pressure of 1.25 x MAOP = 1.25 x 1,440psig = 1,800psig at EL+93ft above MSL.

For reference only, the riser hydrotest will be conducted for at least eight (8) hours at a stabilized pressure of 1.5 x MAOP = 1.5 x 1,440psig = 2,160psig at EL+93ft above MSL.

The following equation calculates the maximum allowable hydrotest pressure for all pipe components. The stress level in any pipe during hydrostatic test does not exceed 95% of yield stress.

$$\sigma_{hoop} = \frac{P \cdot D}{2 \cdot t} \leq 0.95 \cdot S_y$$

$$\frac{\sigma_{hoop}}{S_y} = \frac{P \cdot D}{2 \cdot t \cdot S_y} \leq 95\%$$

$$S_y = 65{,}300\text{psi}$$

$$P = Hydrotest\ Pressure$$

$$D = Outside\ Diameter\ of\ Steel\ Pipe$$

$$t = Steel\ Pipe\ Wall\ Thickness$$

**Table 10: Steel Pipe Stress due to Hydrotest Pressure (HTP)**

| Assembly | Component | P (psig) | D (in) | t (in) | Hoop Stress in Pipe (%SMYS) |
|---|---|---|---|---|---|
| Hot tap piping assembly (up to isolation valve to 12" Shell gas pipeline)[2] | 4.5-inch pipe | 2,160 | 4.5 | 0.337 | 20% |
| PLET, branch pipe | 4.5-inch pipe | 2,160 | 4.5 | 0.337 | 20% |
| PLET, header pipe | 4.5-inch pipe | 2,160 | 4.5 | 0.25 | 29.8% |


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| Assembly | Component | P (psig) | D (in) | t (in) | Hoop Stress in Pipe (%SMYS) |
|---|---|---|---|---|---|
| Pipeline | 4.5-inch pipe | 1,800 | 4.5 | 0.25 | 24% |
| Riser tie-in spool[2] | 4.5-inch pipe | 1,800 | 4.5 | 0.25 | 24% |
| Riser[2] | 4.5-inch pipe | 2,160 | 4.5 | 0.337 | 20% |
| | 5D bend | 2,160 | 4.5 | 0.337 | 23%[1] |

Notes:

1. A 10% wall thinning is considered for induction bends in hydrotest stress calculation.
2. Hot tap, riser and tie-in spool segments are not included in this application permit and presented for reference only.

A record of pipeline pressure and temperature during the test will be maintained as per the requirements listed in §192.517.

## 8.3 §192.515 Environmental Protection and Safety Requirements

(a) In conducting tests under this subpart, each operator shall insure that every reasonable precaution is taken to protect its employees and the general public during the testing. Whenever the hoop stress of the segment of the pipeline being tested will exceed 50 percent of SMYS, the operator shall take all practicable steps to keep persons not working on the testing operation outside of the testing area until the pressure is reduced to or below the proposed maximum allowable operating pressure.

(b) The operator shall insure that the test medium is disposed of in a manner that will minimize damage to the environment.

The pressure test of the proposed subsea fuel gas pipeline shall not induce a hoop stress greater than 50% of the pipeline material SMYS.

## 8.4 §192.739 Overpressure Safety Devices

If the MSP exceeds the pipeline's MAOP, you must install and maintain redundant safety devices meeting the requirements of Section A9 of API RP 14C (incorporated by reference as specified in §192.739). Pressure safety valves (PSVs) may be used only after a determination by the Regional Supervisor that the pressure will be relieved in a safe and pollution-free manner. The setting level at which the primary and redundant safety equipment actuates shall not exceed the pipeline's MAOP.

The SP89E-B fuel gas pipeline maximum source pressure is 1,200psig at the hot tap assembly in the 12-inch Shell gas pipeline. The SP89E-B fuel gas pipeline MAOP is 1,440psig referenced at 93ft above MSL. In accordance with 49 CFR 192.739, there is no requirement for redundant safety devices that meet the requirements of API RP 14C MSP Section A9.

## 8.5 §192.901 Pipeline Integrity Management

Pipelines shall be designed and maintained to mitigate any reasonably anticipated detrimental effects of water currents, storm or ice scouring, soft bottoms, mud slides, earthquakes, subfreezing temperatures and other environmental factors.

The SP89E-B Project will be subject to a pipeline Integrity Management Program that will include pipeline route inspection, which will satisfy the requirements of 49 CFR 192.

The proposed pipeline is designed with offshore environmental data of appropriate return periods to cover temporary and permanent conditions. Pipeline stability against effects of water currents and storms is ensured by its submerged weight. The pipeline is designed to maintain on bottom stability under 10-year return bottom current for empty condition. Additional design precautions are not required to enable the pipeline to withstand soft bottoms, mud slides, earthquakes and other possible environmental factors as they are not present for the selected pipeline route.


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# 9 §250 Subpart J - Pipelines and Pipeline Rights-of-Way

## 9.1 §250.1004 Safety Equipment Requirements for DOI Pipelines

(a) The lessee shall ensure the proper installation, operation, and maintenance of safety devices required by this section on all incoming, departing, and crossing pipelines on platforms.

The following sections are provided to address the proper installation, operation and maintenance of safety devices that will protect the overall system.

(b)(1)(i) Compliance with §250.1004(b) (1) (i) Incoming pipelines to a platform shall be equipped with a flow safety valve (FSV).

The proposed SP89E-B fuel gas pipeline will be tied in subsea via a hot tap to the existing Shell 12-inch gas pipeline. The Shell pipeline is equipped with a FSV at the existing WD143C platform.

(b)(1)(ii) For sulphur operations, incoming pipelines delivering gas to the power plant platform may be equipped with high- and low-pressure sensors (PSHL), which activate audible and visual alarms in lieu of requirements in paragraph (b)(1)(i) of this section. The PSHL shall be set at 15 percent or 5 psi, whichever is greater, above and below the normal operating pressure range.

Not applicable.

(b)(2) Incoming pipelines boarding a production platform shall be equipped with an automatic shutdown valve (SDV) immediately upon boarding the platform. The SDV shall be connected to the automatic and remote emergency shut-in systems.

The proposed SP89E-B fuel gas pipeline will be equipped with an automatic SDV immediately upon boarding the new jacket platform (SP89E-B), and will be connected to the automatic and remote emergency shut-in systems.

(b)(3) Departing pipelines receiving production from production facilities shall be protected by high- and low-pressure sensors (PSHL) to directly or indirectly shut in all production facilities. The PSHL shall be set not to exceed 15 percent above and below the normal operating pressure range. However, high pilots shall not be set above the pipeline's MAOP.

(b)(4) Crossing pipelines on production or manned nonproduction platforms which do not receive production from the platform shall be equipped with an SDV immediately upon boarding the platform. The SDV shall be operated by a PSHL on the departing pipelines and connected to the platform automatic and remote-emergency shut-in systems.

(b)(5) The Regional Supervisor may require that oil pipelines be equipped with a metering system to provide a continuous volumetric comparison between the input to the line at the structure(s) and the deliveries onshore. The system shall include an alarm system and shall be of adequate sensitivity to detect variations between input and discharge volumes. In lieu of the foregoing, a system capable of detecting leaks in the pipeline may be substituted with the approval of the Regional Supervisor.

(b)(6) Pipelines incoming to a subsea tie-in shall be equipped with a block valve and an FSV. Bidirectional pipelines connected to a subsea tie-in shall be equipped with only a block valve.

(b)(7) Gas-lift or water-injection pipelines on unmanned platforms need only be equipped with an FSV installed immediately upstream of each casing annulus or the first inlet valve on the christmas tree.

(b)(8) Bidirectional pipelines shall be equipped with a PSHL and an SDV immediately upon boarding each platform.

(b)(9) Pipeline pumps must comply with section A7 of API RP 14C (incorporated by reference as specified in § 250.198). The setting levels for the PSHL devices are specified in paragraph (b)(3) of this section.

(c) If the required safety equipment is rendered ineffective or removed from service on pipelines which are continued in operation, an equivalent degree of safety shall be provided. The safety equipment shall be identified by the placement of a sign on the equipment stating that the equipment is rendered ineffective or removed from service

Not applicable.


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# 10 §250.1007 What to Include in Application

(a) Applications to install a lease term pipeline or for a pipeline right-of way grant must be submitted in quadruplicate to the Regional Supervisor. Right-of-way grant applications must include an identification of the operator of the pipeline.

This lease term pipeline application is submitted in quadruplicate.

## 10.1 §250.1007(a) (1) Plats

The SP89E pipeline plats are attached in Appendix D.

## 10.2 §250.1007(a) (2) Safety Flow Schematic

The SP89E Process Safety Flow Schematic is attached in Appendix C.

## 10.3 §250.1007(a) (3) (i) General Information - Cathodic Protection

Description of CP system. If pipeline anodes are to be used, specify the type, size, weight, number, spacing, and anticipated life.

Aluminum-zinc-indium sacrificial bracelet anodes will provide CP for the fuel gas pipe system. The minimum design life of the CP system is 30 years. Table 9 shows the CP summary for the pipeline system.

## 10.4 §250.1007(a) (3) (ii) General Information - External Pipeline Coating System

Description of external pipeline coating system;

The 4.5-inch pipeline will have a minimum 97mils thick 3LPP coating. Pipeline field joints will have a single layer marine epoxy type of coating.

The PLET, riser and tie-in spool will have a marine epoxy type of coating for corrosion protection.

## 10.5 §250.1007(a) (3) (iii) General Information - Internal Protective Measures

Description of internal protective measures;

The pipe will be smooth bore without internal coating or lining. A corrosion allowance of 1mm is used to size pipe wall thickness for piggable segments of the pipeline system (PLET header, pipeline, riser and tie-in spool). A corrosion allowance of 4mm is used to size pipe wall thickness for non-piggable segments of the pipeline system (PLET branch, hot tap piping).

## 10.6 §250.1007(a) (3) (iv) General Information - Specific Gravity

Specific gravity of the empty pipe

The specific gravity of the empty pipe is 1.6.

## 10.7 §250.1007(a) (3) (v) General Information - MSP

MSP

The MSP is 1,200psig (at EL +93ft above MSL) at the hot tap assembly to the proposed SP89E-B jacket platform at a water depth of 392.4ft.


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## 10.8 §250.1007(a) (3) (vi) General Information - MAOP and Calculations Used in its Determination

MAOP and calculations used in its determination

Section 4 addresses the pipeline's MAOP (1,440psig at EL +93ft above MSL) and calculations used in its determination.

## 10.9 §250.1007(a) (3) (vii) General Information - Hydrostatic Test Pressure

Hydrostatic test pressure, medium and period of time that the line will be tested;

Section 8 addresses the hydrostatic test pressure, test medium and test period of time.

## 10.10 §250.1007(a) (3) (viii) General Information - MAOP of the Receiving Pipeline or Facility

MAOP of the receiving pipeline or facility,

The fuel gas system, supplied by the proposed 4.5-inch pipeline, will be composed of ANSI Class 600 rated components (MAOP of 1,440psig at EL +93ft above MSL).

The receiving facility, the proposed SP89E-B jacket platform has an MAOP of 3,360psig at EL +140ft above MSL for oil production components. This system is rated for the oil production components.

## 10.11 §250.1007(a) (3) (ix) General Information - Proposed Date of Commencing Installation and Estimated Time for Construction

Proposed date for commencing installation and estimated time for construction;

The pipeline system will be installed using the reel-lay method. Pipeline installation is targeted to commence as early as Q1 2018. The estimated time for construction is approximately 30 days.

## 10.12 §250.1007(a) (3) (x) General Information - Type of Protection for Crossing Pipelines

Type of protection to be afforded crossing pipelines, subsea valves, taps, and manifold assemblies, if applicable.

Crossed pipelines shall be protected with concrete mattresses. Subsea valves, tap, and piping assemblies shall be protected with protection structures (such as HTK Subsea Netguard or other equivalent) and/or sandbags.

## 10.13 §250.1007(a) (4) Additional Design Precautions

A description of any additional design precautions you took to enable the pipeline to withstand the effects of water currents, storm or ice scouring, soft bottoms, mudslides, earthquakes, permafrost, and other environmental factors.

No additional design precautions are required.

## 10.14 §250.1007(a) (4) (i) Unbonded Flexible Pipe

If you propose to use unbonded flexible pipe, your application must include:…

Not applicable.


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## 10.15 §250.1007(a) (4) (ii) Riser Design

If you propose to use one or more pipeline risers for a tension leg platform or other floating platform, your application must include:…

Not applicable.

## 10.16 §250.1007(a) (5) Shallow Hazard Survey Analysis

Oceaneering conducted an autonomous underwater vehicle (AUV) survey in the WD129, WD 128, WD 145, SP88, and SP 89 Block areas in August 2016, which covers the SP89E-B pipeline route. A site-specific geohazard study, Archaeological, Engineering and Hazard Assessment by Oceaneering, dated October 2016, evaluates the seafloor and subsurface geologic and manmade features and conditions, was prepared in accordance with NTL 2005-G07, NTL 2008-G05 and NTL 2009-G39. The assessment is included in Appendix E as an enclosure in this pipeline application.

In accordance with the requirements of NTL No. 2008-G05, up-to-date information will be input into a state-of-the-art, real-time navigational positioning system. The system will be used to depict all existing pipelines and other potential hazards located within 150 meters of the operation.

BP expressly agrees that if any site, structure or object of historical or archaeological significance should be discovered during the conduct of any operations within the permitted right-of-way or area of operation, BP shall report immediately such findings to the director, Gulf of Mexico OCS Region, and make every reasonable effort to preserve and protect the cultural resources from damage until said Director has given directions as to its preservation.

## 10.17 §250.1007(b) Applications to Modify an Approved Lease Term or Right-of-Way Grant

Applications to modify an approved lease term pipeline or right-of-way grant shall be submitted in quadruplicate to the Regional Supervisor. These applications need only address those items in the original application affected by the proposed modification.

Not applicable.

# 11 Compliance with NTLs

## 11.1 NTL 2007-G20

The purpose of this NTL is to provide and consolidate guidance for the avoidance and protection of biologically sensitive features and areas (i.e., topographic features, pinnacles, live bottoms (low-relief features), and other potentially sensitive biological features) when conducting OCS operations in water depths less than 300 meters (984 feet) in the Gulf of Mexico.

In accordance with NTL No. 2009-G39 Biologically-Sensitive Underwater Features and Areas, the statement is made that there are no disturbances within 250 feet of chemosynthetic communities.

## 11.2 NTL 2009 - G39

The purpose of this NTL is to provide and consolidate guidance for the avoidance and protection of biologically sensitive features and areas (i.e., topographic features, pinnacles, live bottoms (low-relief features), and other potentially sensitive biological features) when conducting OCS operations in water depths less than 300 meters (984 feet) in the Gulf of Mexico.

In accordance with NTL No. 2009-G39 Biologically-Sensitive Underwater Features and Areas, the statement is made that there are no disturbances within 250 feet of chemosynthetic communities.


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## 11.3 NTL 2005-G07, NTL 2008-G05

Oceaneering conducted an autonomous underwater vehicle (AUV) survey in the WD129, WD128, WD 145, SP88, and SP89 Block areas in August 2016, which covers the SP89E-B pipeline route. A site-specific geohazard study, Archaeological, Engineering and Hazard Assessment by Oceaneering, dated October 2016, evaluates the seafloor and subsurface geologic and manmade features and conditions, was prepared in accordance with NTL 2005-G07, NTL 2008-G05 and NTL 2009-G39. The assessment is included in Appendix E as an enclosure in this pipeline application.

In accordance with the requirements of NTL No. 2008-G05, up-to-date information will be input into a state-of-the-art, real-time navigational positioning system. The system will be used to depict all existing pipelines and other potential hazards located within 150 meters of the operation.

BP expressly agrees that if any site, structure or object of historical or archaeological significance should be discovered during the conduct of any operations within the permitted right-of-way or area of operation, BP shall report immediately such findings to the director, Gulf of Mexico OCS Region, and make every reasonable effort to preserve and protect the cultural resources from damage until said Director has given directions as to its preservation.


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# Appendix A - SP89E Field Layout and Crossing Drawings

| Location (Easting, Northing, or KPs) (ft) | Span Number | Span Length (ft) | VIV Mitigation Method |
|---|---|---|---|
| E= 865,496.52; N= 10,418,379.65 | 15 (Crossing 1) | 79 | Strakes |
| | 16 (Crossing 1) | 75 | |
| E= 866,710.05; N= 10,418,452.75 | 18 (Crossing 2) | 64 | Strakes |
| | 19 (Crossing 2) | 66 | |
| E= 871,435.52; N= 10,420,116.72 | 21 (Crossing 3) | 79 | Strakes |
| | 22 (Crossing 3) | 66 | |
| E= 871,687.04; N= 10,420,708.43 & E= 871,725.67; N= 10,420.799.30 | 23 (Crossing 4) | 69 | Strakes |
| | 24 (Crossing 4 & 5) | 82 | |
| | 25 (Crossing 5) | 89 | |


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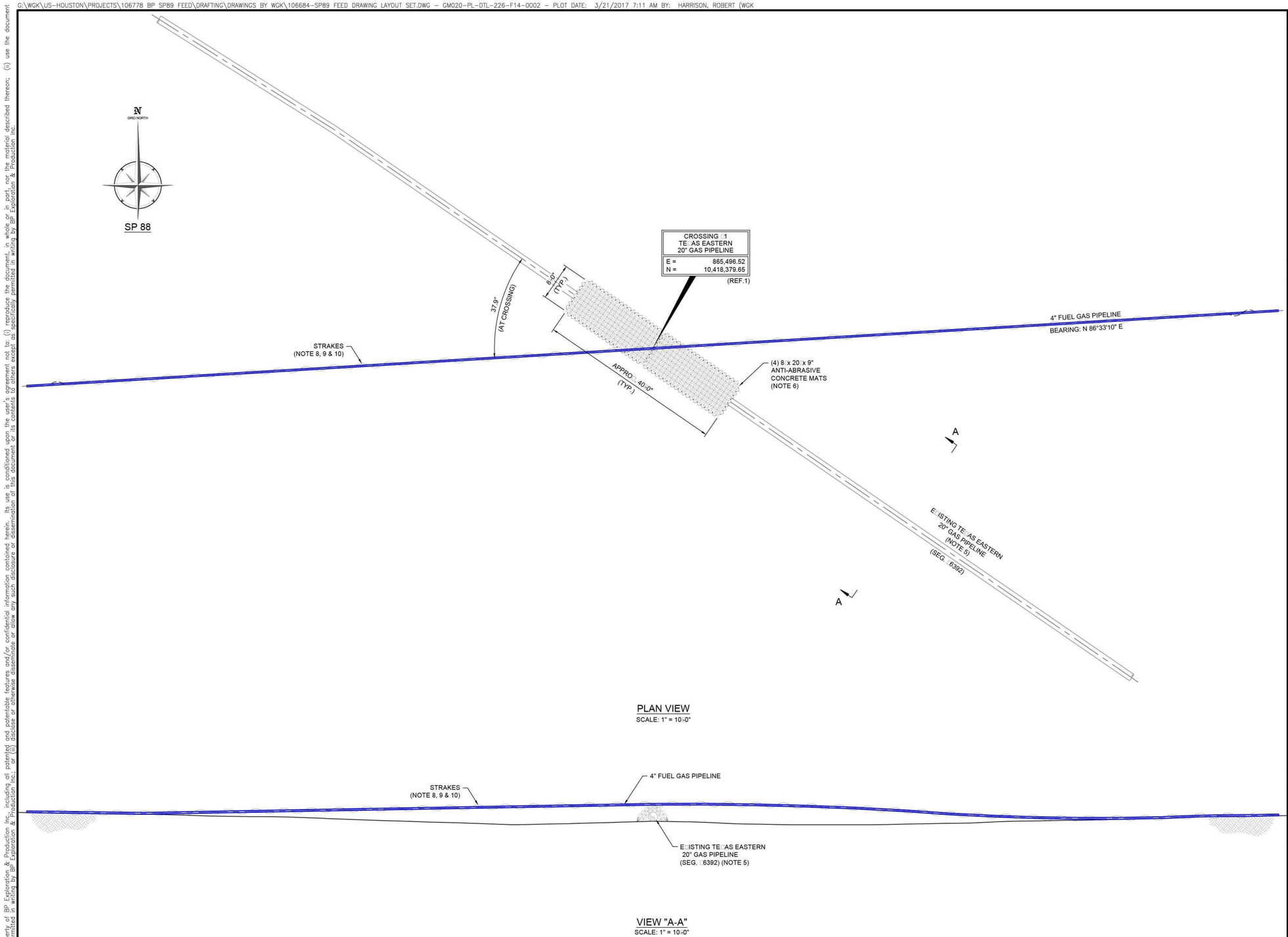



PLAN VIEW
SCALE: 1" = 10'-0"




VIEW "A-A"
SCALE: 1" = 10'-0"

NOTES:

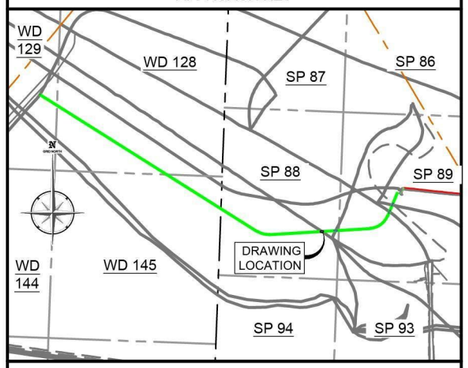
1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF EXISTING FLOWLINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS EXISTING PIPELINE IS FULLY EXPOSED.
6. TWO LAYERS OF STANDARD 8'x20'x9" CONCRETE MATTRESSES TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE EXISTING PIPELINE.
7. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
8. STRAKES SECTION LENGTH IS SPECIFIED IN THE FUEL GAS PIPELINE CROSSING DESIGN REPORT. (REF. 2)
9. STRAKES SECTION LENGTH INCLUDES AN ADDITIONAL 20 FT. OF EXTRA COVERAGE ON EACH END OF THE CROSSING SPANS TO ACCOUNT FOR INSTALLATION TOLERANCE.
10. STRAKES SHALL HAVE CP SHIELDING PREVENTION FEATURES INCORPORATED INTO THE STRAKES DESIGN.
11. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" | ARCH D / DATE |

APPROACH KEY




REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

bp

# GULF OF MEXICO
## SP89E EXPANSION

## FUEL GAS PIPELINE CROSSING 1

DRAWING NO: GM020-PL-DTL-226-F14-0002 REV: B01

BASED ON DWG-ENG-1104 REV 3

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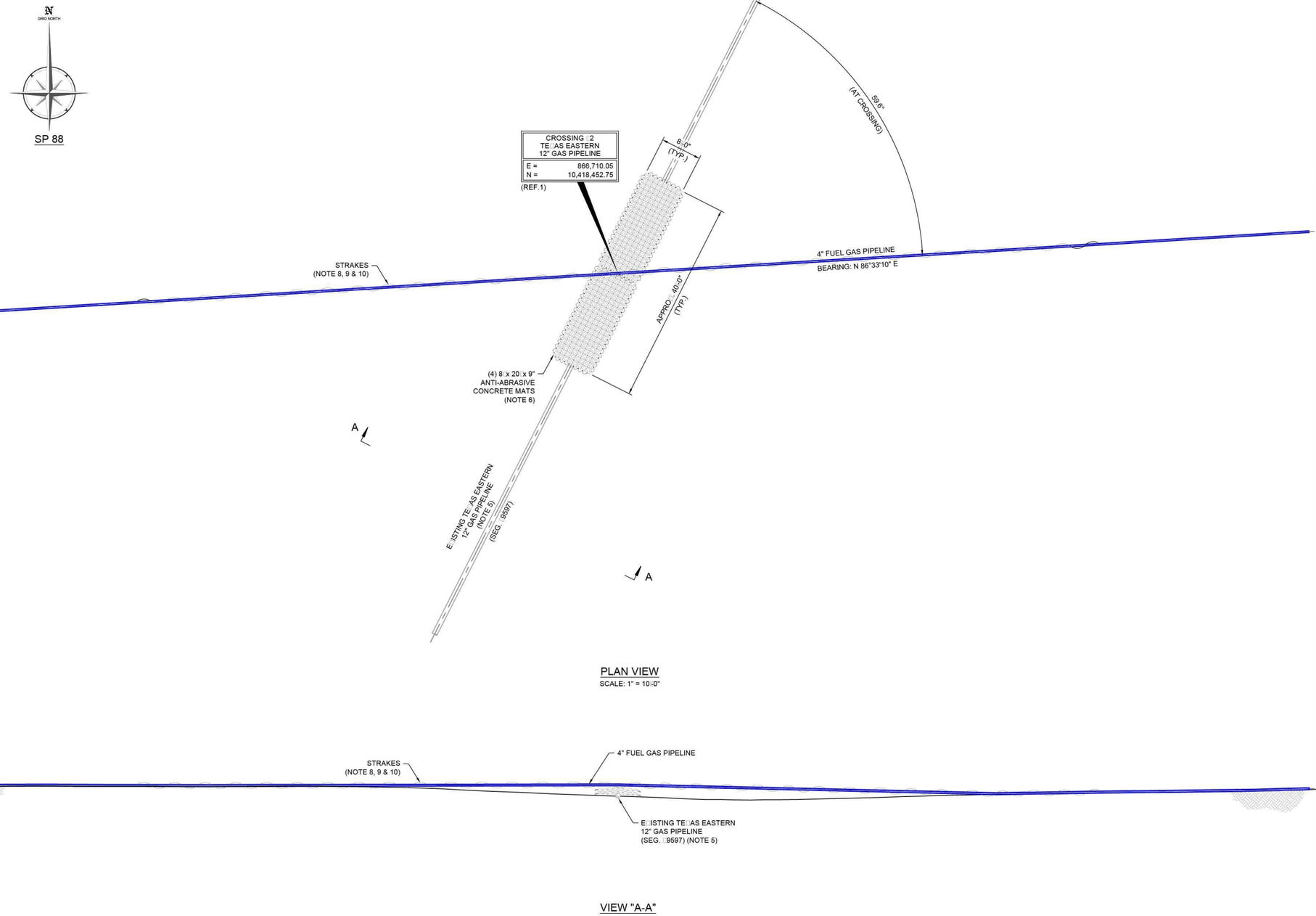


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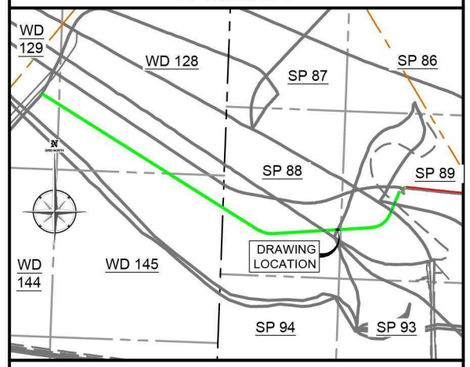


## REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

NOTES:

1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING FLOWLINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE IS FULLY E□POSED.
6. TWO LAYERS OF STANDARD 8□x20□x9" CONCRETE MATTRESSES TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE.
7. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
8. STRAKES SECTION LENGTH IS SPECIFIED IN THE FUEL GAS PIPELINE CROSSING DESIGN REPORT. (REF. 2)
9. STRAKES SECTION LENGTH INCLUDES AN ADDITIONAL 20 FT. OF E□TRA COVERAGE ON EACH END OF THE CROSSING SPANS TO ACCOUNT FOR INSTALLATION TOLERANCE.
10. STRAKES SHALL HAVE CP SHIELDING PREVENTION FEATURES INCORPORATED INTO THE STRAKES DESIGN.
11. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" | ARCH D / DATE |

bp

# GULF OF MEXICO
## SP89E EXPANSION

## FUEL GAS PIPELINE CROSSING 2

DRAWING NO: GM020-PL-DTL-226-F14-0003 REV: B01

BASED ON GWO-ENG-1104 REV 3

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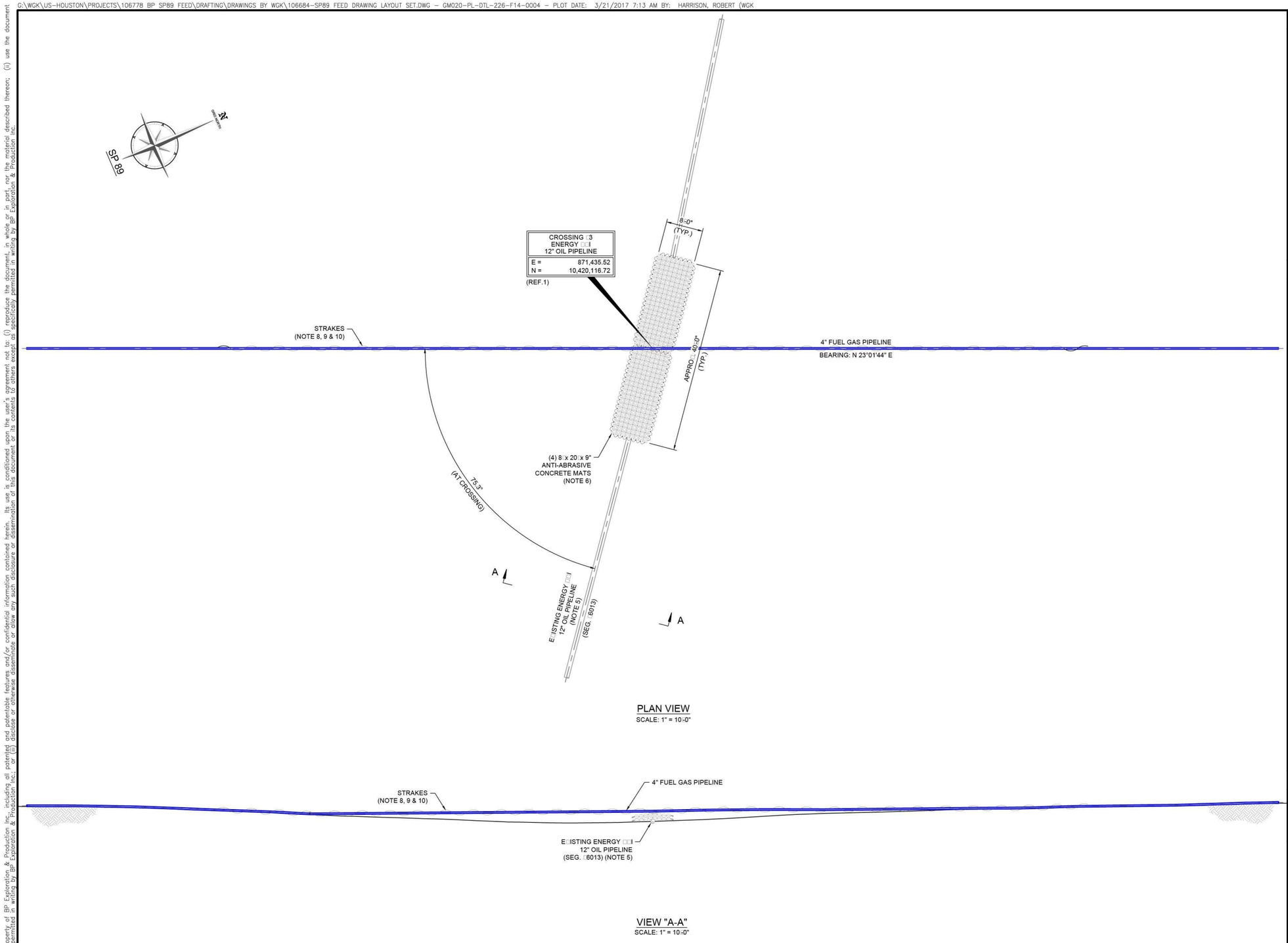
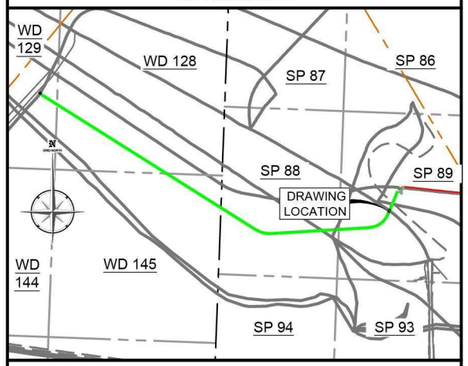



## APPROACH KEY




## REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

NOTES:

1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING FLOWLINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE IS FULLY E□POSED.
6. TWO LAYERS OF STANDARD 8□x20□x9" CONCRETE MATTRESSES TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE.
7. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
8. STRAKES SECTION LENGTH IS SPECIFIED IN THE FUEL GAS PIPELINE CROSSING DESIGN REPORT. (REF. 2)
9. STRAKES SECTION LENGTH INCLUDES AN ADDITIONAL 20 FT. OF E□TRA COVERAGE ON EACH END OF THE CROSSING SPANS TO ACCOUNT FOR INSTALLATION TOLERANCE
10. STRAKES SHALL HAVE CP SHIELDING PREVENTION FEATURES INCORPORATED INTO THE STRAKES DESIGN.
11. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" | ARCH D |

bp

# GULF OF MEXICO
## SP89E EXPANSION

## FUEL GAS PIPELINE CROSSING 3

DRAWING NO: GM020-PL-DTL-226-F14-0004 REV: B01

BASED ON DWG-ENG-1104 REV 3

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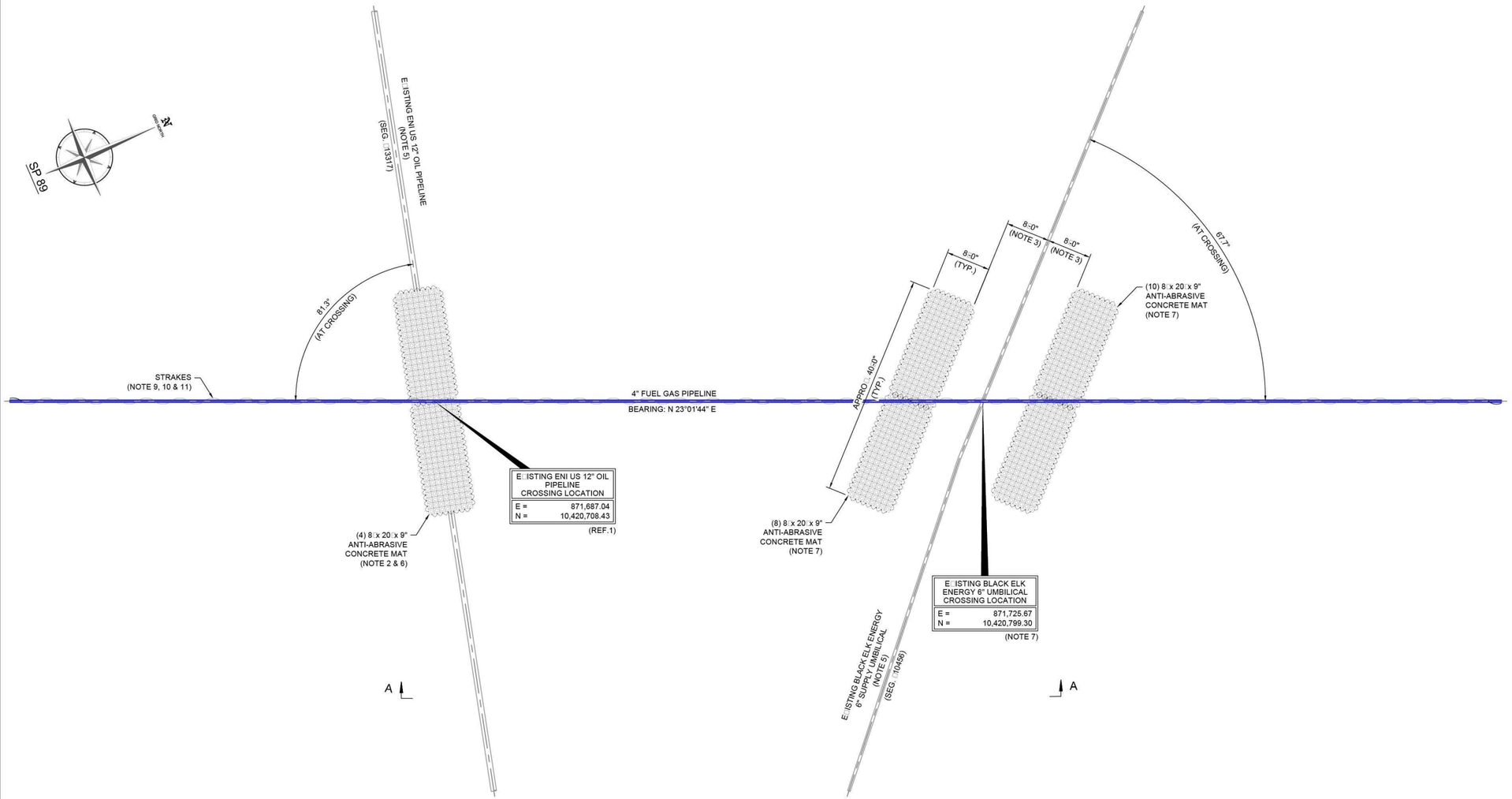
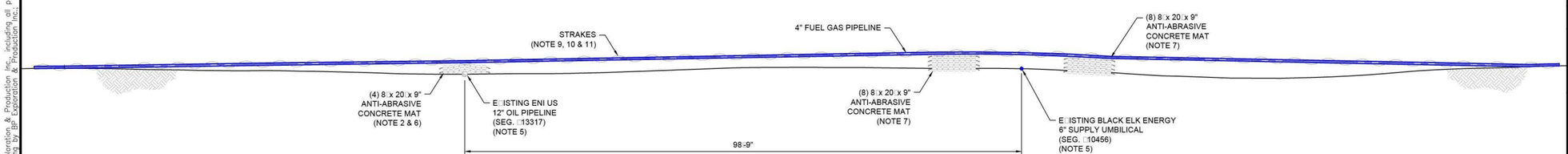
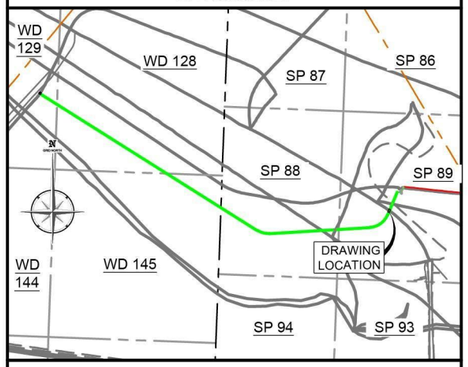



PLAN VIEW
SCALE: 1" = 10□0"




VIEW "A-A"
SCALE: 1" = 10□0"

## APPROACH KEY




## REFERENCES

| | | |
|---|---|---|
| 1. | GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. | GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. | GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

NOTES:

1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING FLOWLINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE AND UMBILICAL ARE HALF BURIED.
6. TWO LAYERS OF STANDARD 8□x20□x9" CONCRETE MATTRESSES TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE
7. UMBILICAL CROSSING IS A BRIDGE TYPE DESIGN
8. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
9. STRAKES SECTION LENGTH IS SPECIFIED IN THE FUEL GAS PIPELINE CROSSING DESIGN REPORT. (REF. 2)
10. STRAKES SECTION LENGTH INCLUDES AN ADDITIONAL 20 FT. OF E□TRA COVERAGE ON EACH END OF THE CROSSING SPANS TO ACCOUNT FOR INSTALLATION TOLERANCE.
11. STRAKES SHALL HAVE CP SHIELDING PREVENTION FEATURES INCORPORATED INTO THE STRAKES DESIGN.
12. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" | ARCH D |

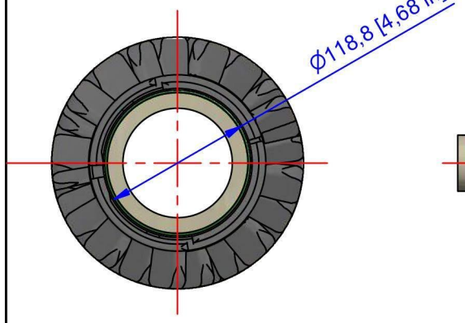
bp

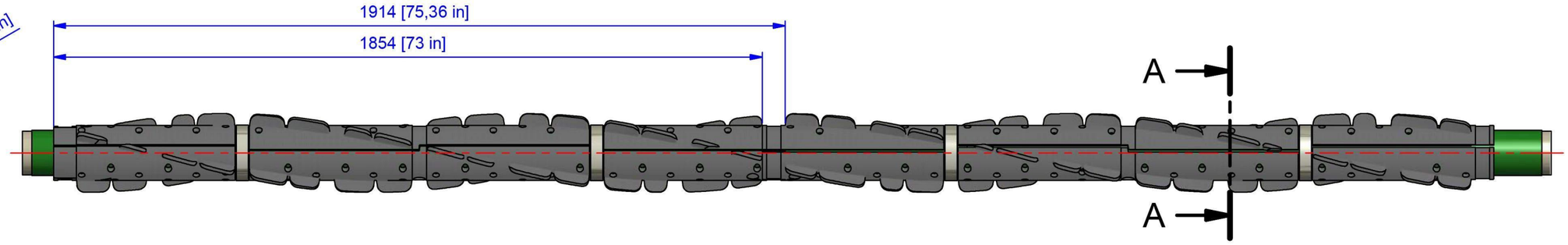
# GULF OF MEXICO
## SP89E EXPANSION

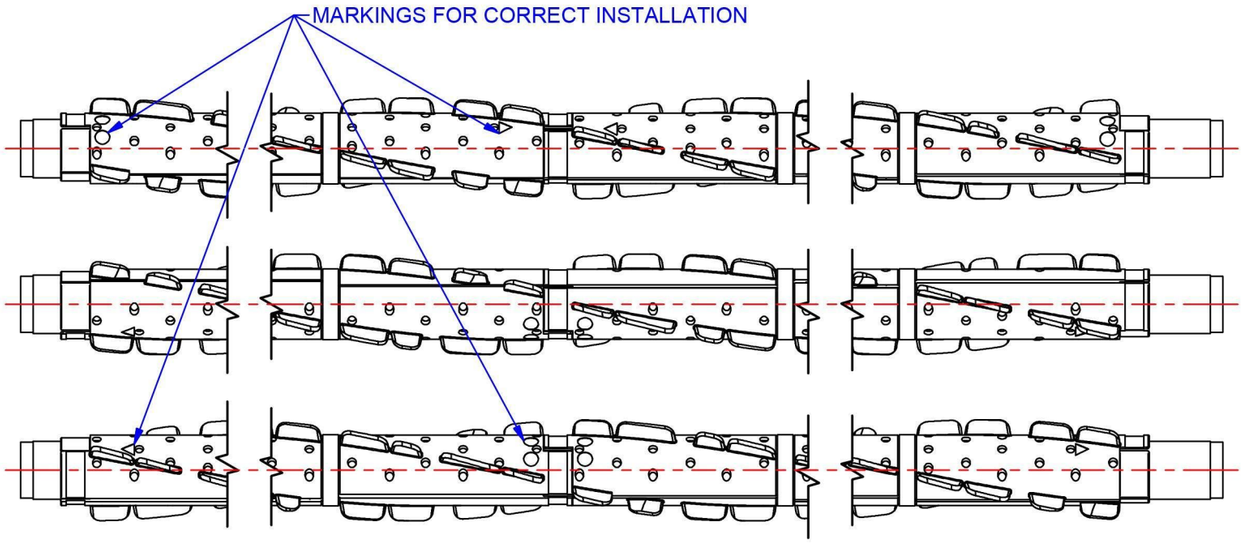
## FUEL GAS PIPELINE CROSSING 4 & 5

DRAWING NO: GM020-PL-DTL-226-F14-0005 REV: B01

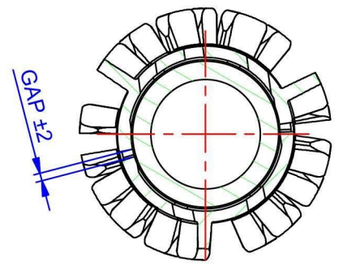
BASED ON DWG-ENG-1104 REV 3

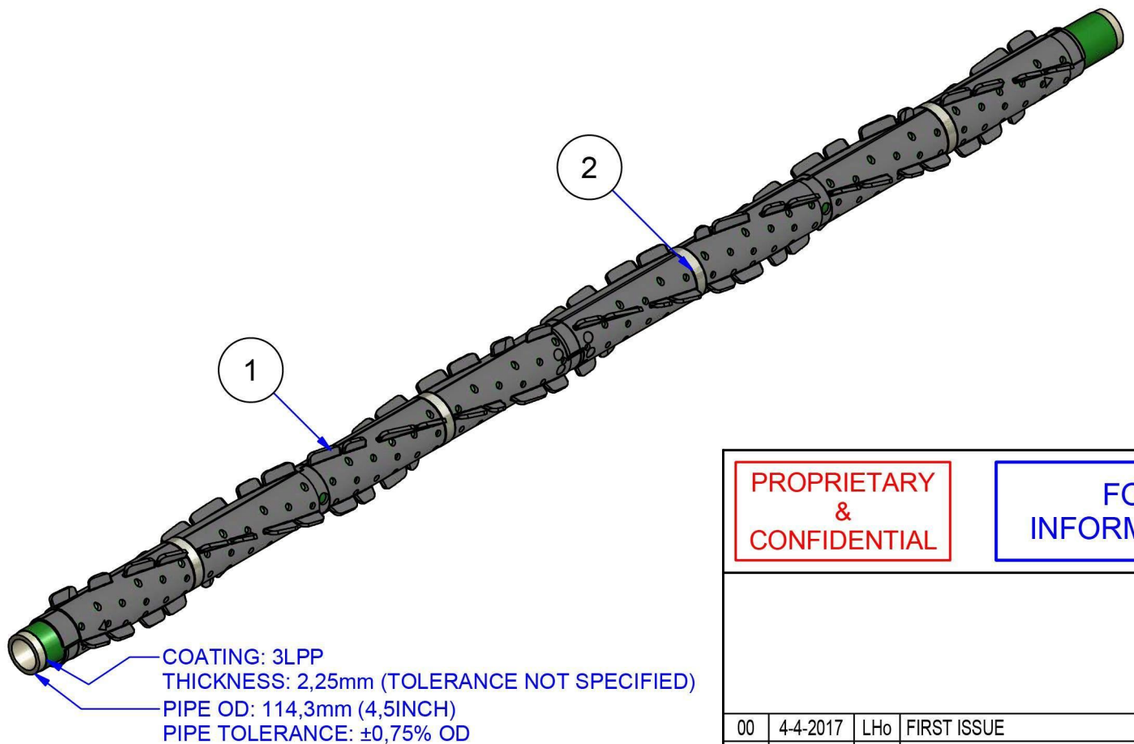



A-A ( 1:5 )




STRAPPING:
Min. Tool Pressure: 90 psi (6,2 BAR) Max. Tool Pressure: 101,5 psi (7 BAR)
Net circumference: 450 mm, Required strap (cutting) length = 800 mm

Dry 360 dgr. circumferential weight incl. strapping: approx. 3,70 kg/meter

Subm. 360 dgr. circumferential weight incl. strapping: approx. (-) 0,71 kg/meter (uplift)

| ITEM | QTY | TITLE | DESCRIPTION | MATERIAL/REMARKS | MASS |
|---|---|---|---|---|---|
| 2 | 4 | ALLOY STRAPPING | 31,75x0,8x800 (NET. CIRC.: 450+350) | ALLOY 625, SILVER | 0,090 kg |
| 1 | 4 | VIV STRAKE CP RECESS | VIV R60,8-164° - 184° | PE, BLACK | 3,279 kg |

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FOR INFORMATION

| REV | DATE | BY | DESCRIPTION | CHK | APPR |
|---|---|---|---|---|---|
| 00 | 4-4-2017 | LHo | FIRST ISSUE | RBo | |

TITLE: VIV STRAKE 4,8INCH CP RECESS
SUBJECT: ASSEMBLY
PROJECT: BP SOUTH PASS
CLIENT: SUBSEA 7

COMMENTS:
US PATENT NO. 7.458.752

TOLERANCES UNLESS SPECIFIED: DIMENSIONAL: ±2%
WEIGHT: ±10% < 5 kg > ±5%

DWG.NO.: 88F17425-A
REV: 00
PARTNO.:
SHEET: 1 OF 2
SCALE: 1:12,5
UNITS: MM
SIZE: A3
PROJ. METHOD

Lankhorst Mouldings
Sneek-Holland

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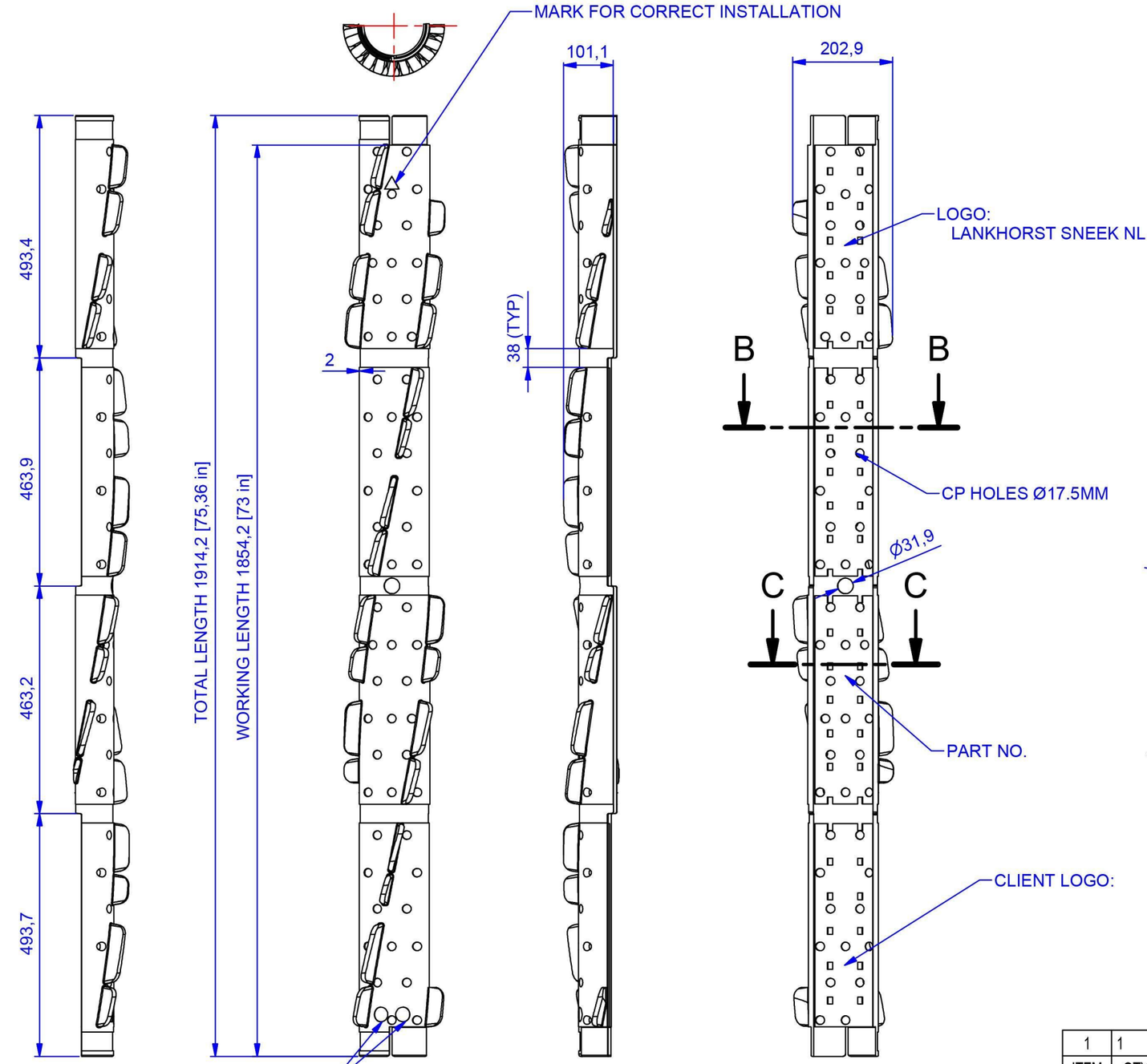
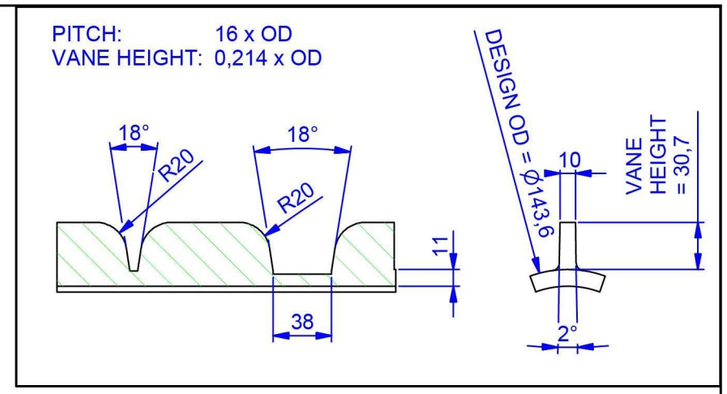
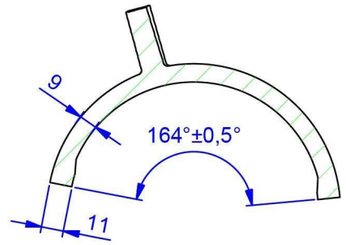
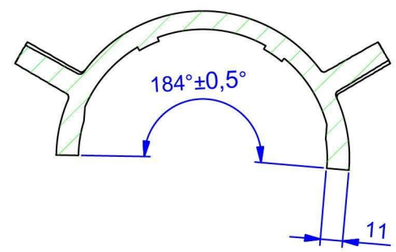


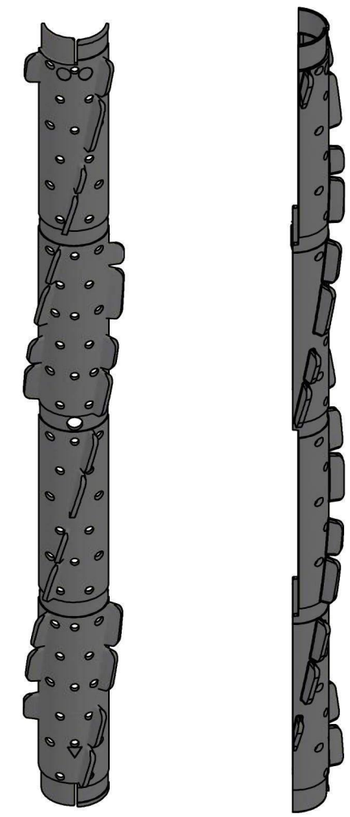



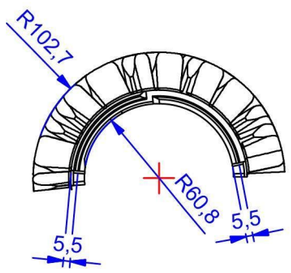

B-B ( 1:3 )




C-C ( 1:3 )






PROPRIETARY & CONFIDENTIAL

FOR INFORMATION

| REV | DATE | BY | DESCRIPTION | CHK | APPR |
|---|---|---|---|---|---|
| 00 | 4-4-2017 | LHo | FIRST ISSUE | RBo | |

| ITEM | QTY | TITLE | DESCRIPTION | MATERIAL/REMARKS | MASS |
|---|---|---|---|---|---|
| 1 | 1 | VIV STRAKE CP RECESS | VIV R60,8-164° - 184° | PE, BLACK | 3,3 kg |

TITLE: VIV STRAKE 4,8INCH CP RECESS

SUBJECT: VIV R60,8-164° - 184°

PROJECT: BP SOUTH PASS

CLIENT: SUBSEA 7

COMMENTS:
US PATENT NO. 7.458.752

TOLERANCES UNLESS SPECIFIED: DIMENSIONAL: ±2%
WEIGHT: ±10% < 5 kg > ±5%

| DWG.NO.: | REV: |
|---|---|
| 88F17425-A | 00 |

| PARTNO.: | SHEET: | SCALE: | UNITS: | SIZE: | PROJ. METHOD |
|---|---|---|---|---|---|
| TBD | 2 OF 2 | 1:12,5 | MM | A3 | |

Lankhorst Mouldings
Sneek-Holland

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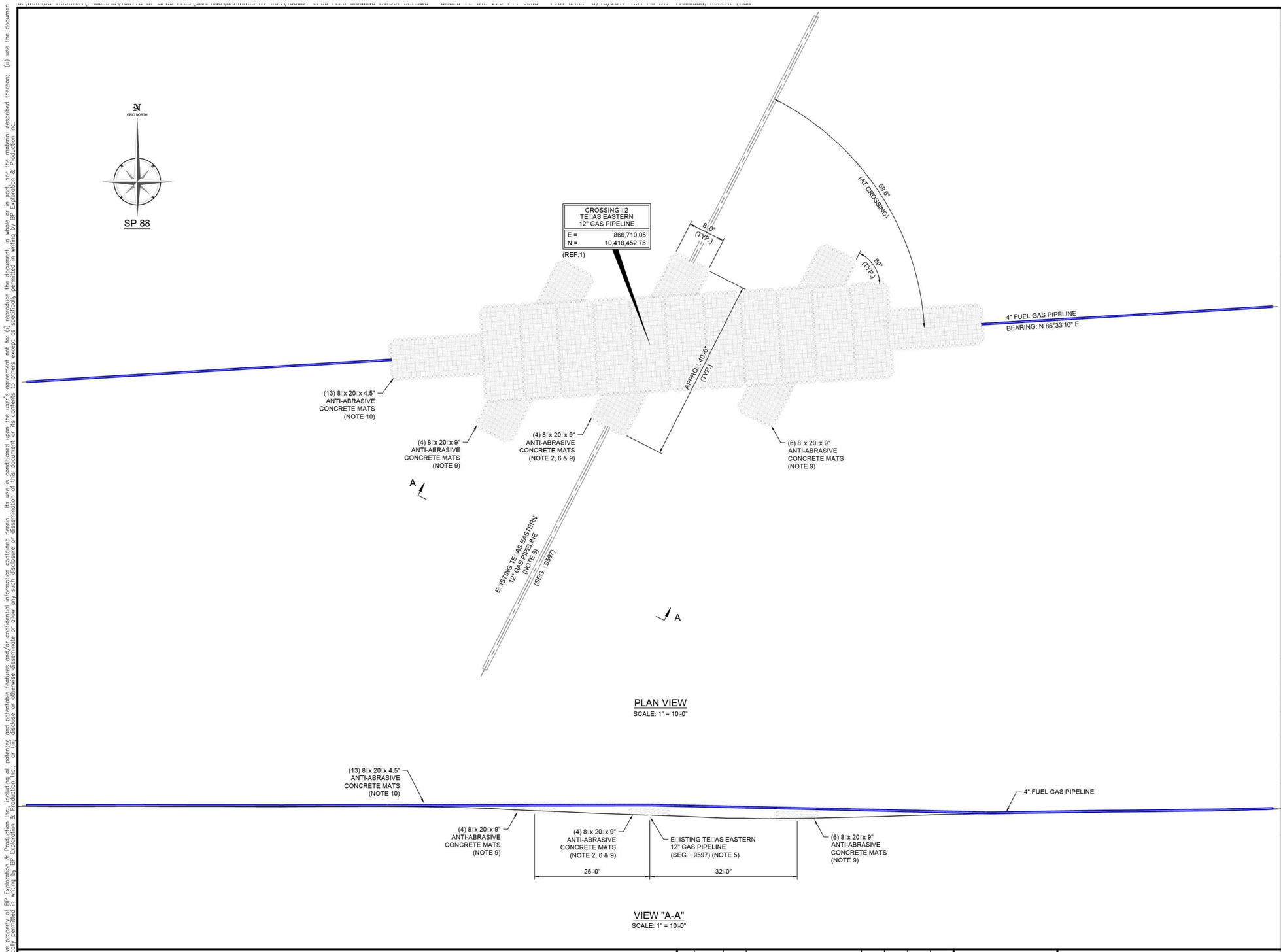
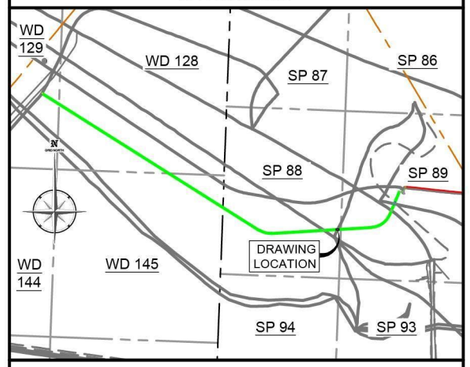



## APPROACH KEY




## REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR PRE-LAID SUPPORTS

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 9" | 14 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR CAPPING

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 4.5" | 13 (NOTE 11) |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

NOTES:
1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS OVERLAID ON E□ISTING PIPELINE ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING PIPELINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE IS FULLY E□POSED.
6. TWO LAYERS OF STANDARD 8'x20'x9" CONCRETE MATTRESSES OVER E□ISTING PIPELINE TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE.
7. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
8. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.
9. TWO (2) 8' x 20' MATTRESSES ARE STITCHED TO CREATE ONE (1) 8' x 40' MATTRESS. THE SUPPORT POSITION TOLERANCE SHALL BE ± 3 FEET. THE SUPPORT ORIENTATION TOLERANCE SHALL BE ± 5 DEGREE.
10. AT LEAST TWO BLOCKS OF COVERING MATS SHOULD BE IN THE SOIL AND PARTIALLY BURIED.
11. THE NUMBER AND PLACEMENT ORIENTATION OF COVERING MATS CAN BE ADJUSTED DEPENDING ON ACTUAL FIELD CONDITIONS AT THE TIME OF THE INSTALLATION.
12. IN ORDER TO SHOW THE SUPPORT LOCATIONS AND THE DISTANCE BETWEEN THEM, THIS ELEVATION VIEW HAS INTENTIONALLY NOT SHOWN THE DETAILS OF COVERING MATTRESSES IN RELATION TO THEIR CONTACT AND SETTLEMENT WITH/INTO SEABED.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B02 | 9/13/17 | RK | ISSUED FOR USE | JS | SS | RC | |
| B01A | 9/7/17 | RK | ISSUED FOR CLIENT REVIEW | JS | SS | RC | |
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" ARCH D | DATE |

bp

# GULF OF MEXICO
## SP89E EXPANSION

## FUEL GAS PIPELINE CROSSING 2

DRAWING NO: GM020-PL-DTL-226-F14-0003 REV: B02

BASED ON GWO-ENG-1104 REV 3

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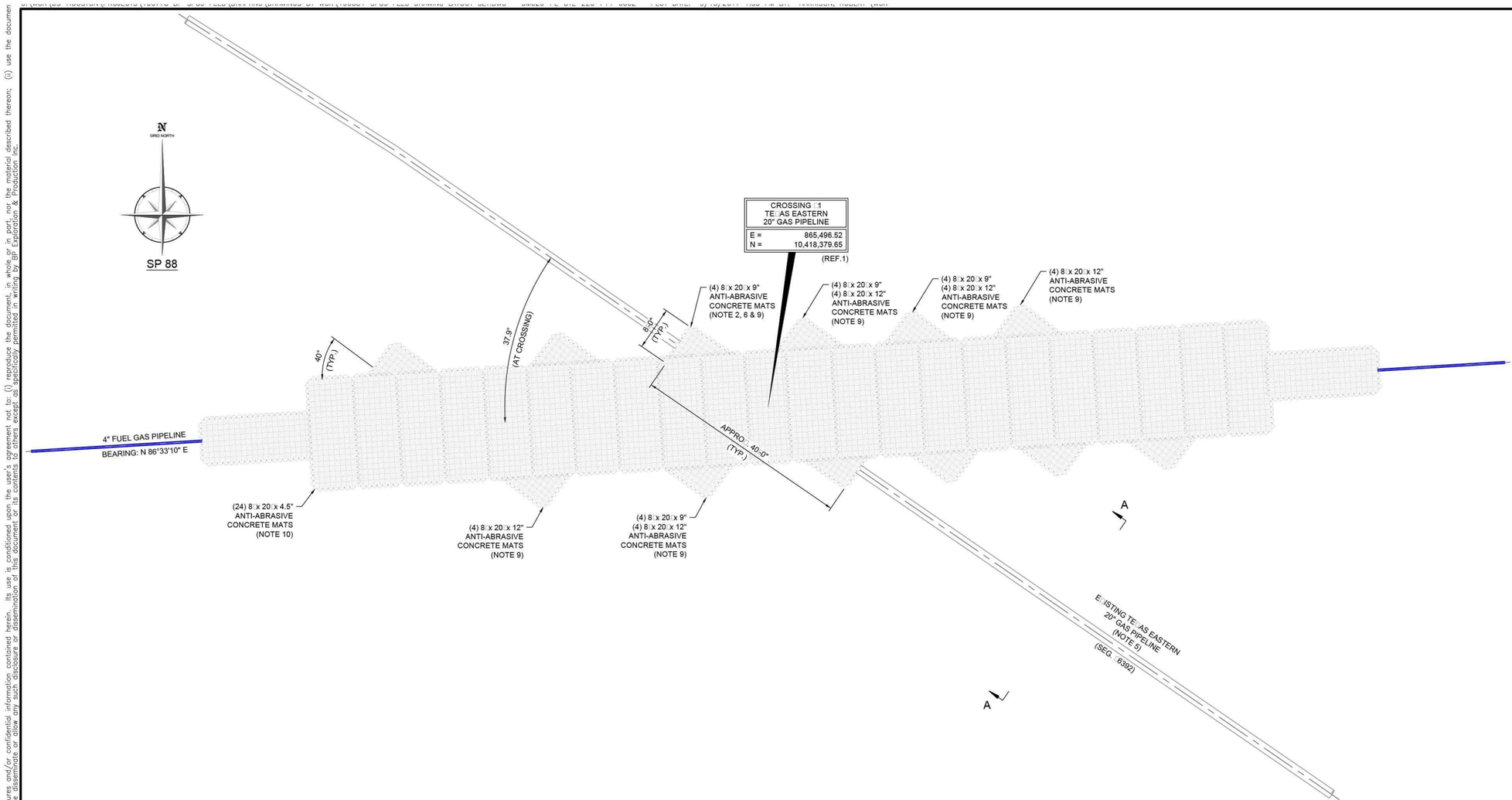
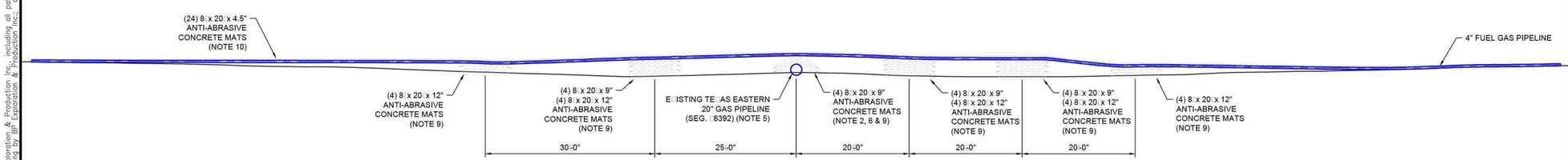



PLAN VIEW
SCALE: 1" = 10□0"

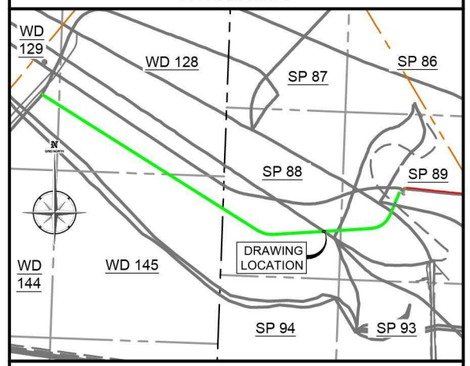



VIEW "A-A"
SCALE: 1" = 10□0"

NOTES:
1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS OVERLAID ON E□ISTING PIPELINE ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING PIPELINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE IS FULLY E□POSED.
6. TWO LAYERS OF STANDARD 8'x20'x9" CONCRETE MATTRESSES OVER E□ISTING PIPELINE TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE.
7. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
8. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.
9. TWO (2) 8' x 20' MATTRESSES ARE STITCHED TO CREATE ONE (1) 8' x 40' MATTRESS. THE SUPPORT POSITION TOLERANCE SHALL BE ± 3 FEET. THE SUPPORT ORIENTATION TOLERANCE SHALL BE ± 5 DEGREE.
10. AT LEAST TWO BLOCKS OF COVERING MATS SHOULD BE IN THE SOIL AND PARTIALLY BURIED.
11. THE NUMBER AND PLACEMENT ORIENTATION OF COVERING MATS CAN BE ADJUSTED DEPENDING ON ACTUAL FIELD CONDITIONS AT THE TIME OF INSTALLATION.
12. IN ORDER TO SHOW THE SUPPORT LOCATIONS AND THE DISTANCE BETWEEN THEM, THIS ELEVATION VIEW HAS INTENTIONALLY NOT SHOWN THE DETAILS OF THE COVERING MATTRESSES IN RELATION TO THEIR CONTACT AND SETTLEMENT WITH/INTO SEABED.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B02 | 9/13/17 | RK | ISSUED FOR USE | JS | SS | RC | |
| B01A | 9/7/17 | RK | ISSUED FOR CLIENT REVIEW | JS | SS | RC | |
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

## APPROACH KEY




## REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR PRE-LAID SUPPORTS

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 12" | 20 |
| 8□x 20□x 9" | 16 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR CAPPING

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 4.5" | 24 (NOTE 11) |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" | ARCH D |

bp

# GULF OF MEXICO
## SP89E EXPANSION

FUEL GAS PIPELINE CROSSING 1

DRAWING NO: GM020-PL-DTL-226-F14-0002 REV: B02

BASED ON DWG-ENG-1104 REV 3

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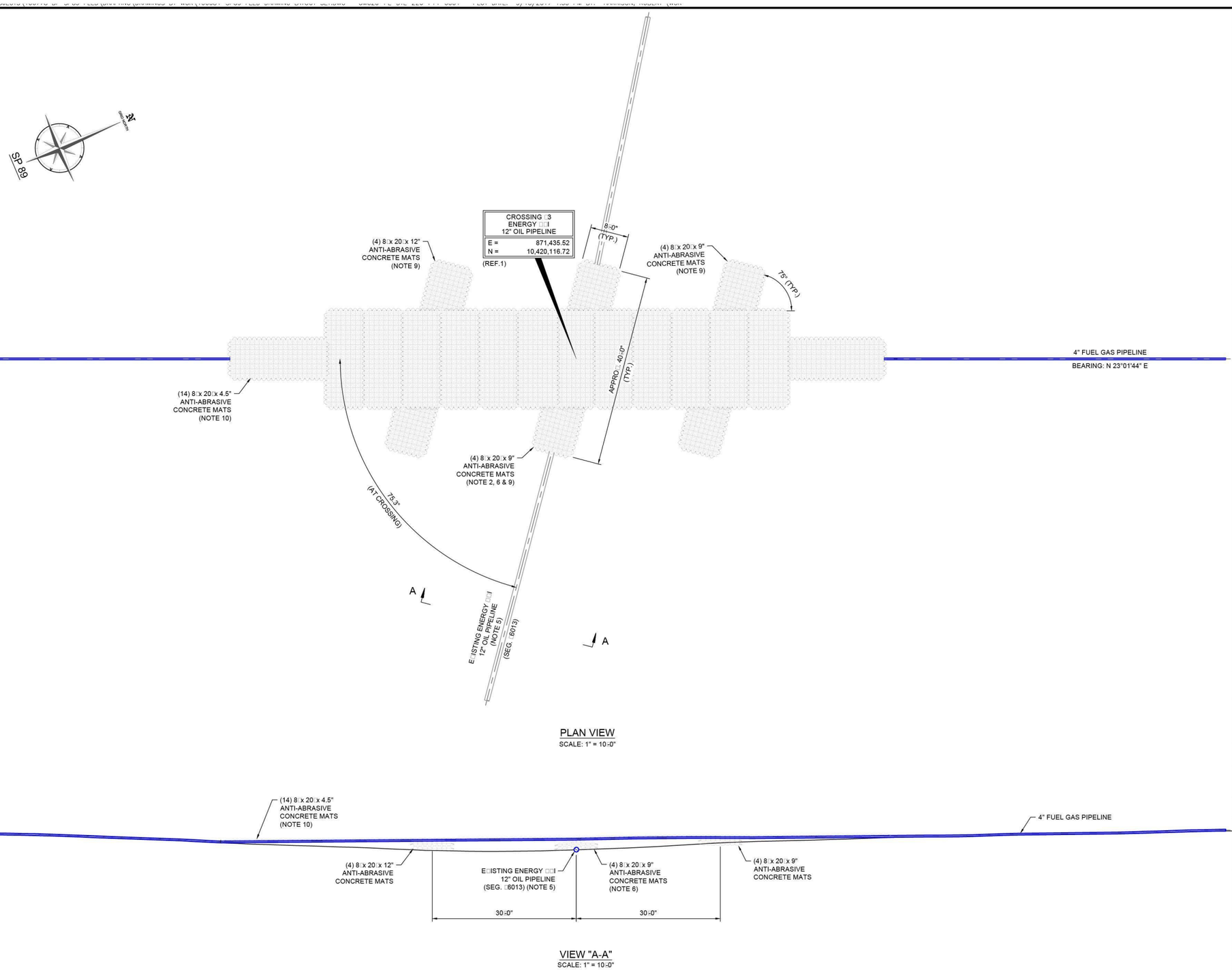
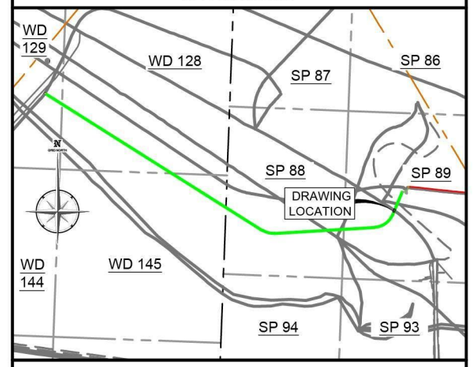



PLAN VIEW
SCALE: 1" = 10□0"




VIEW "A-A"
SCALE: 1" = 10□0"

## APPROACH KEY




## REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR PRE-LAID SUPPORTS

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 12" | 4 |
| 8□x 20□x 9" | 8 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR CAPPING

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 4.5" | 14 (NOTE 11) |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

NOTES:
1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS OVERLAID ON E□ISTING PIPELINE AT CROSSING ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING PIPELINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR□S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE IS HALF EMBEDDED.
6. TWO LAYERS OF STANDARD 8'x20'x9" CONCRETE MATTRESSES OVER E□ISTING PIPELINE TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE.
7. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
8. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.
9. TWO (2) 8' x 20' MATTRESSES ARE STITCHED TO CREATE ONE (1) 8' x 40' MATTRESS. THE SUPPORT POSITION TOLERANCE SHALL BE ± 3 FEET. THE SUPPORT ORIENTATION TOLERANCE SHALL BE ± 5 DEGREE.
10. AT LEAST TWO BLOCKS OF COVERING MATS SHOULD BE IN THE SOIL AND PARTIALLY BURIED.
11. THE NUMBER AND PLACEMENT ORIENTATION OF COVERING MATS CAN BE ADJUSTED DEPENDING ON ACTUAL FIELD CONDITIONS AT THE TIME OF INSTALLATION.
12. IN ORDER TO SHOW THE SUPPORT LOCATIONS AND THE DISTANCE BETWEEN THEM, THIS ELEVATION VIEW HAS INTENTIONALLY NOT SHOWN THE DETAILS OF THE COVERING MATTRESSES IN RELATION TO THEIR CONTACT AND SETTLEMENT WITH/INTO SEABED.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B02 | 9/13/17 | RK | ISSUED FOR USE | JS | SS | RC | |
| B01A | 9/7/17 | RK | ISSUED FOR CLIENT REVIEW | JS | SS | RC | |
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: | B. ABDALLA | 11/8/16 |
| DRAWN BY: | R. HARRISON | 11/8/16 |
| CHECKED BY: | J. SUN | 11/8/16 |
| APPROVED BY: | P. FITZPATRICK | 11/8/16 |
| SCALE: | 1" = 10'-0" ARCH D | DATE |

bp

# GULF OF MEXICO
## SP89E EXPANSION

## FUEL GAS PIPELINE CROSSING 3

DRAWING NO: GM020-PL-DTL-226-F14-0004 REV: B02

BASED ON GWO-ENG-1104 REV 3

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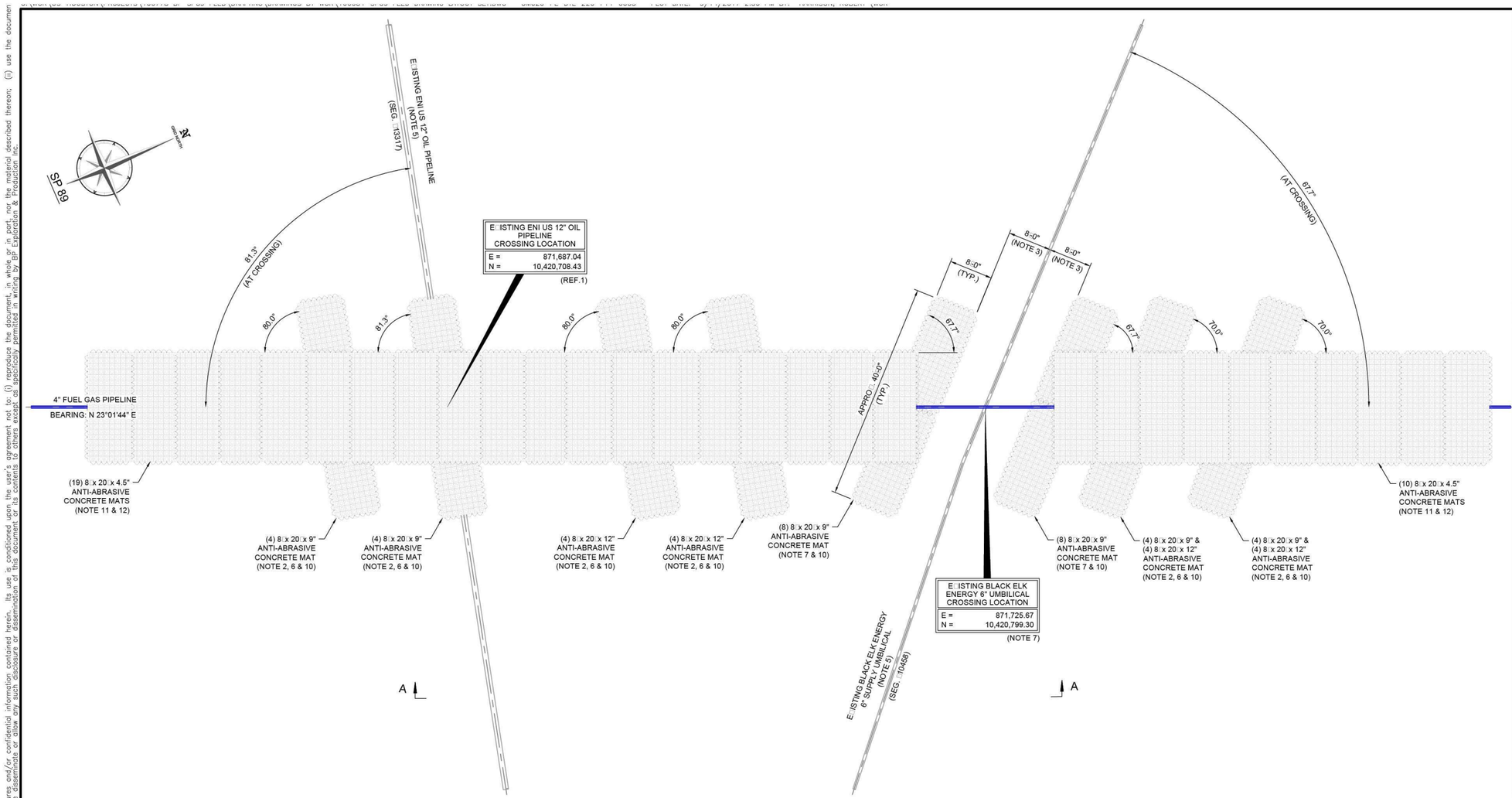
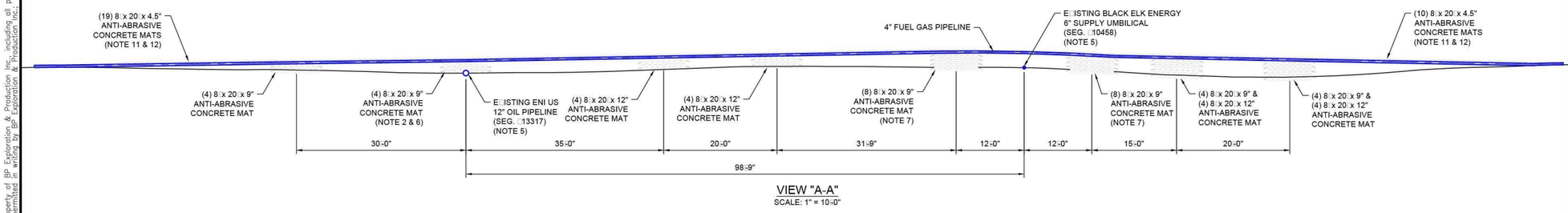



PLAN VIEW
SCALE: 1" = 10'-0"

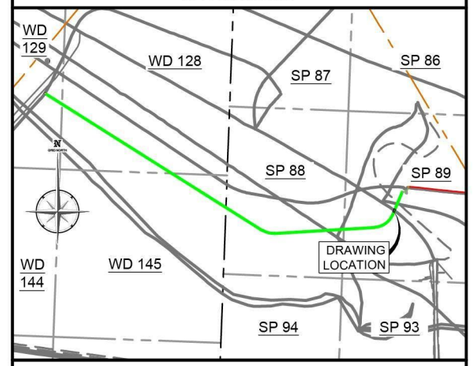



VIEW "A-A"
SCALE: 1" = 10'-0"

NOTES:
1. ALL UNITS ARE IN FEET UNLESS NOTED OTHERWISE.
2. MATS OVERLAID ON E□ISTING PIPELINE ARE TO BE INSTALLED SO THE BOTTOM MAT HAS A MINIMUM OF ONE MAT BLOCK ON THE SEAFLOOR ON BOTH SIDES OF E□ISTING PIPELINE.
3. MATS TO BE INSTALLED PER INSTALLATION CONTRACTOR'S PROCEDURE.
4. MAT SURFACE IN CONTACT WITH PIPELINE WILL HAVE NON-ABRASIVE MESH PADS. PADS WILL NOT AFFECT OR SHIELD OFF CP SYSTEM.
5. BASE CASE ASSUMPTION IS E□ISTING PIPELINE AND UMBILICAL ARE HALF BURIED.
6. TWO LAYERS OF STANDARD 8'x20'x9" CONCRETE MATTRESSES OVER E□ISTING PIPELINE TO MAINTAIN REGULATION (CFR) REQUIREMENT OF 18" SEPARATION AT THE E□ISTING PIPELINE
7. UMBILICAL CROSSING IS A BRIDGE TYPE DESIGN. THE BRIDGE SUPPORT POSITION TOLERANCE SHALL BE ± 3 FEET. THE BRIDGE MATS SHALL NOT BE IN CONTACT WITH UMBILICAL.
8. SEABED PROFILE IS BASED ON PIPELINE INSTALLATION CORRIDOR CENTERLINE.
9. PIPELINE SHALL BE INSTALLED ± 5 FT. FROM THE CENTER OF THE PRE-LAID CONCRETE MATS.
10. TWO (2) 8' x 20' MATTRESSES ARE STITCHED TO CREATE ONE (1) 8' x 40' MATTRESS. THE SUPPORT POSITION TOLERANCE SHALL BE ± 3 FEET. THE SUPPORT ORIENTATION TOLERANCE SHALL BE ± 5 DEGREE.
11. CAPPING MATS NOT TO BE PLACED AT UMBILICAL CROSSING TO PREVENT RISK OF UMBILICAL DAMAGE.
12. AT LEAST TWO BLOCKS OF COVERING MATS SHOULD BE IN THE SOIL AND PARTIALLY BURIED.
13. THE NUMBER AND PLACEMENT ORIENTATION OF COVERING MATS CAN BE ADJUSTED DEPENDING ON ACTUAL FIELD CONDITIONS AT THE TIME OF INSTALLATION.
14. IN ORDER TO SHOW THE SUPPORT LOCATIONS AND THE DISTANCE BETWEEN THEM, THIS ELEVATION VIEW HAS INTENTIONALLY NOT SHOWN THE DETAILS OF THE COVERING MATTRESSES IN RELATION TO THEIR CONTACT AND SETTLEMENT WITH/INTO SEABED.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B03 | 9/14/17 | RK | ISSUED FOR USE | JS | SS | RC | |
| B02 | 9/13/17 | RK | ISSUED FOR USE | JS | SS | RC | |
| B01A | 9/7/17 | RK | ISSUED FOR CLIENT REVIEW | JS | SS | RC | |
| B01 | 3/21/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| A02 | 3/7/17 | RH | ISSUED FOR CLIENT REVIEW | JS | AA | RC | |
| A01 | 12/13/16 | AG | ISSUED FOR CLIENT REVIEW | JS | SK | PF | |
| 01 | 12/12/16 | AG | ISSUED FOR IDC | JS | AA | PF | |

## APPROACH KEY




## REFERENCES

| | |
|---|---|
| 1. GM020-PL-LAY-226-F14-0001 | OVERALL FIELD LAYOUT |
| 2. GM020-PL-REP-226-F14-0009 | FUEL GAS PIPELINE CROSSING DESIGN REPORT |
| 3. GM020-PL-ALS-226-F14-0001-004 | FUEL GAS PIPELINE ALIGNMENT SHEET 4 OF 4 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR PRE-LAID SUPPORTS

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 12" | 16 |
| 8□x 20□x 9" | 32 |

## ANTI-ABRASIVE CONCRETE MATTRESS FOR CAPPING

| TYPE | QUANTITY |
|---|---|
| 8□x 20□x 4.5" | 29 (NOTE 13) |

## GEODETIC DATA

| | | | |
|---|---|---|---|
| PROJECTION: | UTM | DATUM: | NAD 27 |
| ZONE: | 16N | CENTRAL MERIDIAN: | 87° W |
| SPHEROID: | CLARK 1866 | GRID UNITS: | US SURVEY FEET |

10 0 10 20 30
FEET

4 0 4 8 12
METERS

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: B. ABDALLA | | 11/8/16 |
| DRAWN BY: R. HARRISON | | 11/8/16 |
| CHECKED BY: J. SUN | | 11/8/16 |
| APPROVED BY: P. FITZPATRICK | | 11/8/16 |
| SCALE: 1" = 10'-0" | ARCH D | DATE |

bp

# GULF OF MEXICO
## SP89E EXPANSION

FUEL GAS PIPELINE CROSSING 4 & 5

DRAWING NO: GM020-PL-DTL-226-F14-0005 REV: B03

BASED ON DWG-ENG-1104 REV 3

# Appendix B - SP89E Vicinity Chart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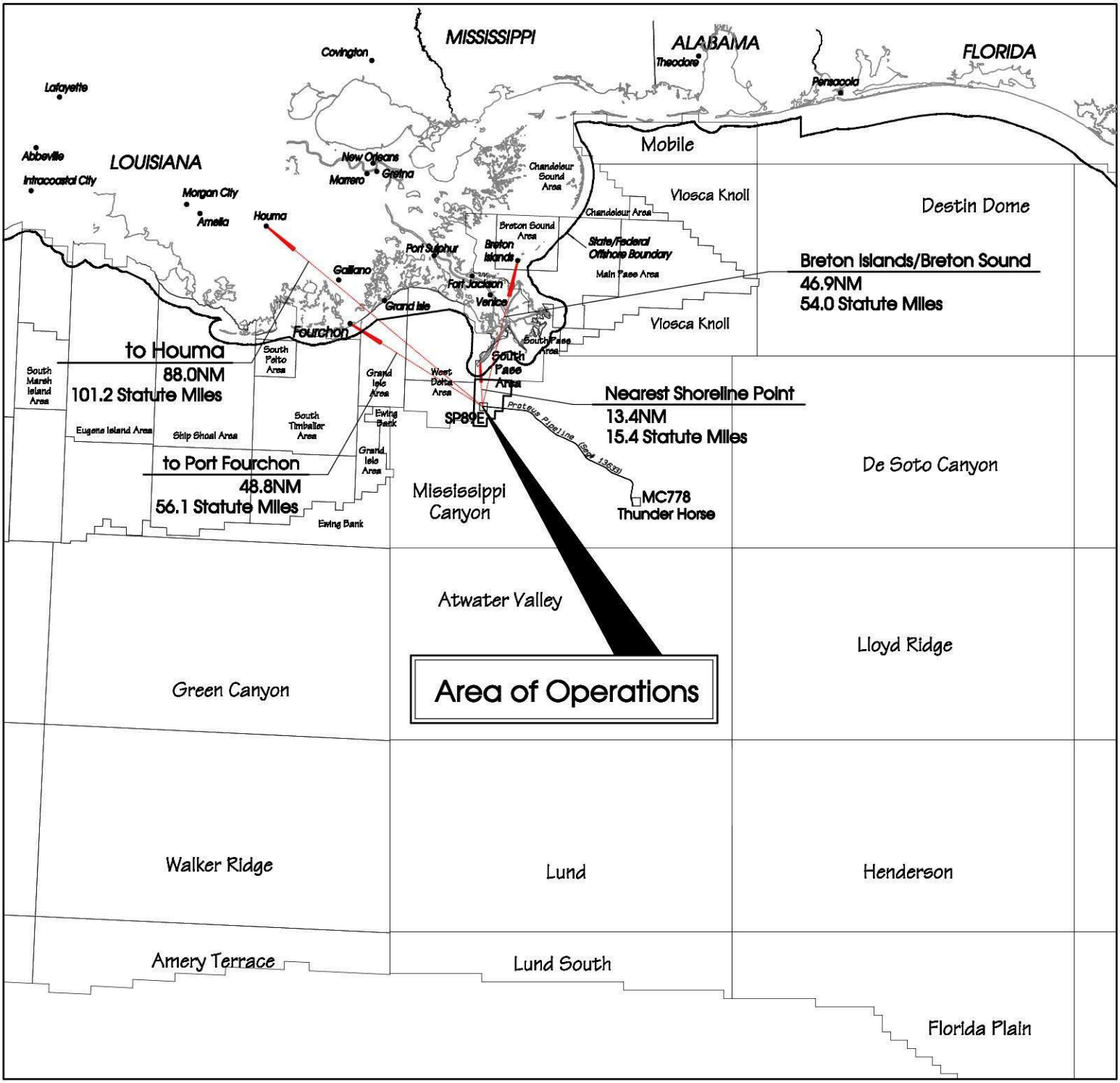



Grid: UTM Zone 16 North
Datum: NAD27
Units: US Survey Feet

# "VICINITY CHART"

| | | |
|---|---|---|
| bp | BP EXPLORATION AND PRODUCTION<br>Proposed DOCD Location - South Pass Area, SP89E Expansion Project<br>South Pass Area, South and East Addition (OPD# LA9A) Block 89 Offshore Federal<br>Plat prepared by: Robert M. Frost, PLS, BP Reservoir Development | Scale 1" = 50 miles<br>Date: 2 March 2016 |

C: \Data\Aug2015_Forward\GoM\SouthPass\SP89E\DOCD_Vicinity_Chart\Vicnity_Chart_SP89E_Expansion_Feb2016.pro

# Appendix C - SP89E Process Safety Flow Schematic


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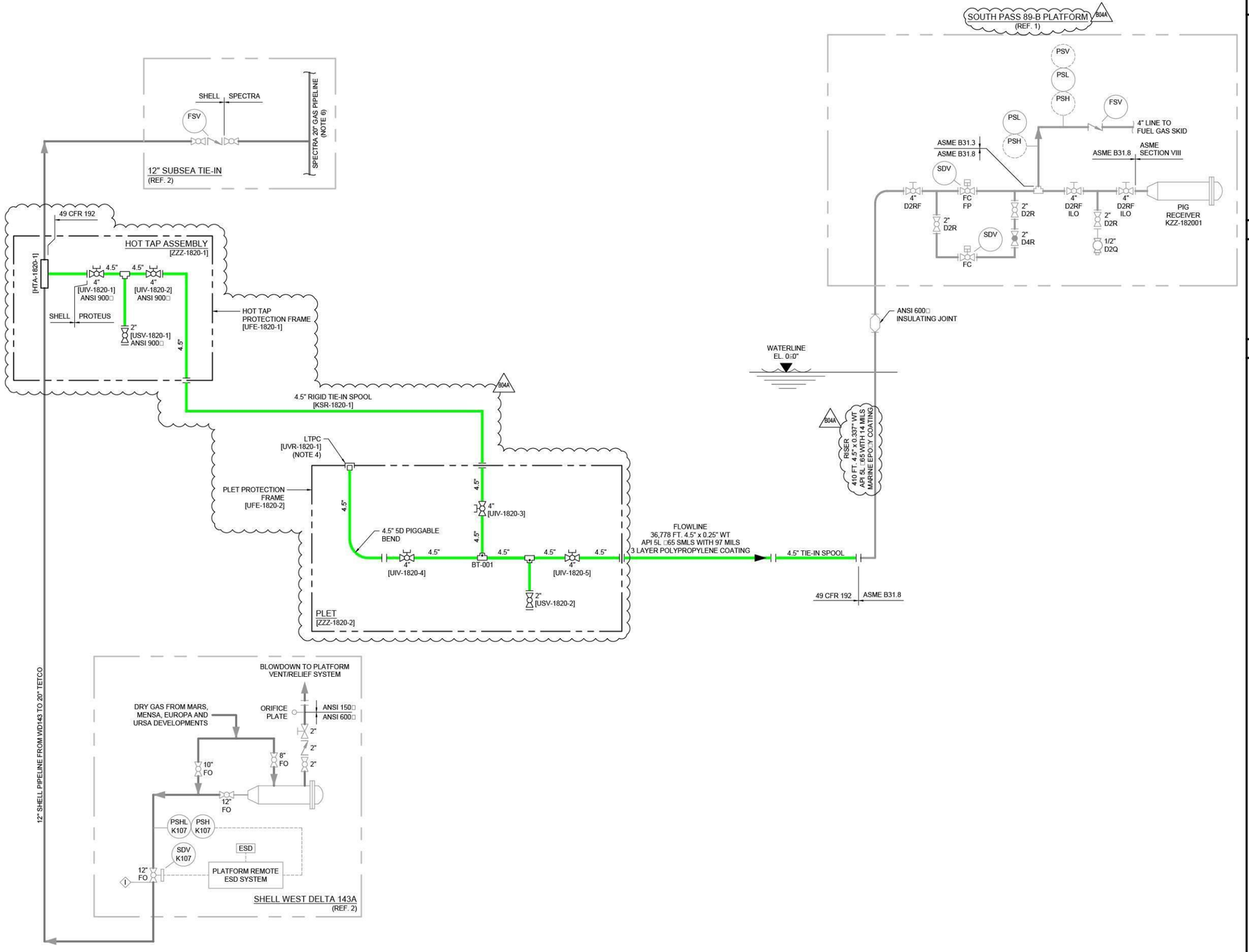


## LEGEND

- PRODUCTION (PRIMARY)
- PRODUCTION PRIMARY E□ISTING
- AREA BOUNDARY
- TOP SIDES
- BALL VALVE (FLANGES) (OPEN)
- ROV OPERATED BALL VALVE (OPEN)
- FLOW ARROW
- BARRED TEE
- HOT TAP
- TEE
- PIPE BREAK
- FLANGE
- VERTICAL CONNECTOR B04A

## NOMENCLATURE

| | |
|---|---|
| ANSI: | AMERICAN NATIONAL STANDARDS INSTITUTE |
| API: | AMERICAN PETROLEUM INSTITUTE |
| ASME: | AMERICAN SOCIETY OF MECHANICAL ENGINEERS |
| BT: | BARRED TEE |
| CFR: | CODE OF FEDERAL REGULATIONS |
| EL: | ELEVATION |
| HTA: | HOT TAP ASSEMBLY |
| PLET: | PIPELINE END TERMINATION |
| ROV: | REMOTELY OPERATED VEHICLE |

## REFERENCES

| | |
|---|---|
| 1. GM020-PR-PID-226-F14-0500 | PIPING AND INSTRUMENT DIAGRAM INCOMING FUEL GAS PIPELINE AND RECEIVER, REV. B02 |
| 2. SD-33665 | FLOW DIAGRAM - SAFETY SCHEMATIC FOR 12-INCH GAS PIPELINE, REV. 01 (By: Shell) |

NOTES:

1. VALVE SELECTION TO FOLLOW 49 CFR 192.
2. ALL FLANGES SELECTION TO FOLLOW 49 CFR 192.
3. ALL COMPONENTS TO HAVE ANSI 600□ RATING E□CEPT WHERE NOTED.
4. DELETED.
5. SYMBOLOGY, NOMENCLATURE AND COMPONENT NAMING CONVENTIONS NOT PROVIDED BY WOOD GROUP ARE NOT IDENTIFIED IN LEGEND.
6. SPECTRA 20" GAS PIPELINE PRESSURE RATING 1,440 PSIG.

| REV | DATE | BY | DESCRIPTION | CHK | ENGR | APPR | CLIENT |
|---|---|---|---|---|---|---|---|
| B04A | 5/17/17 | AG | ISSUED FOR CLIENT REVIEW | AA | MM | RC | |
| B04 | 2/27/17 | RH | ISSUED FOR USE | JS | AA | RC | |
| B03 | 1/17/17 | RH | ISSUED FOR USE | JS | MM | RC | |
| B02 | 1/11/17 | AG | ISSUED FOR USE | JS | MM | RC | |
| B01 | 11/30/16 | RH | ISSUED FOR USE | JS | MM | PF | |
| A02 | 11/16/16 | RH | ISSUED FOR CLIENT REVIEW | JS | MM | PF | |
| A01 | 11/8/16 | RH | ISSUED FOR CLIENT REVIEW | SK | MM | PF | |
| 01 | 11/8/16 | RH | ISSUED FOR IDC | BA | MM | PF | |

WOOD GROUP

| | | |
|---|---|---|
| PROJECT NO: | 106684 | |
| DESIGNED BY: M. MARINOS | | 11/8/16 |
| DRAWN BY: R. HARRISON | | 11/8/16 |
| CHECKED BY: B. ABDALLA | | 11/8/16 |
| APPROVED BY: P. FITZPATRICK | | 11/8/16 |
| SCALE: NTS | ARCH D | DATE |

bp

# GULF OF MEXICO
## SP89E EXPANSION

## FUEL GAS PIPELINE SAFETY SCHEMATIC

DRAWING NO: GM020-PL-SCM-226-F14-0004 REV: B04A

BASED ON DWG-ENG-1104 REV 3

# Appendix D - SP89E PLATs


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# Appendix E - SP89E Archaeological, Engineering and Hazard Assessment


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**Proteus Oil Pipeline Company, LLC**
**c/o BP Pipelines (North America) Inc.**
**30 South Wacker Drive**
**Suite 900**
**Chicago, IL 60606**

December 20, 2016

Energy Resource Technology GOM, LLC
500 Dallas Street, Suite 2000
Houston, TX 77002

Attn: Land & Right of Way Agent, Offshore

Re: Request for No Objection to Construction of Proposed 4-inch Fuel Gas Pipeline
Mississippi Canyon Area, OCS Federal Waters, Gulf of Mexico

Dear Sir/Madam:

Proteus Oil Pipeline Company, LLC ("Proteus") has submitted an application to the Bureau of Safety and Environmental Enforcement ("BSEE") for the installation of a 4-inch fuel gas pipeline to be installed in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, all on the Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico (GOM), Offshore Louisiana.

The proposed 4-inch fuel gas pipeline will cross Energy's lease number G01618, as described in more detail in Annexes D and G of the aforementioned application.

In accordance with BSEE requirements, Proteus is providing you with a full and complete copy of the application and requesting that you review this application with respect to the proposed crossing of your lease. Proteus does further request Energy's indication of "No Objection" to construction of the proposed 4-inch fuel gas pipeline by signing this letter in the space provided below and returning the signed copy to me using the self-addressed stamped envelope provided herein.

Please direct any questions or requests for additional information to Mark Buteau, Compliance Advisor at 337-654-1184.

Sincerely,

Lisa Krenz

Lisa Krenz
Land & Right of Way Department
BP Pipelines (North America) Inc.
Lisa.Krenz@bp.com

**I hereby confirm that Energy Resource Technology GOM, LLC has "No Objection" to Proteus' proposed pipeline construction and crossing of Energy's lease as described within the copy of Proteus' BSEE application that was provided with this letter.**

**By:** _____

**Title:** V.P. of Production Operations

**Date:** 1/23/17

energy XXI
Pipeline II, LLC

**Robin R. Anderson**

Senior Land Advisor

1021 Main (One City Centre)
Suite 2626
Houston, Texas 77002
DID 713-351.3144
Fax 713.351.3244
**www.energyxxi.com**

**SENT VIA OVERNIGHT MAIL**

April 11, 2017

Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive, Suite 900
Chicago, Illinois 60606-9957

Attention: Ms. Lisa Krenz

Re: Proposed Letter of No Objection for Proteus Oil Pipeline Company, LLC Pipeline Crossing of Energy XXI Pipeline II, LLC's Pipeline Segment No. 6013 in the West Delta and South Pass Areas, OCS Federal Waters, Gulf of Mexico

Ladies and Gentlemen:

Energy XXI Pipeline II, LLC ("**EXXI**") is in receipt of Proteus Oil Pipeline Company, LLC's ("**PROTEUS**") request for approval to cross its 12-inch Active Oil Segment No. 6013 (ROW OCS-G 04633) originating in South Pass Block 89 and terminating onshore at the West Delta Receiving Station situated in Plaquemines Parish, Louisiana ("**EXXI Pipeline**"). The EXXI Pipeline is a part of the South Pass West Delta Gathering System which is owned and operated by EXXI. EXXI agrees to allow PROTEUS to proceed with the proposed crossing of its proposed 4-inch fuel gas line in accordance with the terms and provisions of this letter.

1. PROTEUS shall notify EXXI's Pipeline Superintendent, Mr. Jason Palombo, or his successor, at 713.730.6055 at least five (5) business days prior to commencing the crossing operations or any anchoring activities ("**Work**").
2. All Work performed by PROTEUS hereunder shall be completed to EXXI's satisfaction and in accordance with the construction and engineering plans submitted by PROTEUS. PROTEUS will obtain EXXI's written approval prior to the installation of any subsea hardware on or below the seabed within 500-meters of the EXXI Pipeline.
3. Prior to mobilization, PROTEUS shall furnish EXXI with a list of all marine vessels involved in the pre-crossing, crossing and post crossing operations.
4. PROTEUS shall notify EXXI's Pipeline Superintendent at 713.730.6055 in the event of an abnormal condition discovered on the EXXI Pipeline during the progression of the Work. If any repairs to the EXXI Pipeline, including repairs to the coating, are required,

PROTEUS will cooperate in good faith to ensure no abnormal conditions exist before crossing activities can proceed.

5. If damage to EXXI Pipeline is suspected as a result of the PROTEUS activity in performing the Work, an inspection acceptable to EXXI will be promptly made. Copies of Jogs, diver/ROV reports, videos and other documentation on the inspection will be readily available to EXXI for its assessment and permanent records. If appropriate inspection personnel and/or equipment are not available or if the Work vessel(s) leave(s) the Work site before completing an inspection to the satisfaction of EXXI, EXXI reserves the right to mobilize an inspection team to inspect for suspected damage.
6. PROTEUS shall reimburse EXXI for any and all reasonable costs EXXI incurs hereunder.
7. PROTEUS will provide EXXI copies of as-built videos and videos of any abnormal situations.
8. PROTEUS will install two (2) twenty foot (20') mats in a forty foot (40') target zone. The crossing will be complete in the middle twenty foot (20') section of the two (2) mats. EXXI will not permit any jetting and/or lowering of the EXXI Pipeline. EXXI will not allow Jet Sled operation within 200-feet of the EXXI Pipeline. Separation of the two pipelines shall be made with sand/cement bags or approved flexible concrete mats only.
9. It shall be the responsibility of PROTEUS to verify the position of the EXXI Pipeline at the proposed crossing location. PROTEUS shall not cross the EXXI Pipeline at any location where the EXXI Pipeline is not fully supported by the seabed.
10. PROTEUS will verify by diver or ROV video the placement and position of placement and position of PROTEUS's gas lift pipeline on the supporting concrete mattresses over the EXXI Pipeline. PROTEUS will provide EXXI copies of as-built videos and videos of any abnormal situations. Inspection will be performed as soon as practical after the initial crossing and again after the hydrostatic test. Specific requirements related to mattresses include:

    i. The manufacturer of mattresses used in this crossing must be specified to EXXI prior to installation. If concrete mattresses are placed in contact with the EXXI Pipeline, the mattresses must be installed with an anti-abrasive (Tuf-N-Nuf or equal) between the EXXI Pipeline and the concrete mattresses.

    ii. If concrete mattresses are laid directly over the EXXI Pipeline and the visibility is poor, reflectors shall be installed at appropriate locations to ensure the crossing is properly oriented. Alternate methods will be considered but must be approved by EXXI prior to the beginning of the actual fieldwork.

11. PROTEUS shall furnish EXXI with an electronic and a hard copy set of drawings, maps, plans, and any pertinent information about completed work within ninety (90) days after completion of the work contemplated herein. Both sets should be submitted to:

    Energy XXI Pipeline II, LLC
    Attn: Mr. Kirk Trascher
    1021 Main Street, Suite 2626
    Houston, Texas 77002
    Email: ktrascher@energyxxi.com
    Phone: 713.351.3174

12. There will be no anchored vessels used in the Work, vessel operations will occur twenty-four (24) hours a day via dynamic positioning vessel(s). The following guidelines must be followed by PROTEUS and EXXI prior to the activity taking place:

    i. PROTEUS shall submit procedure plans to EXXI prior to actual field work, allowing sufficient time for the plan's review and approval by EXXI.

    ii. If damage to EXXI Pipeline is suspected as a result of PROTEUS activity in performing the Work, an inspection acceptable to EXXI will be promptly made. Copies of logs, diver/ROV reports, videos and other documentation on the inspection will be readily available to EXXI for its assessment and permanent records. If appropriate inspection personnel and/or equipment are not available or if the work vessel(s) leave(s) the work site before completing an inspection to the satisfaction of the EXXI, EXXI reserves the right to mobilize an inspection team to inspect for suspected damage; and PROTEUS will be responsible for all reasonable costs incurred.

    iv. PROTEUS will furnish survey equipment and licensed survey personnel to verify the position of the EXXI Pipeline in relation to the Work. The surveyor will furnish EXXI with copies of all information such as cable crossings, etc. upon request.

    v. PROTEUS will ensure that, if a barge(s) is (are) employed on this project, all barge anchors will be equipped with pennant wires and can buoys. All barge anchors will be deployed and retrieved with an anchor handling tug. This tug will be equipped with a remote LORAN/D.G.P.S. tied in the survey equipment on the construction vessel. This paragraph is not applicable if a self-propelled dive support type vessel is utilized.

    vi. PROTEUS agrees that no anchors shall be placed within 500' of any EXXI pipeline during the course of this Work. When in the course of this Work it becomes necessary that PROTEUS's anchor patterns extend across any EXXI pipeline, PROTEUS agrees that these anchors shall be placed no closer than 1,000 feet from the pipelines being crossed by the anchor lines. This paragraph is not applicable if a self-propelled dive support type vessel is utilized.

    vii. When working within 500-meters of the EXXI Pipeline a Risk Assessment must be completed to include but not limited to a review of the following: dropped objects, adverse met-ocean conditions, vessel drift offs, vessel routing, SIMOPS, anchor positioning operations, etc. PROTEUS will not have any jet machine operations within 200-feet of the EXXI Pipeline.

    viii. To prevent damage from dropped objects to the EXXI Pipeline, PROTEUS will minimize all lifting operations within 500-meters of the EXXI Pipeline.

    ix. Any anchoring operations will be conducted in daylight hours unless otherwise mutually agreed upon. The decision shall be made considering wind and sea conditions, water depth, quality of survey equipment on the vessel, availability of current pipeline maps of the area, pipeline congestion in the area, etc. This paragraph is not applicable if a self-propelled dive support type vessel is utilized.

x. Any anchor lines crossing the EXXI Pipeline shall be equipped with pennant lines and buoys for marking the anchor location and for deploying and recovering the anchors. The PROTEUS surveyor shall confirm the location of the anchors after any adjustment to the anchors and after any weather event that could have caused anchor slippage. This paragraph is not applicable if a self-propelled dive support type vessel is utilized.

13. PROTEUS will secure all necessary permits and approvals and, along with its employees, representatives, agents, contractors and subcontractors, shall comply with all applicable laws, rules, ordinances, decrees and regulations in connection with the performance of the Work contemplated hereunder.
14. If any provision of this Agreement is adjudicated or otherwise found to be against public policy, void, or otherwise unenforceable, then such provision shall be deleted or modified, as necessary, in keeping with the express intent of the parties hereto to render all the remainder of this Agreement, valid and enforceable. All such deletions or modifications shall be the minimum required to effect the foregoing.
15. This Agreement may not be assigned by PROTEUS without the prior written consent of EXXI, which consent shall not be unreasonably withheld.
16. No waiver by PROTEUS of any one or more defaults by EXXI in the performance of any provision of this Agreement shall operate or be construed as a waiver of any future default or defaults, whether of a like or different character.
17. **PROTEUS SHALL RELEASE, DEFEND, INDEMNIFY AND HOLD HARMLESS EXXI AND ITS AFFILIATES, AND ITS AND THEIR AGENTS, EMPLOYEES, OFFICERS, DIRECTORS, INSURERS, CONTRACTORS, SUBCONTRACTORS, REPRESENTATIVES, SUCCESSORS AND ASSIGNS (THE "EXXI PARTIES") FROM AND AGAINST ANY AND ALL ACTIONS, CLAIMS, SETTLEMENTS, JUDGMENTS, DEMANDS, LIENS, LOSSES, LIABILITIES, DAMAGES, FINES, PENALTIES, INTEREST, COSTS, EXPENSES, (INCLUDING, WITHOUT LIMITATION, EXPENSES ATTRIBUTABLE TO THE DEFENSE OF ANY ACTIONS OR CLAIMS), AND REASONABLE ATTORNEY'S FEES AND OTHER LEGAL EXPENSES AND COSTS (COLLECTIVELY, "LOSSES") ARISING OUT OF (a) INJURY OR DEATH OF PERSONS (INCLUDING ANY EXXI PARTY OR ANY EMPLOYEE, CONTRACTOR OR SUBCONTRACTOR OF PROTEUS) (b) DAMAGE TO OR LOSS OF ANY PROPERTY (INCLUDING THAT OF ANY EXXI PARTY OR ANY EMPLOYEE, CONTRACTOR OR SUBCONTRACTOR OF PROTEUS) OR (c) HARM TO THE ENVIRONMENT, IN EACH CASE CAUSED BY, ARISING OUT OF, OR RESULTING FROM, EITHER DIRECTLY OR INDIRECTLY, THE ACTIVITIES OF PROTEUS, INCLUDING ITS OPERATOR, CONTRACTORS OR SUBCONTRACTORS, CONTEMPLATED UNDER THIS AGREEMENT, REGARDLESS OF WHETHER SUCH LOSSES ARE CAUSED OR CONTRIBUTED TO (OR ALLEGEDLY CAUSED OR CONTRIBUTED TO) BY THE SOLE, JOINT, CONCURRENT OR ANY OTHER FORM OF NEGLIGENCE, STRICT LIABILITY (STATUTORY OR OTHERWISE) OR OTHER FAULT OF ANY EXXI PARTY, THE UNSEAWORTHINESS OR UNAIRWORTHINESS OF ANY VESSEL OR CRAFT OR A PRE-EXISTING CONDITION, BUT EXCLUDING ANY LOSSES TO THE EXTENT CAUSED BY THE GROSS NEGLIGENCE OR WILLFUL MISCONDUCT OF ANY EXXI PARTY.**
18. PROTEUS shall carry adequate insurance or shall self-insure in order to support its indemnification obligations hereunder; provided, however, that PROTEUS's failure to secure such insurance coverage shall in no way act to relieve PROTEUS from its obligations hereunder. Notwithstanding anything herein to the contrary, PROTEUS's indemnification obligations under this Agreement shall not be limited in amount or scope to coverage provided by insurance that is required of PROTEUS hereunder.
19. PROTEUS and its agents, contractors, employees, representatives, servants and subcontractors shall observe and comply with all federal, state, and local laws, ordinances, rules, regulations, orders and decrees regarding the environment and cultural resource, including but not limited to, with the terms of 30 CFR 250.1009. Additionally, PROTEUS and it's agents, contractors, employees, representatives, servants and subcontractors shall take all necessary steps to prevent cultural, environmental, and natural resource impairment in the vicinity of the EXXI Pipeline.

20. To the maximum extent possible, the general maritime laws of the United States shall govern the validity, construction, interpretation and effect of this agreement, excluding any choice of law rules which would otherwise require the application of the laws of any other jurisdiction. In the event maritime law is held inapplicable by a court of competent jurisdiction, the laws of the State of Texas shall apply.
21. EXXI and its co-lessees or assigns reserve the right to subsequently cross PROTEUS's pipeline in accordance with applicable governmental regulations and accepted pipeline industry practices, should the need arise. In such event, EXXI will provide to PROTEUS thirty (30) days advance written notice of the crossing subject to EXXI's acceptance and execution of a letter of no objection prepared by PROTEUS which said letter of no objection shall be substantially similar in wording to this letter except that PROTEUS's name shall be substituted for that of EXXI and EXXI for that of PROTEUS.

If PROTEUS is agreeable to the aforementioned provisions, please indicate agreement by having an authorized representative sign in the space provided and return one executed original to EXXI, attention Ms. Robin Anderson. Any questions can be directed to Ms. Robin Anderson at 713.351.3144 or via email at randerson@energyxxi.com.

Very truly yours,

**ENERGY XXI PIPELINE II, LLC**

Robin R. Anderson
Senior Land Advisor

DMS

**ACCEPTED AND AGREED TO THIS** 12th **DAY OF** April **, 2017.**

**By:** Kimberly Bragg

**Printed Name:** Kimberly Bragg

**Date:** April 12, 2017

eni us operating
eni us operating co. inc.
1200 Smith Street, Suite 1700
Houston, TX 77002
Tel. 713-393-6100 Land Fax 713-393-6208

March 27, 2017

Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive, Suite 900
Chicago, Illinois 60606-9957

Attention: Ms. Lisa Krenz
Land and Right of Way Department

**RE: Crossing Agreement for Proteus Oil Pipeline, LLC's installation of a 4.5" Fuel Gas Pipeline Crossing Eni's 12" Pipeline in South Pass 89**

Dear Ms. Krenz:

We are in receipt of your letter dated December 20, 2016 addressed to Eni Petroleum US, LLC, informing us of the proposed installation, by Proteus Oil Pipeline, LLC and BP Pipelines (North America) Inc. (hereinafter collectively referred to as "Proteus"), of the above referenced 4.5" fuel gas pipeline, and its proposed crossing of a 12" oil pipeline (pipeline segment #13317) owned by Eni Petroleum US LLC and operated by Eni US Operating Co. Inc. (collectively, "Eni") at a point located in South Pass Block 89. In your letter you request that Eni sign a Letter of No Objection to the proposed crossing. The 4.5" fuel gas pipeline will transport fuel gas from a 12" Shell gas pipeline located in West Delta Block 129 to Proteus' platform E located in South Pass 89.

Please be advised Eni presently has no objection to Proteus' plans, provided Proteus agrees to, and complies with, the following requirements:

1. All activities conducted on behalf of Eni, and all activities conducted by or on behalf of Proteus, with respect to the installation of the proposed 4.5" fuel gas pipeline, shall be at the sole risk, expense and liability of Proteus.

2. Proteus will secure all necessary permits and approvals and comply with all applicable laws, rules, and regulations in constructing, operating, maintaining, and repairing the proposed 4.5" fuel gas pipeline. The crossing of Eni's pipeline segment #13317 will be accomplished in accordance with standard industry practice and with the drawings and specifications contained in Proteus' application to the Bureau of Safety and Environmental Enforcement ("BSEE"), a copy of which accompanied your letter dated December 20, 2016.

3. At least 7 days prior to commencing the crossing operations, or of approaching within the vicinity of pipeline segment #13317, Proteus and/or its contractor will notify Eni so that an Eni representative may be present during any pipeline construction, installation, maintenance, and/or repair operations on the subject lease(s) and/or Eni pipeline crossing operation(s). Eni will provide helicopter transportation for Eni's representative from shore to the inspection and/or maintenance site and

from said site to shore. Proteus agrees to provide free accommodations to Eni representative on board the Proteus installation vessel(s). Such notice will be given to:

Michael Budde
Email: michael.budde@enipetroleum.com

4. Proteus will take adequate precautions, in accordance with good accepted industry practices, concerning existing intra-lease pipelines and flow-lines. The Proteus installation vessel will have a DP system, adequate surface and underwater position systems and be equipped with a work class ROV.

5. Proteus agrees to identify pipeline segment #13317 visually with a ROV or use a pipe tracker mounted on the ROV before installing any mats, caps, half-shells, etc. for crossing. Continuous ROV monitoring is required during the entire crossing operation for all identified crossing locations. Proteus agrees that visual verification shall be provided onsite for each crossing location that the 4.5" fuel gas pipeline section covered by the mats, etc. will land on pipeline segment #13317. In case the mats, etc. miss pipeline segment #13317, Proteus shall rectify this by recovering the 4.5" fuel gas pipeline to the surface, re-attaching the mats, etc., to the 4.6" line, and re-laying from the installation vessel. Proteus agrees that Eni's representative, unless otherwise agreed, will be present on board the vessel during the periods of diving inspection. ROV video footage for all crossings over pipeline segment #13317 shall be supplied together with the as-built documentation.

6. Within ninety (90) days following completion of the installation of the proposed 4.5: fuel gas pipeline, Proteus will furnish Eni, at the above address, an "as-built" drawing of said pipeline showing the crossing location coordinates.

7. Proteus shall conduct all operations, including construction, repair, and maintenance, of the proposed pipeline so as not to interfere with any of Eni's operations in the field. Proteus operations will always be subject to the prior right of Eni to utilize any and all portions of the lease in which the proposed crossing occurs in any manner consistent with good industry practices. Should Eni at any time need to remove its pipeline from beneath the proposed 4.5" fuel gas pipeline at a crossing location and relay it over and across the Proteus line, Eni shall have the right to require Proteus to cooperate with Eni. Eni shall not be liable to Proteus for any loss of revenue due Proteus in taking measures to cooperate with Eni's removal of pipeline segment #13317 from beneath the proposed 4.5" fuel gas pipeline. In the event the 4.5" fuel gas pipeline is ever removed from over the Eni pipeline at this crossing, Proteus will use care and diligence in removing same; the expense of repairing any damage that might occur to the Eni pipeline or its coating as a result of the removal of the Proteus 4.5" fuel gas pipeline will be borne by Proteus.

8. Prior to the proposed project commencement date, should there be any re-routing or adjustment to the 4.5" fuel gas pipeline's route as proposed with respect to the crossing of any lease block in the vicinity of Eni's facilities, whether or not specifically identified on the maps or in the formal application for the 4.5" fuel gas pipeline, Proteus shall promptly notify Eni of such changes and allow Eni sufficient time to respond thereto.

9. **Proteus shall defend, indemnify and hold harmless Eni, its agents, employees, officers, directors, insurers, successors, and affiliate companies, from and against any loss, damage, claim, suit, liability, judgment and expense of any nature whatsoever (including attorneys' fees and other costs of litigation), and any fines, penalties and assessments, or other similar liabilities, arising out of injury, disease or death of persons (including that of Proteus or Eni or their contractors and subcontractors), lost product and/or lost business due to the installation, operation, maintenance and/or eventual removal and abandonment of the above referenced pipeline and/or interference with Eni property/pipeline operation(s), and any environmental harm, or damages to natural resources, caused by, arising out of or resulting from, either directly or indirectly, the activities of Proteus and its contractors in the construction, operation, maintenance, and/or eventual removal and abandonment of the proposed 4.5" fuel gas pipeline, and this indemnity shall apply, except to the extent caused by the gross negligence or willful misconduct of Eni, whether or not Eni is claimed to be passively, concurrently or actively negligent and regardless of whether liability without fault, including but not limited to strict liability, is imposed or sought to be imposed upon Eni.**

10. **Proteus shall protect, defend, indemnify and hold Eni harmless from and against any and all claims, costs, penalties or liability for property or environmental damage to or loss of property, including but not limited to loss of product, of any third party and for bodily injury to or death of any third party, including but not limited to third party shippers and transporters of hydrocarbons, arising out of or resulting from the operations or activities of Proteus, its employees, contractors and their employees, associated with the installation, maintenance, operation and eventual abandonment and/or removal of the 4.5" fuel gas pipeline, and this indemnity shall apply, except to the extent caused by the gross negligence or willful misconduct of Eni, whether or not Eni is claimed to be passively, concurrently or actively negligent and regardless of whether liability without fault, including but not limited to strict liability, is imposed or sought to be imposed upon Eni.**

11. This conditional letter of no objection covers only the activities mentioned in Proteus' correspondence dated December 20, 2016 and in all of the materials included therewith. as the same relates or may apply to Eni. Further, this conditional letter of no objection in no way implies Eni's consent to Proteus' proposed 4.5" fuel gas pipeline installation and/or any pipeline crossing(s) on acreage/OCS block(s) that are leased and/or owned by third parties (whether co-lessee or otherwise). Proteus recognizes that it is not the intention of Eni by this letter agreement to grant a right-of-way or easement or any fee interest, but merely to signify that insofar as its interests are concerned, Eni has no objection to Proteus installation of the 4.5" fuel gas pipeline if done in accordance with the provisions of this letter.

12. The rights and obligations set forth in this letter shall be governed by U. S. General Maritime Law. If any provision herein is adjudicated or otherwise found to be against public policy, void, or otherwise unenforceable, then such provision shall be deleted or modified, in keeping with the express intent of the parties hereto, as necessary to render all the remainder of this agreement, valid and enforceable. All such deletions or modifications shall be the minimum required to effect the foregoing.

13. The rights set forth herein may not be assigned by Proteus without the prior written consent of Eni, which consent shall not be unreasonably withheld.

14. No waiver by Eni of any one or more defaults by Proteus in performance of any provision hereunder shall operate or be construed as a waiver of any future default or defaults, whether of a like or different character.

If Proteus is agreeable to the foregoing, please have the proper authority indicate acceptance thereof by dating, executing and returning one original of this agreement to my attention at the above address. Should you have any questions or be in need of further assistance please contact Mr. David Lawler at 713-393-6126.

Yours very truly,

Gary Clifford
Business Development Manager

AGREED TO AND ACCEPTED THIS
12th DAY OF April, 2017. DMS

Proteus Oil Pipeline Company, LLC

BY: Kimberly Bragg

TITLE: Vice President

AGREED TO AND ACCEPTED THIS
12th DAY OF April, 2017. DMS

BP Pipelines (North America) Inc.

BY: Gerald J. Maret

TITLE: President

17-002

FIELDWOOD ENERGY

March 28, 2017

Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (north America) Inc.
30 South Wacker Drive
Suite 900
Chicago, Illinois 60606
Attn: Ms. Lisa Krenz

**Subject: Request for No Objection for 4-inch Fuel Gas Pipeline Crossing over South Pass Block 89 and West Delta Block 128**

Dear Ms. Krenz:

Fieldwood Energy LLC ("Fieldwood") has received the Request for No Objection to Construction of Proposed 4-inch Fuel Gas Pipeline to be installed in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, dated December 20, 2016 from Proteus Oil Pipeline Company, LLC ("Proteus"). Fieldwood has no objection to the proposed pipeline installation subject to the following terms and conditions:

1. The crossing of the leases and pipelines of Fieldwood and/or subsidiaries is to be at the sole cost, risk and expense of Proteus.

2. Prior to move-in of marine construction equipment, Proteus will locate and buoy existing pipelines through the potential anchor spread corridors. Such buoys will be set at a maximum of 1,000 foot spacing along the pipeline and will be maintained for so long as the marine construction equipment is in the area. In lieu of buoys, real time electronic survey equipment such as DGPS will be acceptable. When anchors are placed over existing pipelines, Proteus shall maintain a minimum of 1000' between anchor placement and existing pipelines. When anchors are placed in the vicinity of (but not over) existing pipelines, Proteus shall maintain a minimum of 500' between anchor placement and existing pipelines.

3. Concrete mats used to protect any pipelines of Fieldwood and subsidiaries shall be manufactured by a generally accepted manufacturer for such mats in the United States Gulf of Mexico. The proposed crossing shall be accomplished while any pipelines are in service and under pressure.

4. Proteus agrees to notify Mr. Shannon Savoy, Fieldwood's authorized representative, in Fieldwood's Lafayette office (337) 354-8034, a minimum of seventy-two (72) hours before construction reaches the crossing site.

5. PROTEUS SHALL PROTECT, DEFEND, INDEMNIFY, RELEASE AND HOLD HARMLESS, FIELDWOOD AND ITS AGENTS, CO-LESSEES, CONTRACTORS, DIRECTORS, EMPLOYEES, INSURERS, JOINT VENTURES, OFFICERS, PARTNERS, REPRESENTATIVES, SERVANTS, SUBCONTRACTORS, AND AFFILIATED, PARENT, AND SUBSIDIARY COMPANIES AND ITS AND THEIR AGENTS, CONTRACTORS, DIRECTORS, EMPLOYEES, INSURERS, OFFICERS, REPRESENTATIVES, SERVANTS, AND SUBCONTRACTORS (THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CAUSES OF ACTION, CLAIMS, DAMAGES, DEMANDS, LIABILITY, LOSSES, AND SUITS OF EVERY TYPE AND CHARACTER, INCLUDING ALL EXPENSES OF LITIGATION, COURT COSTS, AND ATTORNEY'S FEES ("CLAIMS"), ARISING OUT OF OR RESULTING FROM THE DECOMMISSIONING OF PROTEUS' PIPELINE, WITHOUT REGARD TO WHETHER ANY SUCH CLAIM IS CAUSED, IN WHOLE OR IN PART, BY THE NEGLIGENCE (WHETHER SOLE, JOINT OR CONCURRENT; ACTIVE OR PASSIVE), STRICT LIABILITY, STATUTORY LIABILITY, CONTRACTUAL LIABILITY OR OTHER FAULT OF ANY OF THE INDEMNIFIED PARTIES (EXEPT TO THE EXENT OF THE GROSS NEGLIGENCE AND/OR WILLFUL MISCONDUCT OF THE INDEMNIFIED PARTIES) OR BY ANY DEFECT OR PRE-EXISTING CONDITION (WHETHER KNOWN OR UNKNOWN; PATENT, LATENT OR OTHERWISE).

6. Proteus and its agents, contractors, employees, representatives, servants, and subcontractors shall observe and comply with all federal, state, and local laws, ordinances, rules, regulations, orders, and decrees regarding the environment and cultural resource, including but not limited to, with the terms of 30 CFR 250.1009. Additionally, Proteus and its agents, contractors, employees, representatives, servants and subcontractors shall take all necessary steps to prevent cultural, environmental, and natural resource impairment in the vicinity of the facilities of Fieldwood, its affiliates and/or subsidiaries.

7. PROTEUS SHALL BE FULLY RESPONSIBLE FOR THE MANAGEMENT OF ANY HAZARDOUS OR TOXIC WASTE, MATERIAL, OR ANY COMPONENT THEREOF ("WASTE") GENERATED IN CONNECTION WITH THE DECOMMISSIONING OF PROTEUS' PIPELINE OR CROSSING OF THE FIELDWOOD PIPELINE. PROTEUS SHALL ASSUME SOLE RESPONSIBILITY FOR ALL LOSSES, DAMAGES, AND LIABILITIES TO PERSONS OR PROPERTY RESULTING FROM SUCH GENERATION OF WASTE. PROTEUS SHALL PROTECT, DEFEND, INDEMNIFY, RELEASE AND HOLD HARMLESS THE INDEMNIFIED PARTIES FROM AND AGAINST ALL CLAIMS THAT RESULT IN ALLEGED OR ACTUAL POLLUTION OR OTHER DAMAGE, ENVIRONMENTAL OR OTHERWISE, THAT ARISE OUT OF OR ARE RELATED IN ANY WAY WITH THE WASTE, WITHOUT REGARD TO WHETHER ANY SUCH CLAIM IS CAUSED, IN WHOLE OR IN PART, BY THE NEGLIGENCE (WHETHER SOLE, JOINT OR CONCURRENT; ACTIVE OR PASSIVE), STRICT LIABILITY, STATUTORY LIABILITY, CONTRACTUAL LIABILITY OR OTHER FAULT OF ANY OF THE INDEMNIFIED

PARTIES (EXEPT TO THE EXENT OF THE GROSS NEGLIGENCE AND/OR WILLFUL MISCONDUCT OF THE INDEMNIFIED PARTIES) OR BY ANY DEFECT OR PRE-EXISTING CONDITION (WHETHER KNOWN OR UNKNOWN; PATENT, LATENT OR OTHERWISE).

8. Proteus shall maintain general liability insurance in support of the assumptions of liability and indemnity, defense and hold harmless obligations as set forth herein and shall name the Indemnified Parties as additional insureds and waive subrogation against the Indemnified Parties on such policies of liability insurance to the extent of such liability assumptions and indemnify, defense and hold harmless obligations.

9. If any provision of this agreement is adjudicated or otherwise found to be against public policy, void, or otherwise unenforceable, then such provision shall be modified or deleted, in keeping with the express intent of the parties hereto, as necessary to render all the remainder of this letter agreement valid and enforceable. All such modifications or deletions shall be the minimum required to effect the foregoing.

10. This agreement may not be assigned by Proteus without the prior written consent of Fieldwood, which shall not be unreasonably withheld.

11. No modification to this agreement shall be or become effective unless executed by duly authorized representatives of both parties to a supplementary written agreement.

12. No waiver by Fieldwood of any one or more defaults by Proteus in performance of any provisions of this letter agreement shall operate or be construed as a waiver of any future default or defaults, whether of a like or different character.

14. To the maximum extent possible, the general maritime laws of the United States shall govern the validity, construction, interpretation and effect of this agreement, excluding any choice of law rules which would otherwise require the application of the laws of any other jurisdiction. In the event maritime law is held inapplicable by a court of competent jurisdiction, the laws of the State of Texas shall apply.

If Proteus is agreeable to the aforementioned provisions, please indicate agreement by having an authorized representative sign in the space provided and return one executed original to Fieldwood, attention Mr. John Smith.

Sincerely yours,
**FIELDWOOD ENERGY LLC**

John Smith
Vice President, Land and Business Development

ACCEPTED AND AGREED TO THIS 12th DAY OF April, 2017.

Proteus Oil Pipeline Company, LLC DMS

By: Kimberly Bragg

Title: Vice President

Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive
Suite 900
Chicago, IL 60606

December 20, 2016

Northstar Offshore Group, LLC
11 Greenway Plaza
Houston, TX 77046

Attn: Keith Krenek

Re: Request for No Objection to Construction of Proposed 4-inch Fuel Gas Pipeline
Mississippi Canyon Area, OCS Federal Waters, Gulf of Mexico

Dear Mr. Krenek:

Proteus Oil Pipeline Company, LLC ("Proteus") has submitted an application to the Bureau of Safety and Environmental Enforcement ("BSEE") for the installation of a 4-inch fuel gas pipeline to be installed in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, all on the Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico (GOM), Offshore Louisiana.

The proposed 4-inch fuel gas pipeline will cross Northstar's pipeline, BOEM Segment No. 10456, as described in more detail at Section 3.5.1, Section 6.3, and in Annexes A, D and F of the aforementioned application.

In accordance with BSEE requirements, Proteus is providing you with a full and complete copy of the application and requesting that you review this application with respect to the proposed crossing your existing pipeline(s). Proteus does further request Northstar's indication of "No Objection" to construction of the proposed 4-inch fuel gas pipeline by signing this letter in the space provided below and returning the signed copy to me using the self-addressed stamped envelope provided herein.

Please direct any questions or requests for additional information to Mark Buteau, Compliance Advisor at 337-654-1184.

Sincerely,

Lisa Krenz

Lisa Krenz
Land & Right of Way Department
BP Pipelines (North America) Inc.
Lisa.Krenz@bp.com

**I hereby confirm that Northstar Offshore Group, LLC has "No Objection" to Proteus' proposed pipeline construction and crossing of Northstar's existing pipelines as described within the copy of Proteus' BSEE application that was provided with this letter.**

**By:** _____ KEITH KRENEK

**Title:** VP PRODUCTION

**Date:** 3/1/17

Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive
Suite 900
Chicago, IL 60606

December 20, 2016

Northstar Offshore Group, LLC
11 Greenway Plaza
Houston, TX 77046

Attn: Keith Krenek

Re: Request for No Objection to Construction of Proposed 4-inch Fuel Gas Pipeline
Mississippi Canyon Area, OCS Federal Waters, Gulf of Mexico

Dear Mr. Krenek:

Proteus Oil Pipeline Company, LLC ("Proteus") has submitted an application to the Bureau of Safety and Environmental Enforcement ("BSEE") for the installation of a 4-inch fuel gas pipeline to be installed in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, all on the Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico (GOM), Offshore Louisiana.

The proposed 4-inch fuel gas pipeline will cross Northstar's lease number G01618, as described in more detail in Annexes D and G of the aforementioned application.

In accordance with BSEE requirements, Proteus is providing you with a full and complete copy of the application and requesting that you review this application with respect to the proposed crossing of your lease. Proteus does further request Northstar's indication of "No Objection" to construction of the proposed 4-inch fuel gas pipeline by signing this letter in the space provided below and returning the signed copy to me using the self-addressed stamped envelope provided herein.

Please direct any questions or requests for additional information to Mark Buteau, Compliance Advisor at 337-654-1184.

Sincerely,

Lisa Krenz

Lisa Krenz
Land & Right of Way Department
BP Pipelines (North America) Inc.
Lisa.Krenz@bp.com

**I hereby confirm that Northstar Offshore Group, LLC has "No Objection" to Proteus' proposed pipeline construction and crossing of Northstar's lease as described within the copy of Proteus' BSEE application that was provided with this letter.**

**By:** _____ KEITH KRENEK

**Title:** VP PRODUCTION

**Date:** 3/1/17

# Appendix G - Designated O&G Lease Operators and Right of Way Holders Information


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**Endymion Oil Pipeline Company, LLC**
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive, Suite 900
Chicago, IL 60606

April 12, 2017

BP America Production Company
501 Westlake Park Blvd.
Houston, TX 77002

Re: Working in the Vicinity Guidelines
Proteus Oil Pipeline Company, LLC 4-inch Fuel Gas Pipeline
Mississippi Canyon Area, OCS Federal Waters, Gulf of Mexico

BP Pipelines (North America) Inc. ("BPPL"), as Operator for Endymion Oil Pipeline company, LLC ("Endymion"), is in receipt of the Proteus Oil Pipeline, LLC's ("Proteus") letter dated December 20, 2016 informing us of the proposed installation by BP America Production Company ("BPAPC") on behalf of Proteus, of the above referenced 4.5" fuel gas pipeline in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, in the Gulf of Mexico Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico.

It appears the proposed 4-inch fuel line will be constructed in the vicinity of the Endymion pipeline but does not cross Endymion's pipeline. To that end, Endymion has no objection to the construction of the proposed 4-inch fuel gas pipeline as long as you adhere to the following guidelines;

1. The Work Site shall be defined as all BPAPC work within 500-meters of the Endymion 30-inch oil pipeline.

2. Provide Endymion copies of its BSEE Permits, Work Procedures and Plans, SIMOPS Plans and HAZID documents for all activities within the Work Site.

3. Notify Endymion prior to the installation of any subsea hardware in the Work Site.

4. Where reasonably possible, minimize lifting operations at the Work Site.

5. Provide copies to Endymion of its Critical Lift Plans for overboard crane or winch lifts at the Work Site.

6. BPAPC will notify BPPL's Tulsa Control Center ("TCC") when its marine vessel(s) arrive at Work Site, before any field work is started, and after all Work has been completed and it is preparing to leave the Work Site.

7. Notify the Tulsa Control Center ("**TCC**") (***1-918-660-4451***) in the event of any abnormal condition discovered by BPAPC on the Endymion 30-inch Oil Pipeline.

8. Endymion may choose to mobilize an inspection team to inspect the location during the work in the vicinity or anytime thereafter for any suspected pipeline damage.

8. At least 72 hours prior to BPAPC commencing Work at the Work Site, notify **TCC at *1-918-660-4451*** so that a designated Endymion representative, if Endymion so desires, may be present to witness such activities within the Work Site.

9. Provide the Endymion representative with reasonable access throughout the duration of the Work, to the same communications system provided for the BPAPC Team on board the vessel for communications with TCC and BPPL Management.

10. BPAPC shall secure all necessary permits and approvals and, along with its employees, representatives, agents, contractors and subcontractors, shall comply with all applicable laws, rules, ordinances, decrees and regulations in connection with the performance of the Work.

11. Prior to beginning operations at the Work Site, a HAZID/Risk Assessment must be completed to include but not be limited to a review of the following: dropped objects, adverse met-ocean conditions, DP drift offs, DP run offs, SIMOPS, ROV Operations. The HAZID/Risk Assessment will be approved by the BPAPC Representative or their designee.

12. All marine vessels within the Work Site shall be approved by the BP Marine Authority and follow Vessel Operating Instructions.

13. BPAPC shall follow the BP GoM Marine Authority 500-meter Zone Practice and complete the associated 500-meter checklist prior to entering the Work Site.

14. If anchors are used for vessel positioning within the 500-meter zone of the Endymion 30-inch oil pipeline, the anchors shall come no closer to the pipeline than 1000-ft. If anchors are used they will be deployed and retrieved with an anchor handling marine vessel.

15. No 4-inch Proteus fuel gas pipeline crossings are currently planned over the 30-inch Endymion oil pipeline.

16. For any changes or additions it makes to subsea hardware within the Work Site, BPAPC will furnish Endymion, at BPAPC's expense, with an electronic set and a hard copy set of "as-built" drawings within 45 days after completion of the Work. The as-builts will capture changes in bathymetry, new wells, pipelines and hardware, etc left on the seabed as a result of the Work at the Work Site. Both sets should be mailed or electronically transmitted to:

    Mardi Gras Endymion Oil Pipeline Company, LLC
    c/o BP Pipelines (North America) Inc.
    30 South Wacker Drive, Suite 900
    Chicago, IL 60606
    Email: david.sommerfeld@bp.com

If BPAPC is agreeable to the foregoing, please have the proper authority indicate acceptance thereof by dating, executing and returning one original of this agreement to my attention at the above address.

Sincerely,

David M. Sommerfeld
Right of Way Team Leader
BP Pipelines (North America) Inc.
Operator for Endymion Oil Pipeline Company, LLC

**AGREED TO AND ACCEPTED THIS _____ DAY OF _____ , 2017.**

**BP America Production Company**

**By:** _____

**Name:** _____

**Title:** _____


Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive
Suite 900
Chicago, IL 60606

December 20, 2016

Shell Pipeline Company, LP
910 Louisiana, 41080B
Houston, TX 77002

Attn: Denise McGuire, Sr. Land Agent, Offshore

Re: Request for No Objection to Construction of Proposed 4-inch Fuel Gas Pipeline
Mississippi Canyon Area, OCS Federal Waters, Gulf of Mexico

Dear Ms. McGuire:

Proteus Oil Pipeline Company, LLC ("Proteus") has submitted an application to the Bureau of Safety and Environmental Enforcement ("BSEE") for the installation of a 4-inch fuel gas pipeline to be installed in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, all on the Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico (GOM), Offshore Louisiana.

The proposed 4-inch fuel gas pipeline will be in the vicinity of Shell's pipeline, BOEM Segment Nos. 10778, 15074 and 14730, as described in more detail at Section 3.5.1, Section 6.3, and in Annexes A, D and F of the aforementioned application.

In accordance with BSEE requirements, Proteus is providing you with a full and complete copy of the application and requesting that you review this application with respect to the proposed in the vicinity of your existing pipeline(s). Proteus does further request Shell's indication of "No Objection" to construction of the proposed 4-inch fuel gas pipeline by signing this letter in the space provided below and returning the signed copy to me using the self-addressed stamped envelope provided herein.

PROTEUS
A Pipeline Company

Please direct any questions or requests for additional information to Mark Buteau, Compliance Advisor at 337-654-1184.

Sincerely,

Lisa Krenz

Lisa Krenz
Land & Right of Way Department
BP Pipelines (North America) Inc.
Lisa.Krenz@bp.com

**I hereby confirm that Shell Pipeline Company, LP has "No Objection" to Proteus' proposed pipeline construction in the vicinity of Shell's existing pipelines as described within the copy of Proteus' BSEE application that was provided with this letter.**

**By:** Dennis McInnis

**Title:** Sr. Land Agent, Offshore

**Date:** January 26, 2017

**Proteus Oil Pipeline Company, LLC**
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive, Suite 900
Chicago, IL 60606

April 12, 2017

BP America Production Company
501 Westlake Park Blvd.
Houston, TX 77002

Re: Working in the Vicinity Guidelines
Proteus Oil Pipeline Company, LLC 4-inch Fuel Gas Pipeline
Mississippi Canyon Area, OCS Federal Waters, Gulf of Mexico

BP Pipelines (North America) Inc. ("BPPL"), as Operator for Proteus Oil Pipeline Company, LLC ("Proteus"), is in receipt of the Proteus Oil Pipeline, LLC's ("Proteus") letter dated December 20, 2016 informing us of the proposed installation by BP America Production Company ("BPAPC") on behalf of Proteus, of the above referenced 4.5-inch fuel gas pipeline in and through West Delta Blocks 128 and 145; South Pass Blocks 88 and 89, in the Gulf of Mexico Outer Continental Shelf (OCS) Federal Waters in the Gulf of Mexico.

It appears the proposed 4-inch fuel gas pipeline will be constructed in the vicinity of the existing Proteus pipeline but does not cross Proteus' existing pipeline. To that end, BPPL, as Operator for Proteus, has no objection to the construction of the proposed 4-inch fuel gas pipeline as long as you adhere to the following guidelines;

1. The Work Site shall be defined as all BPAPC work within 500-meters of the existing Proteus 30-inch oil pipeline.

2. Provide BPPL copies of its BSEE Permits, Work Procedures and Plans, SIMOPS Plans and HAZID documents for all activities within the Work Site.

3. Notify BPPL prior to the installation of any subsea hardware in the Work Site.

4. Where reasonably possible, minimize lifting operations at the Work Site.

5. Provide copies to BPPL of its Critical Lift Plans for overboard crane or winch lifts at the Work Site.

6. BPAPC will notify BPPL's Tulsa Control Center ("TCC") when its marine vessel(s) arrive at Work Site, before any field work is started, and after all Work has been completed and it is preparing to leave the Work Site.

7. Notify the Tulsa Control Center (**"TCC"**) (***1-918-660-4451***) in the event of any abnormal condition discovered by BPAPC on the existing Proteus 30-inch Oil Pipeline.

8. BPPL may choose to mobilize an inspection team to inspect the location during the work in the vicinity or anytime thereafter for any suspected pipeline damage.

9. At least 72 hours prior to BPAPC commencing Work at the Work Site, notify **TCC at *1-918-660-4451*** so that a designated BPPL representative, if BPPL so desires, may be present to witness such activities within the Work Site.

9. Provide the BPPL representative with reasonable access throughout the duration of the Work, to the same communications system provided for the BPAPC Team on board the vessel for communications with TCC and BPPL Management.

10. BPAPC shall secure all necessary permits and approvals and, along with its employees, representatives, agents, contractors and subcontractors, shall comply with all applicable laws, rules, ordinances, decrees and regulations in connection with the performance of the Work.

11. Prior to beginning operations at the Work Site, a HAZID/Risk Assessment must be completed to include but not be limited to a review of the following: dropped objects, adverse met-ocean conditions, DP drift offs, DP run offs, SIMOPS, ROV Operations. The HAZID/Risk Assessment will be approved by the BPAPC Representative or their designee.

12. All marine vessels within the Work Site shall be approved by the BP Marine Authority and follow Vessel Operating Instructions.

13. BPAPC shall follow the BP GoM Marine Authority 500-meter Zone Practice and complete the associated 500-meter checklist prior to entering the Work Site.

14. If anchors are used for vessel positioning within the 500-meter zone of the existing Proteus 30-inch oil pipeline, the anchors shall come no closer to the pipeline than 1000-ft. If anchors are used they will be deployed and retrieved with an anchor handling marine vessel.

15. No 4-inch Proteus fuel gas pipeline crossings are currently planned over the existing 30-inch Proteus oil pipeline.

16. For any changes or additions it makes to subsea hardware within the Work Site, BPAPC will furnish BPPL, at BPAPC's expense, with an electronic set and a hard copy set of "as-built" drawings within 45 days after completion of the Work. The as-builts will capture changes in bathymetry, new wells, pipelines and hardware, etc left on the seabed as a result of the Work at the Work Site. Both sets should be mailed or electronically transmitted to:

Proteus Oil Pipeline Company, LLC
c/o BP Pipelines (North America) Inc.
30 South Wacker Drive, Suite 900
Chicago, IL 60606
Email: david.sommerfeld@bp.com

Thank you for your cooperation in this matter. Please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

David M. Sommerfeld
Right of Way Team Leader
BP Pipelines (North America) Inc.
Operator for Proteus Oil Pipeline Company, LLC

December 21,2016

Dear Customer:

Proof-of-delivery letters are being provided for the following shipments:

| | |
|---|---|
| **778002584808** | HOUSTON,TX |
| **778001101539** | HOUSTON,TX |
| **778001160181** | HOUSTON,TX |
| **778001242093** | HOUSTON,TX |
| **778001339858** | HOUSTON,TX |
| **778003150210** | HOUSTON,TX |
| **778003311766** | HOUSTON,TX |
| **778003371875** | HOUSTON,TX |
| **778003435906** | HOUSTON,TX |
| **778003502046** | HOUSTON,TX |

You may save or print this Batch Signature Proof of Delivery file for your records.

Thank you for choosing FedEx.

FedEx
1.800.GoFedEx 1.800.463.3339

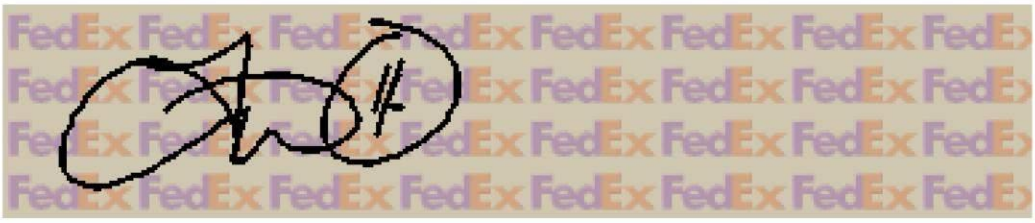
December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778002584808**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Shipping/Receiving |
| **Signed for by:** | F.WEAVER | **Delivery location:** | 5400 WESTHEIMER CT<br>HOUSTON, TX 77056 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 10:37 |
| **Special Handling:** | Deliver Weekday | | |



## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778002584808 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Roger Russell
Texas Eastern Transmission, LP
5400 WESTHEIMER CT
HOUSTON, TX 77056 US

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US

**Reference**
SP89E

Thank you for choosing FedEx.

December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778001101539**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Receptionist/Front Desk |
| **Signed for by:** | E.EFFIONG | **Delivery location:** | 1021 MAIN ST<br>HOUSTON, TX 77002 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 11:35 |
| **Special Handling:** | Deliver Weekday | | |

## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778001101539 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Robin Anderson
Energy EXXI Pipeline II, LLC
1021 MAIN ST
STE 2626
HOUSTON, TX 77002 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

Thank you for choosing FedEx.

December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778001160181**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Receptionist/Front Desk |
| **Signed for by:** | S.GUYEWSKI | **Delivery location:** | 1200 SMITH ST STE 1700<br>HOUSTON, TX 77002 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 12:18 |
| **Special Handling:** | Deliver Weekday | | |

## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778001160181 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Casey Jones
ENI Petroleum US LLC
1200 SMITH ST
STE 1700
HOUSTON, TX 77002 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

Thank you for choosing FedEx.

December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778001242093**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivery location:** | 11 GREENWAY STE 2800<br>HOUSTON, TX 77046 |
| **Signed for by:** | Signature release on file | **Delivery date:** | Dec 21, 2016 11:12 |
| **Service type:** | FedEx Priority Overnight | | |
| **Special Handling:** | Deliver Weekday | | |

NO SIGNATURE REQUIRED
Proof-of-delivery details appear below; however, no signature is available for this FedEx Express shipment because a signature was not required.

## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778001242093 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Keith Krenek
Northstar Offshore Group, LLC
11 GREENWAY PLZ
STE 2800
HOUSTON, TX 77046 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

Thank you for choosing FedEx.

December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778001339858**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Receptionist/Front Desk |
| **Signed for by:** | L.BRIGHAM | **Delivery location:** | 910 LOUISIANA<br>HOUSTON, TX 77002 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 11:09 |
| **Special Handling:** | Deliver Weekday | | |

## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778001339858 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Denise McGuire
Shell Pipeline Company LP
910 LOUISIANA ST
Suite 41080B
HOUSTON, TX 77002 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

Thank you for choosing FedEx.

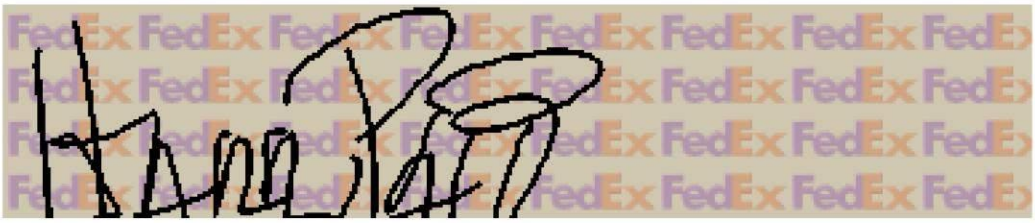
December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778003150210**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Receptionist/Front Desk |
| **Signed for by:** | H.PAIGE | **Delivery location:** | 201 HELIOS WAY<br>HOUSTON, TX 77079 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 10:30 |
| **Special Handling:** | Deliver Weekday | | |



## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778003150210 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Kim Bragg
Mardi Gras Endymion Oil Pipeline
501 WESTLAKE PARK BLVD
WL-1, 4.328B
HOUSTON, TX 77079 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

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December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778003311766**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Mailroom |
| **Signed for by:** | N.RIVERA | **Delivery location:** | 2000 POST OAK BLVD<br>HOUSTON, TX 77056 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 12:58 |
| **Special Handling:** | Deliver Weekday | | |

NO SIGNATURE IS AVAILABLE
FedEx Express proof-of-delivery details appear below; however, no signature is currently available for this shipment. Please check again later for a signature.

## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778003311766 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Alicia Elias
Apache Corporation
2000 POST OAK BLVD
STE 100
HOUSTON, TX 77056 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

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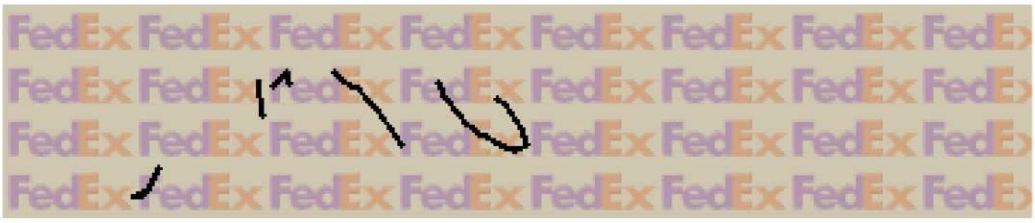
December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778003371875**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Receptionist/Front Desk |
| **Signed for by:** | S.HERNANDEZ | **Delivery location:** | 500 DALLAS ST<br>HOUSTON, TX 77002 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 11:55 |
| **Special Handling:** | Deliver Weekday | | |



## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778003371875 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Land & Right of Way
Energy Resource Technology GOM LLC
500 DALLAS ST
Suite 2000
HOUSTON, TX 77002 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

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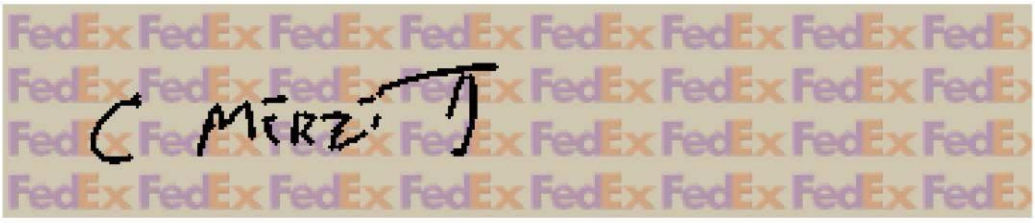
December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778003435906**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Shipping/Receiving |
| **Signed for by:** | C.MERRETT | **Delivery location:** | 600 NORTH DAIRY ASHFORD<br>HOUSTON, TX 77079 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 12:00 |
| **Special Handling:** | Deliver Weekday | | |



## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778003435906 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Dave Strople
Louisiana Land & Exploration Co.
600 N DAIRY ASHFORD RD
HOUSTON, TX 77079 US

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US

**Reference**
SP89E

Thank you for choosing FedEx.

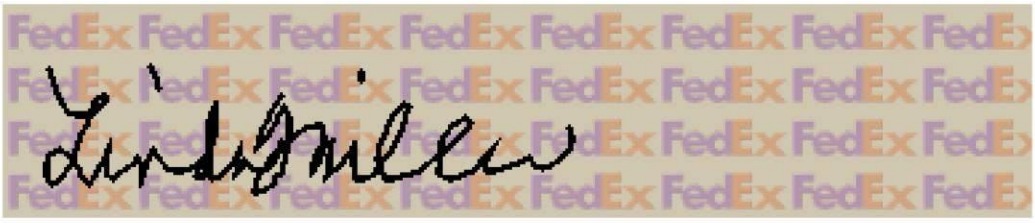
December 21,2016

Dear Customer:

The following is the proof-of-delivery for tracking number **778003502046**.

## Delivery Information:

| | | | |
|---|---|---|---|
| **Status:** | Delivered | **Delivered to:** | Receptionist/Front Desk |
| **Signed for by:** | L.MILLER | **Delivery location:** | 2000 W SAM HOUSTON PKWY S 1200<br>HOUSTON, TX 77042 |
| **Service type:** | FedEx Priority Overnight | **Delivery date:** | Dec 21, 2016 10:52 |
| **Special Handling:** | Deliver Weekday | | |



## Shipping Information:

| | | | |
|---|---|---|---|
| **Tracking number:** | 778003502046 | **Ship date:** | Dec 20, 2016 |
| | | **Weight:** | 1.0 lbs/0.5 kg |

**Recipient:**
Greg Labove
Fieldwood Energy LLC
2000 W SAM HOUSTON PKWY S
STE 1200
HOUSTON, TX 77042 US
**Reference**

**Shipper:**
Lisa Krenz
BP Pipelines (North America) Inc.
30 S WACKER DR
STE 900
CHICAGO, IL 60606 US
SP89E

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# Appendix H - CZM Consistency Certification


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JOHN BEL EDWARDS
GOVERNOR

THOMAS F. HARRIS
SECRETARY

# State of Louisiana

## DEPARTMENT OF NATURAL RESOURCES

## OFFICE OF COASTAL MANAGEMENT

January 24, 2017

Mark Buteau
BP US Pipelines and Logistics
310 Shepard Drive
Lafayette, LA 70508
*Via email:* mark.buteau@bp.com

RE: **C20160213,** Coastal Zone Consistency
**BP Pipelines (North America) Inc.**
Bureau of Safety and Environmental Enforcement
Federal License or Permit
Install 4 inch gas Right of Way Pipeline from West Delta 129 to South Pass 89
**Offshore, Louisiana**

Dear Mr. Buteau:

The above referenced project has been reviewed for consistency with the approved Louisiana Coastal Resources Program (LCRP) as required by Section 307 of the Coastal Zone Management Act of 1972, as amended. The project, as proposed in the application, is consistent with the LCRP.

If you have any questions concerning this determination, please contact Carol Crapanzano of the Consistency Section at (225) 342-9425 or carol.crapanzano@la.gov.

Sincerely yours,

**/S/ Don Haydel**
Acting Administrator
Interagency Affairs/Field Services Division

DH/SK

cc: BSEE ATTENTION PIPELINE APPROVALS
Tershara Matthews, BOEM 5412
Brian Cameron, BOEM 5412
Dave Butler, LDWF

# Memorandum

| | |
|---|---|
| To: | David LaGroue |
| From: | Marcus Marinos |
| cc: | Robert Clark |
| Date: | 10 July 2017 |
| Reference: | 106684-Memo-001 |
| **Subject:** | **SP89 Project – ANSI Flange Material Acceptability** |

## 1 Introduction & Purpose

This memo clarifies the acceptability of ASTM A694 Grade F65 for subsea use in the SP89E-B fuel gas pipeline system. Refer to the fuel gas pipeline permit (GM020-PL-PRM-226-F14-0001) for further details. The subsea portion of the SP89E-B fuel gas pipeline specifies the following flanges:

| Flange Size | ANSI Class | Water Depth (ft) | Material Specification | Pressure Rating (psi) | Temperature Rating (°F) |
|---|---|---|---|---|---|
| 4in ANSI Flange | 900 | 344 | ASTM A694 F65 | 2,250 | -20 to +140 |
| 4in ANSI Flange | 600 | 344 | ASTM A694 F65 | 1,500 | -20 to +140 |

## 2 Federal Regulations

Title 49, Section 192 of the Code of Federal Regulations, Section 192.147(a) states that:

*(a) Each flange or flange accessory (other than cast iron) must meet the minimum requirements of ASME/ANSI B16.5, MSS SP–44 (incorporated by reference, see §192.7), or the equivalent.*

*(b) Each flange assembly must be able to withstand the maximum pressure at which the pipeline is to be operated and to maintain its physical and chemical properties at any temperature to which it is anticipated that it might be subjected in service.*

## 3 Design Codes

Regarding the acceptability of ASTM A694 Grade F65:

- ASME B31.8 is the governing design code for the fuel gas pipeline system.
- ASME B31.8 (Section 831.2.1) states that flange dimensions shall conform to B16.5 or MSS SP-44. See Figure 1.
- ASME B31.8 (Appendix C) lists ASTM A694 as an acceptable material for pipeline fittings. See Figure 2.
- MSS SP-44 (a similar code to ASME B16.5) lists ASTM A694 as an acceptable material in Section 3.1.2; this code covers flanges sized >12". This specification matches ASME B16.5 dimensions on flanges on overlapping sizes. See Figure 3 through Figure 5.
- ASME B16.5 (Section 5.1) states that alternate materials may be used beyond those listed in B16.5 Table 1A, provided that the alternate material requirements of the ASME specification are

identical to or more stringent than the ASTM specification for the Grade, Class, or type of material. See Figure 6.

> *(e)* Welding neck flanges are permitted in sizes and pressure classes established in ASME B16.5 and MSS SP-44. The bore of the flange should correspond to the inside diameter of the pipe used. For permissible welding end treatment, see Mandatory Appendix I, Fig. I-5.

Figure 1: ANSI/ASME B31.8 Excerpt from Section 831.2

> ASTM A 694/A 694M, Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves and Parts for High-Pressure Transmission Service

Figure 2: ANSI/ASME B31.8 Appendix C Excerpt

3. **MATERIALS**

3.1 The steel used in the manufacture of these flanges shall be selected by the manufacturer to meet the following requirements.

3.1.1 All materials used for flanges shall be "killed" steel. Welding neck flanges shall be made from forgings. Blind flanges may be made from either forged steel or from steel plate.

The selected material shall meet the specified chemistry limits in Table 1, grade requirements of Table 2, and other provisions of Section 3.

A ladle and product analysis shall be reported on the Certified Material Test Report (CMTR). The product analysis is subject to over/under tolerances as specified in ASTM A961/A961M.

3.1.2 The steel used shall be suitable for field welding to other flanges, fittings, or pipe manufactured according to ASTM A105, ASTM A53, ASTM A106, ASTM A350, ASTM A381, ASTM A516, ASTM A537, ASTM A694, ASTM A707, or API Specification 5L.

3.1.3 The steel used shall have a maximum carbon content of 0.30% and a carbon equivalent (CE) computed by the following equation:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

that shall not exceed 0.48%, based on ladle analysis, without prior approval of the purchaser. If the CE exceeds 0.45%, the flange shall be marked with the actual CE result.

Example: "CE=0.46".

3.1.3.1 The choice and use of alloying elements, within the limits prescribed in Table 1, to give the required tensile properties prescribed in Section 3.1.4, shall be made by the flange manufacturer and included and reported in the ladle and product analysis to identify the type of steel.

3.1.4 The steel used shall have tensile properties conforming to the requirements prescribed in Table 2 and capable of meeting the requirements of Section 4 and the flange manufacturer's design conditions, as specified in Annex A for welding neck flanges and Annex B for blind flanges. All test methods shall be as specified in ASTM A370.

Figure 3: ANSI/MSS SP-44 Excerpt from Section 3

**TABLE 1**
**Chemistry Limits (Percentage)**

| Element | Limit (%) | |
|---|---|---|
| | Min. | Max. |
| C | – | 0.30 |
| Mn | 0.60 | 1.60 |
| P | – | 0.025 |
| S | – | 0.025 |
| Si | 0.15 | 0.35 |
| Cu | – | 0.40 |
| Ni | – | 0.40 |
| Cr | – | 0.30 |
| Mo | – | 0.12 |
| V | – | 0.11 |
| Nb | – | 0.05 |
| B | – | 0.001 |
| Cu+Ni+Cr+Mo | – | 1.00 |

Figure 4: ANSI/MSS SP-44 Material Chemical Requirements

**TABLE 2**
**Tensile Requirements – SI (Metric) and U.S. Customary**

| GRADE | YIELD POINT (Min.) | | TENSILE STRENGTH (Min.) | | ELONGATION 50 mm (2 in.) (Min. %) |
|---|---|---|---|---|---|
| | MPa | ksi | MPa | ksi | |
| F36 | 248[a] | 36[a] | 414 | 60 | 20 |
| F42 | 290 | 42 | 414 | 60 | 20 |
| F46 | 317 | 46 | 414 | 60 | 20 |
| F48 | 331 | 48 | 427 | 62 | 20 |
| F50 | 345 | 50 | 441 | 64 | 20 |
| F52 | 359 | 52 | 455 | 66 | 20 |
| F56 | 386 | 56 | 469 | 68 | 20 |
| F60 | 414 | 60 | 517 | 75 | 20 |
| F65 | 448 | 65 | 531 | 77 | 18 |
| F70 | 483 | 70 | 552 | 80 | 18 |
| F80 | 550 | 80 | 620 | 90 | 16 |

**NOTE:** (a) Except as required in Section 4.2.

Figure 5: ANSI/MSS SP-44 Material Strength Requirements

**5 MATERIALS**

**5.1 General**

*(a)* Materials required for flanges and flanged fittings are listed in Table 1A with the restriction that plate materials shall be used only for blind flanges and reducing flanges without hubs. Flanges and flanged fittings shall be manufactured as one piece in accordance with the applicable material specification. Assembly of multiple pieces into the finished product by welding or other means is not permitted by this Standard.

*(b)* Recommended bolting materials are listed in Table 1B (see para. 5.3).

*(c)* Corresponding materials listed in Section II of the ASME Boiler and Pressure Vessel Code may be used provided that the requirements of the ASME specification are identical to or more stringent than the ASTM specification for the Grade, Class, or type of material.

Figure 6: ANSI/ASME B16.5 Excerpt

## 4 ASTM A694 F65 Material

ASTM A694 Grade F65 is a low alloy steel, usually supplied in the quench and tempered condition. It is typified by having moderate strength and impact toughness and is used extensively for the manufacture of flanges and fittings for the offshore oil and gas industry.

Note that the ASTM A694 specification (Section 2.3) refers back to ASME B16.5 as an applicable standard/code. ASTM A694 is equivalent/similar to Group 1.2 materials (ASTM A350 LF6 class 2).

**TABLE 1 Tensile Requirements**

| Grade | Yield Strength (0.2 % Offset), min, ksi [MPa] | Tensile Strength, min, ksi [MPa] | Elongation in 2 in. or 50 mm, min % |
|---|---|---|---|
| F42 | 42 [290] | 60 [415] | 20 |
| F46 | 46 [315] | 60 [415] | 20 |
| F48 | 48 [330] | 62 [425] | 20 |
| F50 | 50 [345] | 64 [440] | 20 |
| F52 | 52 [360] | 66 [455] | 20 |
| F56 | 56 [385] | 68 [470] | 20 |
| F60 | 60 [415] | 75 [515] | 20 |
| F65 | 65 [450] | 77 [530] | 20 |
| F70 | 70 [485] | 82 [565] | 18 |

Figure 7: ASTM A694 Material Strength Requirements

**TABLE 2 Chemical Requirements**

| | Composition, % |
|---|---|
| | Heat Analysis |
| Carbon, max | 0.30 |
| Manganese, max | 1.60 |
| Phosphorus, max | 0.025 |
| Sulfur, max | 0.025 |
| Silicon | 0.15–0.35 |
| Copper[A] | |
| Nickel[A] | |
| Chromium[A] | |
| Molybdenum[A] | |
| Vanadium[A] | |
| Columbium (Niobium)[A] | |
| Boron[A] | |

[A] All elements listed in Table 2 shall be reported. Where no composition limit is listed, values are to be reported but no limits apply except as covered in 6.3.

Figure 8: ASTM A694 Material Chemical Requirements

**TABLE 1 Chemical Requirements**

| Element | Composition, wt. % | | | | | | |
|---|---|---|---|---|---|---|---|
| | Grade LF1 | Grade LF2 | Grade LF3 | Grade LF5 | Grade LF6 | Grade LF9 | Grade LF787 |
| Carbon, max | 0.30 | 0.30 | 0.20 | 0.30 | 0.22 | 0.20 | 0.07 |
| Manganese | 0.60–1.35 | 0.60–1.35 | 0.90 max | 0.60–1.35 | 1.15–1.50 | 0.40–1.06 | 0.40–0.70 |
| Phosphorus, max | 0.035 | 0.035 | 0.035 | 0.035 | 0.025 | 0.035 | 0.025 |
| Sulfur, max | 0.040 | 0.040 | 0.040 | 0.040 | 0.025 | 0.040 | 0.025 |
| Silicon[A] | 0.15–0.30 | 0.15–0.30 | 0.20–0.35 | 0.20–0.35 | 0.15–0.30 | ... | 0.40 max |
| Nickel | 0.40 max[B] | 0.40 max[B] | 3.3–3.7 | 1.0–2.0 | 0.40 max[B] | 1.60–2.24 | 0.70–1.00 |
| Chromium | 0.30 max[B,C] | 0.30 max[B,C] | 0.30 max[C] | 0.30 max[C] | 0.30 max[B,C] | 0.30 max[C] | 0.60–0.90 |
| Molybdenum | 0.12 max[B,C] | 0.12 max[B,C] | 0.12 max[C] | 0.12 max[C] | 0.12 max[B,C] | 0.12 max[C] | 0.15–0.25 |
| Copper | 0.40 max[B] | 0.40 max[B] | 0.40 max | 0.40 max | 0.40 max[B] | 0.75–1.25 | 1.00–1.30 |
| Columbium | 0.02 max[D] | 0.02 max[D] | 0.02 max | 0.02 max | 0.02 max | 0.02 max | 0.02 min |
| Vanadium | 0.08 max | 0.08 max | 0.03 max | 0.03 max | 0.04–0.11 | 0.03 max | 0.03 max |
| Nitrogen | ... | ... | ... | ... | 0.01–0.030 | ... | ... |

[A] When vacuum carbon-deoxidation is required by Supplementary Requirement S4, the silicon content shall be 0.12 % maximum.
[B] The sum of copper, nickel, chromium, vanadium and molybdenum shall not exceed 1.00 % on heat analysis.
[C] The sum of chromium and molybdenum shall not exceed 0.32 % on heat analysis.
[D] By agreement, the limit for columbium may be increased up to 0.05 % on heat analysis and 0.06 % on product analysis.

Figure 9: ASTM A350 Material Chemical Requirements

**TABLE 2 Tensile Properties at Room Temperature[A]**

| | Grades | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | LF1 and LF5 Class 1 | LF2 Classes 1 and 2 | LF3 Classes 1 and 2 LF5 Class 2 | LF6 | | LF9 | LF787 | |
| | | | | Class 1 | Classes 2 and 3 | | Class 2 | Class 3 |
| Tensile strength, ksi [MPa] | 60–85 [415–585] | 70–95 [485–655] | 70–95 [485–655] | 66–91 [455–630] | 75–100 [515–690] | 63–88 [435–605] | 65–85 [450–585] | 75–95 [515–655] |
| Yield strength, min, ksi [MPa][B,C] | 30 [205] | 36 [250] | 37.5 [260] | 52 [360] | 60 [415] | 46 [315] | 55 [380] | 65 [450] |
| Elongation: | | | | | | | | |
| Standard round specimen, or small proportional specimen, min % in 4D gauge length | 25 | 22 | 22 | 22 | 20 | 25 | 20 | 20 |
| Strip specimen for wall thickness 5/16 in. [7.94 mm] and over and for all small sizes tested in full section; min % in 2 in. [50 mm] | 28 | 30 | 30 | 30 | 28 | 28 | 28 | 28 |
| Equation for calculating min elongation for strip specimens thinner than 5/16 in. [7.94 mm]; min % in 2 in. [50 mm] $t$ = actual thickness in inches | 48$t$ + 13 | 48$t$ + 15 | 48$t$ + 15 | 48 $t$ + 15 | 48$t$ + 13 | 48$t$ + 13 | 48$t$ + 13 | 48$t$ + 13 |
| Reduction of area, min, % | 38 | 30 | 35 | 40 | 40 | 38 | 45 | 45 |

[A] See 7.3 for hardness tests.
[B] Determined by either the 0.2 % offset method or the 0.5 % extension under load method.
[C] For round specimens only.

Figure 10: ASTM A350 Material Strength Requirements

**Table 2-1.2 Pressure–Temperature Ratings for Group 1.2 Materials**

| Nominal Designation | Forgings | Castings | Plates |
|---|---|---|---|
| C–Mn–Si | ... | A216 Gr. WCC (1) | ... |
| C–Mn–Si | ... | A352 Gr. LCC (2) | ... |
| C–Mn–Si–V | A350 Gr. LF6 Cl.2 (3) | ... | ... |
| 2½Ni | ... | A352 Gr. LC2 | A203 Gr. B (1) |
| 3½Ni | ... | A352 Gr. LC3 (2) | A203 Gr. E (1) |

Working Pressure by Classes, bar

| | Class | | | | | | |
|---|---|---|---|---|---|---|---|
| Temp., °C | 150 | 300 | 400 | 600 | 900 | 1500 | 2500 |
| –29 to 38 | 19.8 | 51.7 | 68.9 | 103.4 | 155.1 | 258.6 | 430.9 |
| 50 | 19.5 | 51.7 | 68.9 | 103.4 | 155.1 | 258.6 | 430.9 |
| 100 | 17.7 | 51.5 | 68.7 | 103.0 | 154.6 | 257.6 | 429.4 |

**Table II-2-1.2 Pressure–Temperature Ratings for Group 1.2 Materials**

| Nominal Designation | Forgings | Castings | Plates |
|---|---|---|---|
| C–Mn–Si | ... | A216 Gr. WCC (1) | ... |
| C–Mn–Si | ... | A352 Gr. LCC (2) | ... |
| C–Mn–Si–V | A350 Gr. LF6 Cl. 2 (3) | ... | ... |
| 2½Ni | ... | A352 Gr. LC2 | A203 Gr. B (1) |
| 3½Ni | ... | A352 Gr. LC3 (2) | A203 Gr. E (1) |

Working Pressures by Classes, psig

| | | | | Class | | | |
|---|---|---|---|---|---|---|---|
| Temp., °F | 150 | 300 | 400 | 600 | 900 | 1500 | 2500 |
| –20 to 100 | 290 | 750 | 1,000 | 1,500 | 2,250 | 3,750 | 6,250 |
| 200 | 260 | 750 | 1,000 | 1,500 | 2,250 | 3,750 | 6,250 |

Figure 11: ASME B16.5 Ratings for ASTM A694 Material Equivalent

Kiewit

October 24, 2017

BP
Attention: Doug Hanna
Phone: 630-818-5547
E-Mail: doug.hanna@bp.com

Re: Statement of Design Conformity Request

Mr. Hanna,

Please find attached the requested letter from Wood Group regarding the statement of design conformity for the subsea engineering services being provided by Wood Group.

Kind regards,

Glenn Kliebert

Kiewit Offshore Services Area Manager

**KIEWIT OFFSHORE SERVICES, LTD.**
2440 Kiewit Road, Ingleside, TX 78362
(361) 775-4300 (361) 775-4433 - fax

**Wood Group**
17325 Park Row
Houston, TX 77084
United States
T: 832-809-8000
www.woodgroup.com

October 17, 2017

Kiewit Offshore Services, Ltd.

2440 Kiewit Road

Ingleside, TX

Attn: Glen Kliebert

Re: Statement of Design Conformity

Mr. Kliebert:

Pursuant to the Professional Services Agreement for the Southpass 89E Project entered into by and between Wood Group Mustang, Inc. and Kiewit Offshore Services, Ltd dated December 2nd, 2015 (hereinafter, the "Agreement") Wood Group confirms that the design services were performed per the Subsea Basis of Design Document No. GM-020-UZ-BOD-226-F-14-0001 Rev B04. Wood Group is the engineering contractor supporting Kiewit on the subsea pipeline as part of the SP89E Expansion Project.

.

Very truly yours,

WOOD GROUP USA, INC.

By: Teresa Pahutka

Title: Director of Contracts

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Security Classification: BP Internal

**Global Projects Organization**

bp

# SP89E Expansion
## Subsea Basis of Design

Kiewit

WOOD GROUP

| Rev | Reason for Issue | Author | Date | Checker | Date | Approver | Date |
|---|---|---|---|---|---|---|---|
| B04 | Issued for Use | Marcus Marinos | 01-Aug-17 | Aiman Al-Showaiter | 01-Aug-17 | Robert Clark | 01-Aug-17 |
| B03A | Issued for Client Review | Marcus Marinos | 26-Jun-17 | Aiman Al-Showaiter | 26-Jun-17 | Robert Clark | 26-Jun-17 |
| B03 | Issued for Use | Marcus Marinos | 24-Oct-16 | Basel Abdalla | 24-Oct-16 | Paula Fitzpatrick | 24-Oct-16 |
| B02A | Issued for Client Review | Marcus Marinos | 14-Oct-16 | Ryan Watson | 14-Oct-16 | Paula Fitzpatrick | 14-Oct-16 |
| B02 | Issued for Use | Paula Fitzpatrick | 09-Jun-16 | Ryan Watson | 09-Jun-16 | Paula Fitzpatrick | 09-Jun-16 |
| B01 | Issued for Use | Salil Kulkarni | 17-May-16 | Ryan Watson | 17-May-16 | Paula Fitzpatrick | 17-May-16 |

WG Project Number: 106684

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**List of Tables**




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## List of Figures




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## Revision History

| Amendment Date | Revision Number | Amender Initials | Amendment |
|---|---|---|---|
| 23-Mar-16 | A01 | SK | Issued for Client Review |
| 17-May-16 | B01 | SK | Issued for Use |
| 09-Jun-16 | B02 | SK | Issued for Use |
| 14-Oct-16 | B02A | MM | Issued for Client Review |
| 24-Oct-16 | B03 | MM | Issued for Use |
| 26-Jun-17 | B03A | MM | Issued for Client Review |
| 01-Aug-17 | B04 | MM | Issued for Use |

## Reviewers

| Role | Name | Date Reviewed | Signed |
|---|---|---|---|
| Subsea Engineering | Marcus Marinos | 01-Aug-17 | |
| Subsea Pipeline Lead | Aiman Al-Showaiter | 01-Aug-17 | |
| Subsea Project Manager | Robert Clark | 01-Aug-17 | |
| | | | |

## Definitions

| Term | Definition |
|---|---|
| May | Designates a Permissive Statement, which is an option that is neither mandatory nor specifically recommended. |
| Shall | Designates a BP Requirement and is used only when it is designating a BP Requirement. |
| Should | Designates a specific recommendation where conformance is not mandatory. |
| Will | Designates a future action. |

*The above definitions for ‘may,’ ‘shall’ and ‘should’ conform to BP Policy 000001.


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# 1 Project Overview

## 1.1 General

Platform SP89E is an existing unmanned BP hub platform located at latitude 28° 41' 51" N and longitude 89° 23' 45" W. Water depth at the platform is about 400ft.

The existing platform provides a connection between the incoming 28in Proteus crude pipeline from BP Thunder Horse to the departing 30in Endymion crude pipeline which reaches the shore at Grand Isle, Louisiana, about 55 miles from the existing platform and continues to Clovelly, Louisiana, for a total distance of 90 miles from the existing platform.

The project will also include a new platform located at latitude 28° 41' 48" N and longitude 89° 23' 45" W, which will be connected to the existing platform by a short bridge. The new platform will support the topsides facilities required for the SP89E Expansion and provide tie-in points and risers for the Mattox pipeline and a future fuel gas pipeline for power generation. The existing platform will remain operational during the new platform and bridge installation thereby allowing production to continue. This will minimize the shutdown time required for tie-ins.

The future Mattox pipeline is a 24in crude pipeline from Shell Appomattox to the Endymion pipeline. The pipeline is approximately 90 miles in length. Shell will have the responsibility for the construction of the pipeline through a double block valve located in the proximity of the new platform. The spool pieces connecting the 24in pipeline to the 20.2in riser will include the necessary diameter transition. The fuel gas pipeline will be a new 4.5in pipeline connected to the existing Shell 12in gas line via a subsea hot-tap.

The crude from the Proteus line will flow up the riser onto the existing platform and then across the bridge to the new platform. The Proteus flow will then be combined with the crude flowing from the Mattox line and the combined flow will flow back across the bridge to the existing platform and depart through the Endymion line.

The overall field layout is as shown in Figure 1 below.

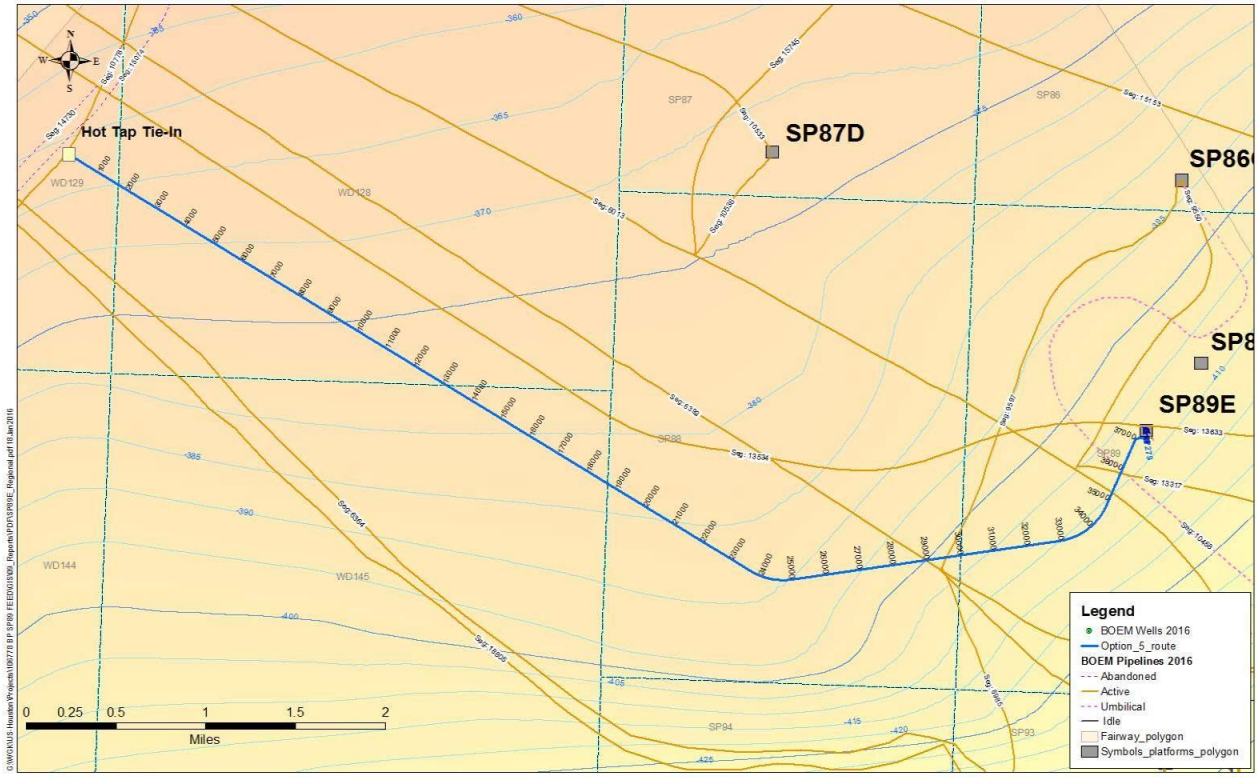


**Figure 1: Overall Field Layout**


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# 2 Scope of Document

The scope of this Basis of Design (BOD) document is to describe the design criteria, methodology and detailed design parameters for the subsea pipeline, riser, tie-in spools and associated hardware of the SP89E Expansion Project. This scope includes:

- Mattox riser and tie-in spool
- Fuel gas riser and tie-in spool
- Mattox and fuel gas riser clamps
- Mattox crossing structure
- Fuel gas pipeline
- Fuel gas PLET
- Fuel gas hot tap

Refer to the BOD for Bridge Connected Platform [Ref. 2] for topsides and facilities engineering details and the flow assurance BOD [Ref. 26] for flow assurance engineering details.

# 3 Codes, Specifications, Regulations and Reference Documents

The following codes provide the basis for this document and shall be interpreted as the minimum requirements applicable to the subject work, and no statement contained in this specification shall be construed as limiting the work to such minimum requirements. The latest editions of the following national codes, standards, regulations and general practices form a part of this document except as modified herein. All applicable portions of these documents are to be used in the engineering, design and fabrication of the related equipment.

Where two (2) or more references define requirements for the same subject, the more restrictive shall govern. Unless listed, the latest editions and addenda of the codes listed shall govern all work.

In case of conflict between the provisions in the specified codes, standards, general practice and this document, SUPPLIER shall notify COMPANY of conflicts for resolution before fabrication begins.

Any requirements in this specification that do not conform to these codes and are not indicated as exceptions to these codes shall immediately be brought to the attention of COMPANY for resolution.

## 3.1 Codes and Standards

**Table 1: Codes and Standards**

| Code Standard | Document Number | Document Title | Issued Date |
|---|---|---|---|
| AISC | 360-05 | Specification for Structural Steel Buildings, Allowable Stress Design (ASD), 13th Edition | 2005 |
| AISC | 316-89 | AISC Manual of Steel Construction: Allowable Stress Design, 9th edition | 1989 |
| API | RP 1111 | Design, Construction, Operation, and Maintenance of Offshore Hydrocarbon Pipelines (Limit State Design) | 2011 |
| API | RP 2A-WSD | Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design | 2014 |
| API | RP 2GEO | Geotechnical and Foundation Design Considerations | 2011 |


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| Code Standard | Document Number | Document Title | Issued Date |
|---|---|---|---|
| API | RP 17H | Remotely Operated Tools and Interfaces on Subsea Production Systems | 2013 |
| API | RP 2201 | Safe Hot Tapping Practices in the Petroleum and Petrochemical Industries | 2003 |
| ASME | B31.8 | Gas Transmissions and Distribution Piping Systems | 2014 |
| ASME | B31.4 | Pipeline Transportation Systems for Liquid Hydrocarbon and Other Liquids | 2012 |
| DNV | OS F101 | Submarine Pipeline Systems | 2013.10 |
| DNV GL | RP F103 | Cathodic Protection of Submarine Pipelines by Galvanic Anodes | 2016.07 |
| DNV | RP B401 | Cathodic Protection Design | 2011.04 |
| DNV | RP F105 | Free Spanning Pipelines | 2006.02 |
| DNV | RP F107 | Risk Assessment of Pipeline Protection | 2010.10 |
| DNV | RP F109 | On-bottom Stability Design of Submarine Pipelines | 2011.11 |
| DNV | RP F110 | Global Buckling of Submarine Pipelines | 2007.10 |
| DNV GL | RP 0005 | Fatigue Design of Offshore Steel Structures | 2016.04 |
| DNV | RP C205 | Environmental Conditions and Environmental Loads | 2014.04 |
| DNV | RP F204 | Riser Fatigue | 2010.10 |
| NACE | SP0115 | Petroleum, Petrochemical and Natural Gas Industries - Cathodic Protection of Pipeline Transportation Systems - Part 2: Offshore Pipelines (ISO 15589-2) | 2015 |

## 3.2 Regulations

**Table 2: Code of Federal Regulations (CFR)**

| Agency | Title | Part | Part Title or Summary | Issued Date |
|---|---|---|---|---|
| BSEE | 30 | 250 | Oil and Gas and Sulphur Operations in the Outer Continental Shelf, Pipelines and Pipeline Rights-of-Way (Subpart J) | 2015.07 |
| BSEE | 49 | 192 | Transportation of Natural and Other Gas by Pipeline: Minimum National Safety Standards | 2015.10 |
| BSEE | 49 | 195 | Transportation of Hazardous Liquids by Pipeline: Minimum National Safety Standards | 2015.10 |


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## 3.3 BP Technical Practices and Specifications

**Table 3: BP Technical Practices and Specifications**

| Document Number | Document Title or Summary | Issued Date |
|---|---|---|
| GP 36-20 | Materials Selection for Subsea Equipment | 2012.02.08 |
| GP 43-21 | Offshore Pipeline System Design and Construction (2014) | 2014.09.15 |
| GP 43-28 | Pipeline Crossings | 2015.04.02 |
| GP 43-50 | Pigging, Pig Launchers, and Receivers | 2014.06.13 |
| GP 43-52 | Inspection and Integrity Assessment of Pipeline Systems | 2013.12.02 |
| GN 65-704 | Riser Fatigue Calculation Guidance Note | 2008.06.27 |
| GN 65-711 | Riser Load Matrices Guidance Note | 2008.03.25 |
| GIS 43-213 | Guidance on Industry Standard for Offshore Pipeline Span Analysis (Supplement to DNV RP F105) | 2006.12.20 |
| GIS 06-402 | Guidance on Industry Standard for Fusion Bonded Epoxy Powder External Pipeline Coating | 2009.11.10 |
| GIS 06-403 | Guidance on Industry Standard for the Application of Three-layer Fusion Bonded Epoxy-Polyethylene Coating and Three-layer Fusion Bonded Epoxy-Polypropylene Coating Systems to Line Pipe | 2007.02.15 |
| GIS 06-602 | Specification for Coating and Painting of Supplier Equipment | 2014.05.16 |
| GIS 36-0002 | Specification for Structural Materials for Floating Offshore Structures | 2010.03.29 |
| GIS 43-2106 | Offshore Pipeline Installation | 2009.05.13 |

## 3.4 Reference Documents

**Table 4: Reference Documents**

| # | Document Number | Document Title or Summary |
|---|---|---|
| 1. | GM020-EM-SOR-000-F14-0002 | SP89E Expansion Statement of Requirements |
| 2. | GM020-PM-BOD-226-F14-0002 | SP89E Expansion, Basis of Design for Bridge Connected Platform, Wood Group Mustang. |
| 3. | GM020-ST-BOD-226-F14-0001 | SP89E Expansion, Structural Design Premise |
| 4. | GM020-ST-REP-000-F14-0002 | SP89E Oceanographic and Meteorological Design Data Summary, Version 1.1. |
| 5. | GM020-UZ-REP-0Z9-F14-0001 | SP89E Expansion, Route Survey and Geotechnical Data Collection, NGI, Rev A01. |
| 6. | 50874771/01/C | Safebuck JIP, Safe Design of Pipelines with Lateral Buckling Design Guideline, SAFEBUCK III, Revision C. |
| 7. | USPL-SP89E-INT-F-14-PL-REP-0004 | SP89E Expansion Select Stage Engineering Support – INT – Fuel Gas Options |
| 8. | USPL-SP89E-INT-F-14-PL-REP-0002 | SP89E Expansion Select Stage Engineering Support – INT – Fuel Gas Pipeline Flow Assurance Study |
| 9. | OMAE 1985 Proceeding, V1 | Murphey C.E., Langner C.G., “Ultimate Pipe Strength under Bending, Collapse and Fatigue”, pp467-477. |


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| # | Document Number | Document Title or Summary |
|---|---|---|
| 10. | Research Report 031 HSE | HSE Phase II, Development of design guidance for neoprene-lined clamps for offshore application |
| 11. | OTH 88 283 | Grouted and Mechanical Strengthening and Repair of Tubular Steel Offshore Structures |
| 12. | C357R001 | Assessment of Repair Techniques for Ageing or Damaged Structures, Dier, Dr. Adrian F., MSL Engineering Ltd. November 2014. |
| 13. | GM020-UZ-SPE-226-F14-0009 | Subsea Specification - Pipeline Valves |
| 14. | GM020-UZ-SPE-226-F14-0007 | Subsea Specification - Flange and Fittings |
| 15. | GM020-ST-SPE-226-F14-0005 | Structural Offshore Materials |
| 16. | GM020-ST-SPE-226-F14-0002 | Fabrication of Offshore Structures |
| 17. | GM020-UZ-SPE-226-F14-0011 | Subsea Specification - Structural Material Design Guidelines |
| 18. | GM020-UZ-SPE-226-F14-0010 | Subsea Specification - Seamless Line Pipe |
| 19. | GM020-UZ-SPE-226-F14-0002 | Subsea Specification - FBE Pipe Coating |
| 20. | GM020-UZ-SPE-226-F14-0001 | Subsea Specification - Field Joint Coating |
| 21. | GM020-UZ-SPE-226-F14-0008 | Subsea Specification - Cathodic Protection Design |
| 22. | GM020-PL-SPE-226-F14-0001 | Subsea Specification - Cathodic Protection Anodes Procurement and Installation |
| 23. | GM020-OP-PHI-226-F14-0001 | 4in Fuel Gas Pipeline Pigging and Commissioning Philosophy |
| 24. | UNCONTROLLED, Provided by Shell | Shell statement of requirements for hot tap assembly |
| 25. | GM004-EN-SPE-000-06005 | Specification for Subsea Cathodic Protection Design |
| 26. | GM020-FL-BOD-226-F14-0001 | Flow Assurance Basis of Design |
| 27. | N/A | Archaeological and Hazard Report, Proposed Kiewit 4'' Fuel Gas Pipeline Survey, Oceaneering Project No. 176466, November 2016 |
| 28. | N/A | Survey Operations Report, Proposed Kiewit 4'' Fuel Gas Pipeline Survey, Oceaneering Project No. 176466, November 2016 |
| 29. | USPL-SP89E-FUG-F-14-GT-REP-0001 | Fugro Geotechnical Investigation Platform "E" Block 89, South Pass Area , Gulf of Mexico, August 2001 |


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# 4 Abbreviations and Acronyms

Table 5 presents the abbreviations and acronyms used in this document.

**Table 5: Abbreviations and Acronyms**

| Item | Description |
|---|---|
| 3LPP | Three Layer Polypropylene |
| AGA | American Gas Association |
| AISC | American Institute of Steel Construction |
| ANSI | American National Standards Institute |
| API | American Petroleum Institute |
| ASD | Allowable Stress Design |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society of Testing and Materials |
| BE | Best Estimate |
| BOD | Basis of Design |
| BSEE | Bureau of Safety and Environmental Enforcement |
| $C_d$ | Normal Drag |
| CFR | Code of Federal Regulations |
| $C_m$ | Added Mass |
| CP | Cathodic Protection |
| CPA | Cubic Plus Association |
| DLF | Design Load Factor |
| DNV | Det Norske Veritas |
| ETP | Engineering Technical Practice |
| FBE | Fusion Bonded Epoxy |
| FEA | Finite Element Analysis |
| FEED | Front End Engineering Design |
| GOM | Gulf of Mexico |
| HE | High Estimate |
| Hmax | Maximum Wave Height |
| Hs | Significant Wave Height |
| ILI | Inline Inspection |
| LE | Low Estimate |
| MAOP | Maximum Allowed Operating Pressure |
| MHHW | Mean Higher High Water |
| MLLW | Mean Lower Low Water |
| MSL | Mean Sea Level |
| NACE | National Association of Corrosion Engineers |
| OD | Outer Diameter |
| PLET | Pipeline End Termination |
| PRCI | Pipeline Research Council International, Inc. |
| RP | Recommended Practice |
| RTJ | Ring Type Joint |
| SMYS | Specified Minimum Yield Strength |
| Su | Undrained Shear Strength |
| THmax | Associated Period for Hmax |
| TMCP | Thermo-Mechanic Control Processing |
| Tp | Peak Period |
| VIV | Vortex Induced Vibrations |
| WSD | Working Stress Design |
| WT | Wall Thickness |


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# 5 General Information

## 5.1 Geodetic Data

All project data (approach and layout drawings, alignment sheets, etc.) shall be presented in the UTM Zone 16N projection in the NAD 27 datum. Grid units shall be listed in US survey feet.

## 5.2 Coordinate System

The flowline local axes and load directionality shall use a typical right-handed Cartesian coordinate system, as per Figure 2. The X-axis will be along the longitudinal axis of the flowline towards the spool tie-in flange. The Y-axis will represent the water depth. Elevation datum presented throughout this document is based on Mean Lower Low Water (MLLW) at elevation (+) 0.0ft. Note that the PLET results will be presented in a coordinate system in which the water depth is along the Z-axis.

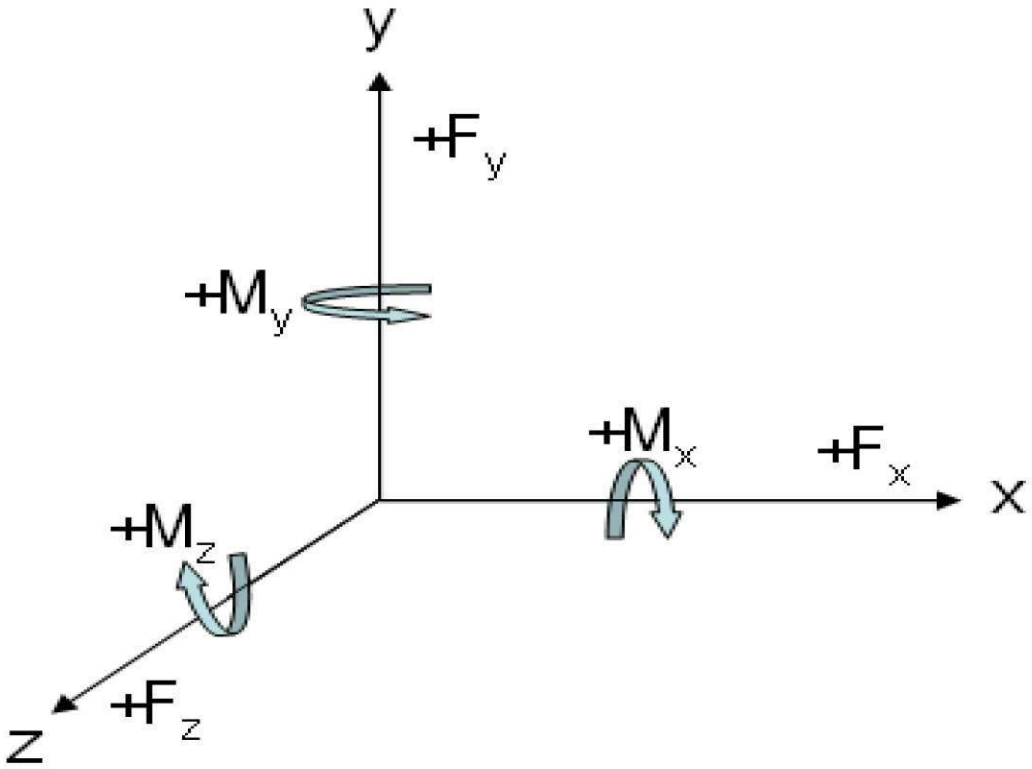


**Figure 2: Coordinate System and Load Directionality**

## 5.3 Unit System

The project shall follow the US English (Imperial) system of units.

## 5.4 Safety

All risks to personnel and the environment resulting from the SP89E project development should be as low as reasonably practicable. Safety is the primary consideration during all phases of the engineering design, construction and installation activities. All risks associated with these activities shall be minimized by adhering to the relevant governing design codes and to approved procedures.


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## 5.5 Software

This section provides a brief description of the software used for the scope design and analysis.

Where a detailed computational analysis is not required, hand calculations shall be performed considering empirical formulas and basic engineering principles.

### 5.5.1 ABAQUS

ABAQUS is commercial finite element analysis software with the capability to perform both linear and non-linear FEA.

### 5.5.2 AGA

AGA is commercial on-bottom stability analysis software by PRCI. Determination of pipeline on-bottom stability shall use a Level 2 analysis method.

### 5.5.3 AutoPIPE

Bentley AutoPIPE is a finite element piping analysis software capable of static and dynamic analysis. The software also offers linear and non-linear analysis capabilities for temperature, wind, wave, buoyancy, snow, seismic, and transient loadings. The piping flexibility analysis will be performed using AutoPIPE.

### 5.5.4 FS2000

FS2000 is a suite of integrated programs based on the finite element method for the analysis and design of pressurized pipework and offshore structures. This program is designed specifically to analyze pipeline/spool/riser systems. FS2000 addresses the problem of static equilibrium of a pipeline tie-in spool system in three dimensions with the following parameters:

- Environmental loading
- Soil reaction forces
- Imposed loads and displacements

FS2000 uses a non-linear finite element method to analyze the spool piece and riser. The sections of the system on the seabed are restrained by vertical, lateral and axial non-linear frictional springs. Wave and current loadings use Morison formulations.

### 5.5.5 MathCAD

MathCAD is a computer program used for engineering calculations. MathCAD operates in a document-centric calculation environment; and supports automatic computation and live editing of typeset mathematical notation and equations.

MathCAD will be used to generate simplified mathematical models of structural components for verification of design specifications.

### 5.5.6 SACS

Bentley SACS is an integrated finite element structural analysis suite of programs that provides for the design, fabrication, installation, operation and maintenance of offshore structures. SACS is widely accepted in the offshore oil and gas industry.

SACS will be used to generate FEA models represented by member and plate elements. SACS will also be used to generate loading, analyze structural elements and perform design specification verifications.


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# 6 Design Data

## 6.1 Operating Data

Table 6 lists the design data for the 4.5in outer diameter (OD) fuel gas spool and pipeline. All pipe sections designed for pigging operations require 5D (five times the nominal outer diameter) bends. Reference Table 19 for the fuel gas pipeline and spool governing design code.

**Table 6: Fuel Gas Pipeline and Spool Operating Data**

| Parameter | Value |
|---|---|
| Design Pressure1, 2 | 1,440psig |
| Maximum Allowable Operating Pressure (MAOP) 2 | 1,440psig |
| Hydrotest Pressure Factor | 1.25•MAOP |
| Maximum Design Temperature 3 | 140°F |
| Minimum Design Temperature | -20°F |
| Design Life | 30 years |
| Maximum Water Depth | 398ft |
| Minimum Water Depth | 344ft |
| 1. This pipeline meets low stress reassessment criteria according to 49 CFR 192.<br>2. All pressures listed are in reference to an elevation of 93ft above Mean Sea Level (MSL).<br>3. CP calculations shall be performed using anticipated operating temperature ranges as specified in Table 25. | |

Table 7 lists the design data for the 4.5in fuel gas riser. All pipe sections designed for pigging operations require 5D bends. Table 19 lists the fuel gas riser governing design code.

**Table 7: 4.5in Fuel Gas Riser Operating Data**

| Parameter | Value |
|---|---|
| Design Pressure1 | 1,440psig |
| MAOP1 | 1,440psig |
| Hydrotest Pressure Factor | 1.5•MAOP |
| Maximum Design Temperature 2 | 140°F |
| Minimum Design Temperature | -20°F |
| Design Life | 30 years |
| Seabed to Mean Sea Level (MSL) | 392 feet |
| Mean Lower Low Water (MLLW) | MSL -0.634 feet |
| 1. All pressures listed are in reference to an elevation of 93ft above MSL.<br>2. CP calculations shall be performed using anticipated operating temperature ranges as specified in Table 25. | |


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Table 8 lists the design data for the 20.2/24in Mattox riser and spool. Table 19 lists the Mattox riser and spool governing design code.

**Table 8: 20.2in/24in Mattox Riser and Spool Operating Data**

| Parameter | Value |
|---|---|
| Design Pressure[1] | 3,630psig |
| MAOP[1] | 3,630psig |
| Hydrotest Pressure Factor | 1.25•MAOP (Spool), 1.5•MAOP (Riser) |
| Maximum Design Temperature [2] | 120°F |
| Minimum Design Temperature | 10°F |
| Design Life | 30 years |
| Seabed to MSL | 392 feet |
| MLLW | MSL -0.634 feet |
| 1. All pressures listed are in reference to an elevation of 93ft above MSL.<br>2. CP calculations shall be performed using anticipated operating temperature ranges as specified in Table 25. | |

## 6.2 Environmental Data

The SP89E platform will be designed to operate in a 100-year winter storm environment and will plan to shut down during a storm greater than a 100-year winter storm (hurricane conditions). Installation and temporary conditions shall be evaluated under 1-year and 10-year winter storm environments, respectively. This section summarizes the corresponding data taken from the metocean report [Ref. 4]. The density of seawater is 64.2lb/ft$^3$.

### 6.2.1 Wave Data

Table 9 lists the SP89E site-specific omnidirectional wave data [Ref. 4] for 1-,10- and 100-year winter storm (operating conditions) and 10- and 100-year hurricane (shut-down) return periods.

**Table 9: Omnidirectional Wave Data**

| Parameter | Winter Storm Return Period (Operating) | | | Hurricane Return Period (Shut-down) | |
|---|---|---|---|---|---|
| | 1-year | 10-year | 100-year | 10-year | 100-year |
| Hs | 16.1ft | 21.0ft | 28.87ft | 34.45ft | 49.54ft |
| Tp | 8.7s - 10.7s | 10.0s-12.0s | 12.0s - 14.0s | 12.4s - 14.4s | 14.7s - 16.7s |
| Hmax | 28.87ft | 37.73ft | 51.84ft | 60.37ft | 86.61ft |
| THmax | 7.4s - 10.2s | 8.5s - 11.4s | 10.2s - 13.3s | 10.5s - 13.7s | 12.5s - 15.9s |

### 6.2.2 Current Data

Table 10 presents omnidirectional current data [Ref. 4] for 1-, 10- and 100-year winter storm (operating condition) and 10- and 100-year hurricane (shutdown condition) return periods.


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**Table 10: Omnidirectional Current Data**

| Water Depth | Winter Storm Return Period (Operating) | | | Hurricane Return Period (Shut-down) | |
|---|---|---|---|---|---|
| | 1-year | 10-year | 100-year | 10-year | 100-year |
| Surface | 1.38ft/s | 1.54ft/s | 2.03ft/s | 6.2ft/s | 7.68ft/s |
| Mid-depth | 1.05ft/s | 1.18ft/s | 1.54ft/s | 4.56ft/s | 5.61ft/s |
| Seabed | 0ft/s | 0ft/s | 0ft/s | 0ft/s | 0ft/s |

### 6.2.3 Seawater Temperature Data

Table 11 shows the seawater ambient temperature [Ref. 4].

**Table 11: Temperature Data**

| Season | Water Depth | Temperature | | |
|---|---|---|---|---|
| | | Mean | Minimum | Maximum |
| Spring | 0ft | 72.1°F | 58.3°F | 82.0°F |
| | 98ft | 70.5°F | 60.6°F | 77.4°F |
| | 197ft | 67.6°F | 62.1°F | 72.3°F |
| | 295ft | 66.6°F | 58.5°F | 71.1°F |
| | 492ft | 61.9°F | 56.1°F | 66.2°F |
| Summer | 0ft | 84°F | 78.8°F | 89.8°F |
| | 98ft | 79.5°F | 69.3°F | 84.6°F |
| | 197ft | 70.5°F | 60.8°F | 82.0°F |
| | 295ft | 67.5°F | 59.7°F | 79.3°F |
| | 492ft | 62.6°F | 55.4°F | 68.5°F |
| Autumn | 0ft | 79.3°F | 71.2°F | 88.0°F |
| | 98ft | 81.1°F | 67.1°F | 85.3°F |
| | 197ft | 72.7°F | 63.3°F | 81.5°F |
| | 295ft | 68.0°F | 59.7°F | 81.7°F |
| | 492ft | 65.5°F | 60.6°F | 77.9°F |
| Winter | 0ft | 68.9°F | 60.8°F | 76.6°F |
| | 98ft | 73.6°F | 60.6°F | 76.5°F |
| | 197ft | 72.0°F | 67.8°F | 78.6°F |
| | 295ft | 67.6°F | 61.5°F | 73.8°F |
| | 492ft | 61.3°F | 58.8°F | 68.4°F |


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### 6.2.4 Marine Growth Data

Table 12 presents marine growth data for the SP89 area [Ref. 4]. The submerged density of the marine growth shall be taken as 75 lb/ft$^3$.

**Table 12: Marine Growth**

| Depth | Thickness |
|---|---|
| Mean High High Water (MHHW) | 1.5in |
| To (-)33ft below MLLW | 1.5in |
| Vary to (-)164ft below MLLW | 0.4in |
| To (-)328ft below MLLW | 0.4in |
| Vary to (-)392ft below MLLW (ML) | 0.2in |

### 6.2.5 Hydrodynamic Coefficients

Hydrodynamic coefficients presented in Table 13 shall apply as per DNV RP C205.

**Table 13: Hydrodynamic Coefficients**

| Hydrodynamic Coefficients | Smooth Tubular Surface | | Rough Tubular Surface | |
|---|---|---|---|---|
| | In-place | Fatigue | In-place | Fatigue |
| Normal Drag ($C_d$) | 0.65 | 0.50 | 1.05 | 0.80 |
| Added Mass ($C_m$) | 1.60 | 2.00 | 1.20 | 2.00 |

## 6.3 Geotechnical Data

Design soil parameters are developed based on field and laboratory testing data presented in the geophysical and geotechnical survey reports [Ref. 5, 27, 28, 29]. The seabed soil at this location is categorized as very soft clay. Table 14 shows the undrained shear strength, submerged unit weight and strength sensitivity of the clay from mudline to 1ft below mudline. The pipe-soil interaction analysis for global analysis of the 4.5in fuel gas pipeline shall use these parameters.

**Table 14: Soil Parameters for Pipe-Soil Interaction Analysis**

| Depth | Undrained Shear Strength (Su) | | | Soil Sensitivity | Submerged Unit Weight (γ') |
|---|---|---|---|---|---|
| | Low Estimate (LE) | Best Estimate (BE) | High Estimate (HE) | | |
| 0ft | 5psf | 12psf | 25psf | 3 | 21pcf |
| 0.33ft | 9psf | 17psf | 25psf | 3 | 21pcf |
| 0.5ft | 18psf | 30psf | 41psf | 3 | 21pcf |
| 1ft | 31psf | 45psf | 58psf | 3 | 21pcf |

The design soil parameters for the shallow foundation analysis are tabulated in Table 15 to Table 17, which apply to the PLET location, crossings 1 and 2 (20in Gas Pipeline S-6392 and 12in Gas Pipeline S-9597), crossings 3, 4 and 5 (12in Oil Pipeline S-6013, 12in Oil Pipeline S-13317, 6in Umbilical S-10458) and the spool tie-in location, respectively.


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**Table 15: Soil Parameters for Fuel Gas PLET Location**

| Depth | Undrained Shear Strength, Su | Submerged Unit Weight γ' | Compression Ratio, CR | Recompression Ratio, RR | OCR |
|---|---|---|---|---|---|
| 0ft | 12psf | 20pcf | 0.24 | 0.024 | 1.4 |
| 1ft | 45psf | 25pcf | 0.24 | 0.024 | 1.4 |
| 1.33ft | 55psf | 25.1pcf | 0.24 | 0.024 | 1.4 |
| 3ft | 55psf | 25.6pcf | 0.24 | 0.024 | 1.4 |
| 8ft | 160psf | 27.2pcf | 0.24 | 0.024 | 1.4 |
| 14ft | 190psf | 29pcf | 0.24 | 0.024 | 1.4 |

**Table 16: Soil Parameters for Crossings 1 and 2**

| Depth | Undrained Shear Strength, Su | Submerged Unit Weight γ' | Compression Ratio, CR | Recompression Ratio, RR | OCR |
|---|---|---|---|---|---|
| 0ft | 12psf | 18pcf | 0.19 | 0.023 | 1.4 |
| 1ft | 45psf | 23.3pcf | 0.19 | 0.023 | 1.4 |
| 1.33ft | 55psf | 25pcf | 0.19 | 0.023 | 1.4 |
| 3.3ft | 55psf | 25pcf | 0.19 | 0.023 | 1.4 |
| 5.4ft | 206psf | 43pcf | 0.19 | 0.023 | 5.2 |
| 14ft | 310psf | 43pcf | 0.19 | 0.023 | 5.2 |

**Table 17: Soil Parameters for Crossings 3, 4 and 5 and Spool Tie-in Location**

| Depth | Undrained Shear Strength, Su | Submerged Unit Weight γ' | Compression Ratio, CR | Recompression Ratio, RR | OCR |
|---|---|---|---|---|---|
| 0ft | 12psf | 23pcf | 0.22 | 0.022 | 1.4 |
| 1ft | 45psf | 23pcf | 0.22 | 0.022 | 1.4 |
| 3ft | 45psf | 23pcf | 0.22 | 0.022 | 1.4 |
| 4ft | 45psf | 31.6pcf | 0.22 | 0.022 | 1.4 |
| 5.2ft | 69.8psf | 43pcf | 0.22 | 0.022 | 1.4 |
| 9ft | 148pcf | 43pcf | 0.22 | 0.022 | 1.4 |

Soil parameters presented in the geophysical and geotechnical report [Ref. 5] and SAFEBUCK III method [Ref. 6] shall provide the basis for pipe-soil interaction parameters including axial/lateral friction factors and vertical resistance.


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Figure 3 shows the bathymetry profile for the fuel gas pipeline. The spool and riser is not included in this figure. The distance from the hot tap to the riser base is approximately seven miles. Refer to the survey report [Ref. 5] for further details.

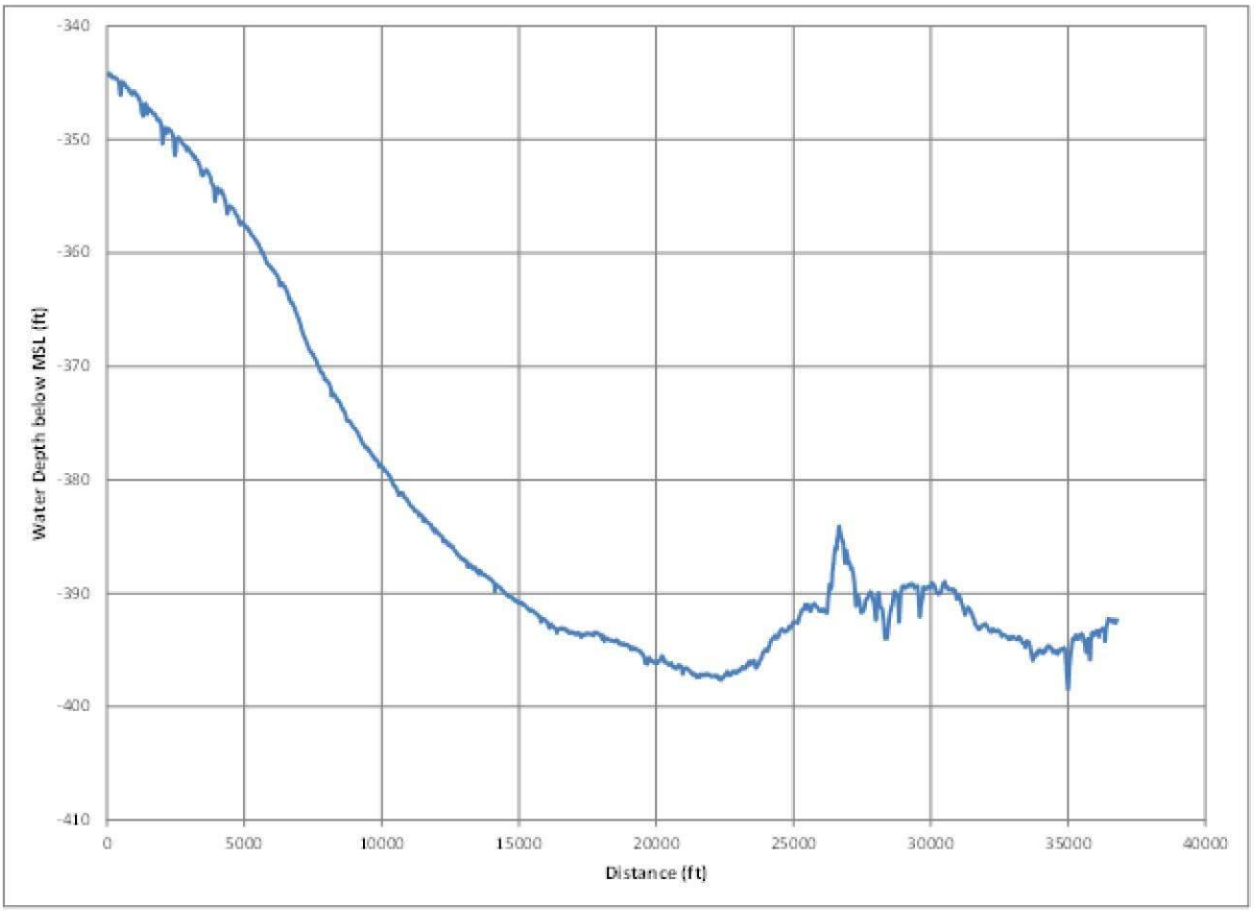


**Figure 3: Fuel Gas Pipeline Bathymetry Profile**

## 6.4 Internal Corrosion Allowance

All pipeline, spools and riser analyses for operating conditions shall include the internal corrosion allowance values shown in Table 18. Pipe stress checks tor installation and hydrotest conditions shall use the full non-corroded wall thickness (WT). No allowance for external corrosion shall be considered in pipe stress checks.

**Table 18: Internal Corrosion Allowances**

| Item | Corrosion Allowance |
|---|---|
| 4.5in OD gas pipeline, riser, spool (piggable) | 0.040in (1mm) |
| 20.2in/24in OD oil riser, spool (piggable) | 0.118in (3mm) |
| 4.5in OD pipeline end termination (PLET) header piping (piggable) | 0.040in (1mm) |
| 4.5in OD hot tap assembly piping and PLET branch piping (non-piggable) | 0.157in (4mm) |


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# 7 Acceptance Criteria

Table 19 establishes the boundaries between governing design codes between subsea assets.

**Table 19: Design Code - Scope Breaks/Boundaries**

| Item | Defined Scope Boundary | Applicable Design Code |
|---|---|---|
| Fuel gas hot-tap assembly | Hot-tap ASME/ANSI 900# flange face to hot-tap clamp assembly | ASME/ANSI B31.8, API RP 2201 |
| Fuel gas pipeline | Pipeline end termination flange face to tie-in flange face | As per Table 20 |
| Fuel gas tie-in spool | Fuel gas pipeline flange face to platform riser flange face | As per Table 20 |
| Fuel gas riser | Tie-in spool flange face to topsides piping flange face | ASME/ANSI B31.8 (gas) |
| Mattox tie-in spool | 20.2in riser flange face to 24in Mattox oil pipeline flange face | ASME B31.4 (oil) |
| Mattox riser | Mattox tie-in spool flange face to topsides piping flange face | ASME/ANSI B31.4 (oil) |

### 7.1.1 Pipeline and Spool

Maximum allowable stress in the pipeline during installation, hydrotest and operation will be limited to the levels indicated in Table 20.

**Table 20: Pipeline and Spool Stress Design Criteria**

| Condition | Parameter | Limiting Stress Criteria | Design Code Source |
|---|---|---|---|
| Operating | Hoop stress[1] | 30% of Specified Minimum Yield Strength (SMYS) | 49 CFR 192 |
| | Longitudinal stress | 80% of SMYS | ASME/ANSI B31.4, B31.8 |
| | Combined stress | 90% of SMYS | |
| Combined Load Factor | Operating loads | 90% of SMYS | API RP 1111 |
| | Extreme loads | 96% of SMYS | |
| | Hydrotest loads | 96% of SMYS | |
| Longitudinal Load Design | Static effective tension | 60% of SMYS | API RP 1111 |

1. In order to comply with low stress reassessment criteria (according to 49 CFR 192), hoop stress is limited to 30% of SMYS.

The maximum allowable bending strain during installation using conventional methods is 0.15% in the sag bend region and 0.20% in the over bend section. The maximum applied bending strain during reeling shall not exceed 2.5%. In no case shall the maximum applied bending strain exceed the strain associated with bending collapse of the pipe. The installation bending strain limits are in accordance with GIS 43-2106 recommendations.


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### 7.1.2 Fuel Gas Riser

The design of the fuel gas riser shall satisfy ASME B31.8, 30 CFR 250 and 49 CFR 192 requirements. Table 21 presents design factors for the fuel gas riser.

**Table 21: Fuel Gas Riser Design Factors**

| Condition | Parameter | Limiting Stress Criteria | Design Code Source |
|---|---|---|---|
| Operating | Hoop Stress | 50% of SMYS | ASME/ANSI B31.8 |
| | Longitudinal Stress | 80% of SMYS | |
| | Combined Stress | 90% of SMYS | |
| Hydrotest | Hoop Stress | 95% of SMYS | 30 CFR 250 |
| | Longitudinal Stress | 95% of SMYS | |
| | Combined Stress | 95% of SMYS | |

### 7.1.3 Mattox Oil Riser

The Mattox oil riser design shall satisfy ASME B31.4 and 30 CFR 250 requirements. Table 22 presents design factors for the Mattox oil riser.

**Table 22: Mattox Oil Riser Design Factors**

| Condition | Parameter | Limiting Stress Criteria | Design Code Source |
|---|---|---|---|
| Operating | Hoop Stress | 60% of SMYS | ASME/ANSI B31.4 |
| | Longitudinal Stress | 80% of SMYS | |
| | Combined Stress | 90% of SMYS | |
| Hydrotest | Hoop Stress | 95% of SMYS | 30 CFR 250 |
| | Longitudinal Stress | 95% of SMYS | |
| | Combined Stress | 95% of SMYS | |

### 7.1.4 Fuel Gas PLET

The fuel gas PLET piping shall satisfy ASME B31.8, 30 CFR 250 and 49 CFR 192 requirements. In order to comply with low stress reassessment criteria (according to 49 CFR 192), hoop stress is limited to 30% of SMYS. Longitudinal and combined stress design factors under operating conditions shall be in accordance with ASME B31.8, Section A842.2.2. Table 23 presents design factors for the fuel gas PLET piping.

**Table 23: PLET Piping Design Factors**

| Condition | Parameter | Limiting Stress Criteria | Design Code Source |
|---|---|---|---|
| Operating | Hoop Stress | 30% of SMYS | 49 CFR 192 |
| | Longitudinal Stress | 80% of SMYS | ASME/ANSI B31.8 |
| | Combined Stress | 90% of SMYS | |
| Hydrotest | Hoop Stress | 95% of SMYS | 30 CFR 250 |
| | Longitudinal Stress | 95% of SMYS | |
| | Combined Stress | 95% of SMYS | |


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# 8 Flow Assurance

Refer to the flow assurance BOD [Ref. 26]. Note that flow assurance is outside the scope of the Mattox oil work for SP89E.

# 9 Material Selection

## 9.1 General

Materials selection shall adhere to the requirements of GP 36-20 Materials Selection for Subsea Equipment and the project specification for Structural Materials Design Guidelines [Ref. 17].

## 9.2 Pressure Piping

Pipe steel grade API 5L X65 (65,300psi yield strength, 77,600psi tensile strength) shall be considered for the 4.5in fuel gas pipeline and tie-in spool, as well as the 24in/20.2in Mattox tie-in spool, riser and associated components [Ref. 18].

## 9.3 Structural Shapes and Plate

The structural steel for the subsea equipment shall be in accordance with GIS 36-0002.

**Table 24: Material Selections**

| Type | Material | Notes |
|---|---|---|
| HSS (round) | API 5L X52<br>ASTM A53 Gr. B | |
| HSS (shaped) | ASTM A500 Gr. B | |
| Plates | API 2H Gr. 50<br>API 2W Gr. 50<br>ASTM A572 Gr. 50 | All padeyes to be API 2H Gr. 50 w/ S1, S3, S4, and S5 |
| Shapes | ASTM A992<br>ASTM A572 Gr. 50 | |

## 9.4 Welding and Fasteners

All structural studs/bolts shall be ASTM A193 Gr. B7M with ASTM A194 Gr. 2H nuts and ASTM F436 washers. Maximum individual hardness values of low alloy steel fastener materials exposed to seawater shall be specified as 34 HRC.

Thin metal coatings that promote electrical continuity and effectiveness of cathodic protection (CP) shall be used. Sherardized, hot spun galvanized, zinc nickel electroplate, or zinc chromate/phosphate are acceptable coatings. Nonmetallic coatings shall not be used.

## 9.5 Flanges

### 9.5.1 Fuel Gas Flanges

BP-owned pipelines and tie-in spools shall be fitted with ANSI Flange class 600#, Ring Type Joint (RTJ) gaskets. Flanges at the hot-tap end shall be ANSI Flange class 900# [Ref. 24]. Note that flange bore shall match pipe internal diameter.


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### 9.5.2 Mattox Oil Flanges

The 20in/24in Mattox oil pipe shall use ANSI flange class 1500# sized for 20in and 24in pipe, as appropriate.

## 9.6 Non-metallics

Neoprene materials used in clamp or guide applications shall have a durometer rating of 80A.

# 10 Coatings and Markings

## 10.1 Corrosion Coating

The pipelines, spools and risers will be protected from external corrosion by a combination of an anti-corrosion coating system in accordance with Subsea Specification - FBE Pipe Coating [Ref. 19] (or a COMPANY-approved equivalent) and in conjunction with a CP system for all piping below the splash zone. Field joint coatings shall be in accordance with Subsea Specification - Field Joint Coating [Ref. 20].

### 10.1.1 Pipeline Coating

A three-layer polypropylene (3LPP) coating system shall be used for reeled sections of all pipelines. Field joints shall be coated with fusion-bonded epoxy (FBE) or a COMPANY-approved equivalent.

### 10.1.2 Risers and Tie-in Spools Coating

A 3-layer marine epoxy coating system (or a COMPANY-approved equivalent) will be used on all risers and tie-in spools, as appropriate as per GIS 06-602.

The splash zone coating shall extend above the splash zone to an elevation accessible for inspection and repair. Both fuel gas and Mattox riser's external splash zone anti-corrosion coating shall be an elastomeric coating.

## 10.2 Marking and Tagging

Equipment identification colors shall be in accordance with API 17H.

# 11 Cathodic Protection Design

Cathodic protection shall be used to protect all structural and subsea equipment (including riser, tie-in spool and pipeline) from corrosion. The cathodic protection system will be designed in accordance with the subsea specifications Cathodic Protection Design [Ref. 21] and Cathodic Protection Anodes Procurement and Installation [Ref. 22]. The total net anode mass must be sufficient to meet the total current demand over the design life. Anodes mass requirements will be determined by attenuation analysis in accordance with NACE SP0115 and DNV RP F103.

CP interference and compatibility between the 12in Shell pipeline and the fuel gas pipeline shall be performed once the CP system design, CP potential and anode consumption survey data for the fuel gas pipeline have been provided containing data of sufficient quality to properly model the interaction between the two CP systems.

CP interference and compatibility between the Mattox pipeline and tie-in spool/riser shall be performed once the CP system design for the Mattox pipeline has been provided. This is a new pipeline, thus the CP potential or anode consumption survey data is not required.

Table 25 summarizes the CP design parameters. Note that CP calculations shall be performed using the anticipated operating temperature ranges as specified in Table 25.


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**Table 25: Design Parameters for Cathodic Protection**

| Parameter | | Value | Source |
|---|---|---|---|
| Design life | | 30 years | Client requirement |
| Resistivity | Seawater | 22.3Ωcm | Ref. 25 |
| | Sediments | 110.0Ωcm | Ref. 25 |
| Anode electrochemical current capacity | Corrected for 40°F | 2000Ahr/kg | Ref. 25 |
| | Corrected for 77°F | 2000Ahr/kg | ISO-15589-2 |
| | Buried, corrected for 77°F | 1500Ahr/kg | ISO-15589-2 |
| Utilization factor | Bracelet anode | 0.8 | Ref. 25 |
| | Platform anode | 0.9 | Ref. 25 |
| Closed circuit anode potential vs Ag/AgCl | | -1.050V | Ref. 25 |
| Closed circuit anode potential vs Ag/AgCl (buried) | | -1.000V | Ref. 25 |
| Design protective potential vs Ag/AgCl | | -0.800V | Ref. 25 |
| Al-Zn-In anode alloy chemistry | | Coldwater | Ref. 25 |
| Alloy density | | 2750kg/m3 | Calculated |
| Coating thickness for riser spools (coating system B3-2) | | 14mils DFT | GIS 06-602 |
| FBE coating thickness for pipeline and risers with 3LPP coating | | 10 to 16mils | GIS 06-403 |
| 3LPP coating thickness for pipeline | | ≥ 2.00mm | GIS 06-403 |
| 3LPP pipeline field joint coating (FBE) | | 14 to 16mils DFT | GIS 06-402 |
| Coating breakdown factor | Initial FBE | 0.04 | Ref. 25 |
| | Mean FBE | 0.07 | Ref. 25 |
| | Final FBE | 0.10 | Ref. 25 |
| | Initial 3LPP | 0.006 | Ref. 25 |
| | Mean 3LPP | 0.009 | Ref. 25 |
| | Final 3LPP | 0.012 | Ref. 25 |
| | Initial marine epoxy | 0.04 | GIS 06-602 |
| | Mean marine epoxy | 0.07 | GIS 06-602 |
| | Final marine epoxy | 0.10 | GIS 06-602 |
| Current density, corrected for 77°F | Unburied pipeline, spools and risers | 50mA/$m^2$ | Ref. 25 |
| | Buried pipeline and spools | 20mA/$m^2$ | Ref. 25 |
| Free corrosion potential of steel vs Ag/AgCl | | -0.630V | H.H Uhligh |
| Resistivity of pipe steel corrected for 77°F | | 17.25μΩcm | Calculated |


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# 12 Pigging Philosophy

New pipelines shall be designed to allow in-line inspection and periodic inspection to verify fitness for continued operation. The pipeline, pig launcher and receiver should be designed to accommodate an ILI tool. Specific requirements for the design of inline inspection (ILI) systems are given in GP 43-50 and GP 43-52. Designing the system for an ILI pig should also satisfy design requirements for decommissioning pigging. During pigging activities, the pipeline should be isolated from all other systems and seawater using double barriers.

Refer to the 4in Fuel Gas Pipeline Pigging Philosophy [Ref. 23] for detailed pigging philosophy.

# 13 Mattox Riser and Tie-in Spool

## 13.1 General

The Mattox oil riser shall be designed to minimize riser induced loading or displacements to the topsides piping. All pipe sections designed for pigging operations shall require 5D (five times the nominal outer diameter) bends. Note that the Mattox pipe is free-issued to BP by Shell. This material has been defined by Shell and no wall thickness checks shall be carried out.

As a minimum, pipe stress analysis of the risers and associated tie-in spools shall consider as-installed, hydrotest and operating cases. In addition, the design shall consider the following:

- Maximum design pressures and temperatures
- Pressure containment
- Capacity of the risers for axial compression
- Thermal expansion and contraction
- Loads and stresses due to pressure, temperature, self-weight, topsides/subsea tie-in, and environmental effects (wave, current, and wind loading)
- Jacket deflections due to environmental loading
- Imposed limitations by the presence of existing infrastructure
- Installation loads

## 13.2 Design Requirements

### 13.2.1 Flexibility Analysis of Risers and Tie-In Spools

Flexibility analysis of the risers and tie-in spools shall be performed using FS2000 and spreadsheet calculations. The analyses shall take into consideration installation, hydrostatic, operational, interface loads from topside piping where applicable.

The riser shall be modelled from the topside deck flange location, down to the first bend near the seabed. The tie-in spools connecting the risers to the flowlines shall be analyzed as part of the riser.

Equivalent stresses under both subsea hydrotest and operating conditions shall be checked in accordance with Section 7. The design report shall provide detail load case matrices, load case combinations and acceptable stress criteria.

### 13.2.2 Vortex Induced Vibration Analysis

The risers support arrangement shall be selected to ensure no inline vibration in current and no cross flow vibration in waves plus current occurs. Span lengths to mitigate against in-line and cross flow vibration shall satisfy the requirements of DNV RP C205. The assessment shall consider water particle velocity enhancement due to the jacket leg.


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### 13.2.3 Fatigue Analysis

Riser fatigue analyses shall satisfy DNV RP F204 and DNVGL RP 0005 requirements.

#### *13.2.3.1 Fatigue Due to Wave*

Wave induced fatigue analysis for the riser shall be based on Weibull distribution stress range and bi-linear S-N curves. The damage shall be calculated by a direct integration of damage below each part of the bi-linear S-N curves. The wave return data shall be taken from the environmental criteria for SP89E field.

$$D := \int_0^{S_1} n_o \cdot dd \cdot \frac{f(S, \Delta\sigma, h)}{10^{\log a_2 - m_2 \cdot \log(S)}} dS + \int_{S_1}^{\Delta\sigma} n_o \cdot dd \cdot \frac{f(S, \Delta\sigma, h)}{10^{\log a_1 - m_1 \cdot \log(S)}} dS$$

The density Weibull function is given by:

$$f(S, \Delta\sigma, h) := h \cdot \frac{S^{h-1}}{\frac{\Delta\sigma^h}{\ln((n_o \cdot dd))}} \cdot \exp\left[-1\left[\frac{S}{\frac{\Delta\sigma}{\ln((n_o \cdot dd))^{\frac{1}{h}}}}\right]^h\right]$$

Where:

Ds: Stress range in period

$n_o$: Number of waves in period

log a: Intercept of log N-axis by S-N curve

m: Negative inverse slope of S-N curve

S: Stress range corresponding to the number of cycles

dd: Directional distribution factor

h: Weibull parameter for long term stress range distribution

The F3 S-N curve in seawater with cathodic protection from DNVGL RP 0005 shall be used for determining fatigue damage. No SCF will be applied to the stress amplitudes as the curves account for SCFs.

#### *13.2.3.2 Fatigue Due Start-up and Shut-down*

The fatigue assessment for operating conditions shall be performed assuming that there are five (5) full shutdowns per month, which equates to 1,800 cycles over the 30-year design life. The range of axial stress shall be derived and used as the stress range in the fatigue assessment.

# 14 Fuel Gas Riser and Tie-in Spool

## 14.1 General

The fuel gas riser shall be designed to minimize riser induced loading or displacements to the topsides piping. All pipe sections designed for pigging operations shall require 5D (five times the nominal outer diameter) bends.

As a minimum, pipe stress analysis of the riser and associated tie-in spool shall consider as-installed, hydrotest and operating cases. In addition, the design shall consider the following:

- Maximum design pressures and temperatures
- Pressure containment
- Capacity of the risers for axial compression
- Thermal expansion and contraction
- Loads and stresses due to pressure, temperature, self-weight, topsides/subsea tie-in, and environmental effects (wave, current, and wind loading)
- Jacket deflections due to environmental loading
- Imposed limitations by the presence of existing infrastructure
- Installation loads


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## 14.2 Design Requirements

### 14.2.1 Flexibility Analysis of Risers and Tie-In Spools

Flexibility analysis of the risers and tie-in spools shall be performed using FS2000 and spreadsheet calculations. The analyses shall take into consideration installation, hydrostatic, operational, interface loads from topside piping where applicable.

The riser shall be modelled from the topside deck flange location, down to the first bend near the seabed. The tie-in spools connecting the risers to the flowlines shall be analyzed as part of the riser.

Equivalent stresses under both subsea hydrotest and operating conditions shall be checked in accordance with Section 7. The design report shall provide detail load case matrices, load case combinations and acceptable stress criteria.

### 14.2.2 Vortex Induced Vibration Analysis

The risers support arrangement shall be selected to ensure no inline vibration in current and no cross flow vibration in waves plus current occurs. Span lengths to mitigate against in-line and cross flow vibration shall satisfy the requirements of DNV RP C205. The assessment shall consider water particle velocity enhancement due to the jacket leg.

### 14.2.3 Fatigue Analysis

Riser fatigue analyses shall satisfy DNV RP F204 and DNVGL RP 0005 requirements.

#### *14.2.3.1 Fatigue Due to Wave*

Wave induced fatigue analysis for the riser shall be based on Weibull distribution stress range and bi-linear S-N curves. The damage shall be calculated by a direct integration of damage below each part of the bi-linear S-N curves. The wave return data shall be taken from the environmental criteria for SP89E field.

$$D := \int_0^{S_1} n_o \cdot dd \cdot \frac{f(S, \Delta\sigma, h)}{10^{loga_2 - m_2 \cdot \log(S)}} dS + \int_{S_1}^{\Delta\sigma} n_o \cdot dd \cdot \frac{f(S, \Delta\sigma, h)}{10^{loga_1 - m_1 \cdot \log(S)}} dS$$

The density Weibull function is given by:

$$f(S, \Delta\sigma, h) := h \cdot \frac{S^{h-1}}{\frac{\Delta\sigma^h}{\ln((n_o \cdot dd))}} \cdot \exp\left[-1\left[\frac{S}{\frac{\Delta\sigma}{\ln((n_o \cdot dd))^{\frac{1}{h}}}}\right]^{-h}\right]$$

Where:

Ds: Stress range in period

$n_o$: Number of waves in period

log a: Intercept of log N-axis by S-N curve

m: Negative inverse slope of S-N curve

S: Stress range corresponding to the number of cycles

dd: Directional distribution factor

h: Weibull parameter for long term stress range distribution

The F3 S-N curve in seawater with cathodic protection from DNVGL RP 0005 shall be used for determining fatigue damage. No SCF will be applied to the stress amplitudes as the curves account for SCFs.


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#### *14.2.3.2 Fatigue Due Start-up and Shut-down*

The fatigue assessment for operating conditions shall be performed assuming that there are five (5) full shutdowns per month, which equates to 1,800 cycles over the 30-year design life. The range of axial stress shall be derived and used as the stress range in the fatigue assessment.

# 15 Mattox and Fuel Gas Riser Clamps

Risers will be attached to the platform jackets by means of using a hang-off and guide clamps. All clamps shall be welded to the jacket.

## 15.1 General

### 15.1.1 Hang-Off Clamps

The hang-off clamp shall support the vertical weight of the riser. The hang-off clamp will be above water and may be welded directly to the jacket via a full-penetration weld, or connected to the jacket member via a doubler plate. The location of the hang-off clamp shall be the first clamp below the shutdown valve; this final location shall be determined based on the riser analysis and constructability reviews.

The hang-off clamp shall be provided with an internal neoprene lining in order to reduce moments on the guide shells due to riser displacement by redistributing the loads. The neooprene will also provide electrical isolation of the riser from the jacket.

The inner diameter of the hang-off clamp including lining shall be slightly larger than the riser diameter to facilitate alignment of the riser in the clamp.

### 15.1.2 Guide Clamps

Guide clamps shall be provided to restrain lateral motion of the risers due to operating loads. Guide clamps shall be provided with neoprene lining in order to reduce moments on the guide shells due to risers' displacement by redistributing the loads and will provide electrical isolation of the riser from the jacket.

Guide clamps located in the splash zone shall be of the non-bolted, sleeved type as per GP 43-21.

Guide clamps located outside the splash zone shall be hinged on one side and shall have a bolted flange connection on the other side. The bolted flange interface shall be adopted thus ensuring that the preloaded bolts do not see fluctuating loads and the load is transferred by friction at the flange interface. No joint separation shall occur for this bolted flange interface.

The inner diameter of the guide clamp including lining shall be slightly larger than the riser diameter to facilitate alignment of the riser in the clamp. All guide clamps will be welded to the platform member.

## 15.2 Design Requirements

Riser supports, clamps and associated bolting shall be designed to withstand loads exerted by the riser in conformance to GP 66-02. The primary design code for the hang-off clamps and guide clamps shall be AISC-360-05/API RP 2A-WSD, HSE Research Report 031 [Ref. 10] and OTH 88 283 [Ref. 11].

Design of the hang-off and guide clamps shall consider all loads induced by the deadweight of the riser, environmental loading and internal temperature/pressure effects. Clamp design shall consider the following parameters:

- Adequacy of bolt closure load
- Stress in clamp shell due to load applied to close gap
- Stress around clamp shell due to bolt tension
- Clamping force capacity
- Shear, bending and combined stresses in the stiffener
- Flange plate capacity


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The bolt preload should exceed the calculated prying force (per bolt) by a factor of safety of 1.2 for both hang-off clamps and guide clamps under all environmental conditions [Ref. 12].

# 16 Mattox Crossing Structure

## 16.1 General

The purpose of the Mattox crossing structure is to provide an elevated structure allowing the 20.2in Mattox tie-in spool to cross the existing Proteus oil pipeline. The crossing structure consists of a skirted mudmat foundation and framing to elevate the Mattox spool.

## 16.2 Design Requirements

The Mattox crossing structure shall be designed to support the anticipated span loading from the 20.2in Mattox tie-in spool with minimal settlement to maintain a minimum clearance of 18in from the existing Proteus pipeline. It is assumed that this existing pipeline is fully exposed (unburied).

The foundation shall be designed in accordance with API RP 2GEO. API RP 2A and AISC 316-89 criteria shall govern analysis of structural framing. The structural materials and fabrication shall conform to criteria in Structural Offshore Materials [Ref. 15] and Fabrication of Offshore Structures [Ref. 16].

Analysis of lifting/installation/retrieval conditions shall consider dynamic amplification and loading within the fabrication rigging tolerances specified in API RP 2A-WSD. The lift/installation rigging is assumed to be a four-leg bridle. To reduce the effects of wave slamming on the plated mudmat structure, the orientation of the structure is assumed to be angled.

Analysis of in-place conditions shall consider the forces due to operation and environmental forces. Operational loads shall consider forces derived from the operating weight of the Mattox tie-in spool. Consideration will be made for the crossing to be offset from the foundation centerline within ±2 1/2ft. The pipeline loading on the crossing structure shall be assumed no greater than 30.0 kips. Evaluation of environmental forces shall consider marine growth when computing the cross-sectional area of the structure for the application of current and wave forces.

# 17 Fuel Gas Pipeline

## 17.1 Design Requirements

### 17.1.1 Pipeline Wall Thickness (WT)

#### *17.1.1.1 Internal Pressure Design*

The pipe wall design shall resist the design pressure, hydrostatic test pressure and incidental overpressure at any point in the pipeline as defined by the governing code. The design analysis shall include pressures due to static elevation head of the content. Reference elevation for the design pressure shall be 93ft above MSL.

The WT calculation for the internal pressure design shall satisfy API RP 1111, ASME B31.8 and 49 CFR 192 requirements. A hydrostatic test factor of 1.25 shall be applied on the MAOP for the pipeline and spool as per provisions in 49 CFR 192.

#### *17.1.1.2 External Pressure Design*

The pipeline WT design shall resist collapse due to external hydrostatic pressure during installation and operation. The design conditions shall include:

- Collapse of the pipe due to external pressure only. In this case, the D/t ratio and the material yield strength control the pipe collapse.
- Pipe buckling due to the external pressure and bending strain developed in the pipe. Buckling shall consider the maximum initial mill delivered ovalization and an additional ovalization due to the reeling


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operations. Installation and operation activities subject the pipe to both external pressure and bending and pipe ovality affects the pipe buckling characteristics.

- Buckle propagation, used to determine the requirements and buckle arrestors' size shall be considered for the pipeline sections on the seabed.

The WT calculation for the external pressure design shall satisfy API RP 1111 requirements.

#### *17.1.1.3 Ovality from Reel-lay Installation*

In case of reel-lay installation, calculations shall assume that the full ovalization induced by the reel bending remains in the pipe after the pipe leaves the installation vessel. This is a conservative assumption; in practice, there will be some recovery of this ovalization during the pipe straightening process on the vessel. The reelability design shall be based on the provisions in API RP 1111 and Murphey's paper [Ref. 9].

The initial reeling strain calculation shall assume a typical reel diameter size until the installation contractor finalizes the installation vessel and reel size.

### 17.1.2 Route Selection

The pipeline route selection shall satisfy GP 43-21 requirements. The selected route shall optimize the overall length of the pipeline and should avoid any known natural hazards, chemosynthetic communities and areas with high probability of chemosynthetic communities. The route will also consider human-made structures such as existing wells, platforms, pipelines and umbilicals as well as archaeological features of interest.

Other route selection criteria are:

- Avoid side slope routing across areas with steep slopes where possible.
- Minimize crossings over other pipelines, umbilicals and cables.
- If practical, avoid seabed obstructions, outcrops, reefs and depressions, which may cause pipe spans, point loadings or high bending stresses.
- Share a corridor with existing pipelines, if possible.
- Give regard to fishing grounds and avoid, if feasible, shellfish beds.
- In the vicinity of a floating or fixed offshore structure, the riser and pipeline route shall avoid or protect against:
  - Dropped objects from the installation, supply boats and other vessels as per DNV RP F107
  - Interference with existing and other planned pipelines and tie-in spool pieces
  - Deposition of drilling mud and other waste materials
  - Footprint and/or anchor placement from jack-up rigs and other vessels

The maximum bottom tension and lower bound soil properties shall determine the radius of the route curvature. The route radius shall consider a safety factor of 1.1.

### 17.1.3 Pipeline Crossings

Pipeline crossing design shall satisfy the provisions in GP 43-21 and GP 43-28. In the absence of any separation distance provision in 49 CFR 192 and GP 43-28, a minimum separation of 18in shall be maintained between the existing pipelines and the new fuel gas pipeline as per 30 CFR 250. Two standard 9in thick concrete mattresses shall provide the required separation, while a bridge shall be used for any existing flexible pipe, umbilicals and cables.

The number of concrete mattresses required for the bridge shall be determined based on the mattresses embedment. The pipeline spans developed due to the crossings shall be provided with intermediate supports using concrete mattresses, capping mattresses or VIV suppression strakes based on the allowable span length for the fuel gas pipeline.


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## 17.1.4 Analysis Considerations

### *17.1.4.1 On-Bottom Stability Analysis*

The pipeline on-bottom stability analysis shall satisfy GP 43-21 requirements. Analysis for Submarine Pipeline On-Bottom Stability software developed by Pipeline Research Council International, Inc. (PRCI) and American Gas Association (AGA) shall be used for assessing the pipeline on-bottom stability. Level 2 analyses shall be performed for the following load cases as per DNV RP F109:

- For permanent operating conditions (with duration in excess of 12 months), winter storm return conditions shall apply.
- For temporary phases (installation, hydrotest, shutdown, etc.) with duration less than 12 months, hurricane return conditions shall apply.

The analysis shall use geotechnical data from Section 6 and metocean data (summarized in Section 6) from the metocean report [Ref. 4]. The pipeline design shall retain a minimum lateral stability safety factor of 1.0.

### *17.1.4.2 Pipeline Bottom Roughness Analysis*

The pipeline bottom roughness analysis shall be performed using commercial FEA software ABAQUS to establish the potential for span formation and associated loads due to seabed imperfections on the pipeline. The seabed shall be modeled using the survey data where possible. An initial check shall be performed for the pipeline susceptibility to global buckling, however the lateral buckling analysis shall confirm the global buckling locations.

The bottom roughness analysis should consider the following assumptions:

- Pipeline is stable on the seabed.
- Pipeline is empty during pipelay.
- Ignore weight of anodes and buckle arrestors (if any).

### *17.1.4.3 Span Analysis*

The outcome of the pipeline bottom roughness analysis in the form of predicted spans will be compared to the maximum allowable span length to determine if span remediation will be required after the pipeline installation.

The maximum allowable span length is determined by investigating the following conditions:

- Maximum pipe stresses – longitudinal and combined stresses (per ASME B31.8). Critical span lengths are determined based on the longitudinal stress and combined stress considerations for the installation, hydrotest, and operating conditions;
- Required length to prevent in-line and cross-flow VIV (per DNV RP F105) – the vibration criterion limits the spans to the lengths that will not allow the onset of resonant vibrations in the pipeline due to vortex shedding. As long as the span natural frequency is higher than the vortex shedding (vibration) frequency, VIV will not occur. If VIV is identified as a concern, a detailed analysis to estimate the fatigue damage due to VIV shall be performed.

### *17.1.4.4 Global Buckling and Expansion Analysis*

Global buckling shall be addressed and analyses performed to determine the impact of thermal expansion forces (axial and bending) on the pipeline. These should be configured to minimize the effect on the subsea equipment. Global buckling and expansion analysis shall include checking the pipeline susceptibility for lateral buckling, upheaval buckling and walking. The analysis shall be performed in accordance with the guidance of DNV RP F110. The global buckling and expansion analysis shall use the global FEA model developed as part of the bottom roughness analysis.

A mitigation strategy shall be developed to manage thermal expansion and any buckling issues, if required.


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#### *17.1.4.5 Installation Analysis*

Installation analysis shall determine the pipeline laying parameters such as the top tension and overbend load responses, to verify whether the pipe stress and strain response will be within allowable limits. The analysis shall satisfy API RP 1111 requirements. Results of the analysis shall be used in preparation of the pipeline installation specifications.

# 18 Fuel Gas PLET

## 18.1 General

The purpose of the fuel gas PLET assembly is to provide isolation and pigging functionality for the 4.5in fuel gas pipeline. The PLET assembly consists of a piping kit and an integral protection frame. The PLET assembly will be lowered independent of the fuel gas pipeline and set upon concrete mats for foundation support.

The PLET piping is comprised of three 4in ball valves providing isolation, a 2in ball valve for bypass and diver intervention access, and a 6" Grayloc connector (w 4in ID) to accommodate a future pig launcher. The pig launcher is intended to provide support in future operations (beyond commissioning activities) when needed. A long-term pressure cap will be installed until the pig launcher is required. Make-up to the fuel gas pipeline and fuel gas spool will be through diver accessible flanges.

## 18.2 Design Requirements

All components of the PLET shall be engineered and designed on a fit-for-purpose basis taking into consideration the project requirements concerning standardization and current technology. Designs shall take into account industry-proven engineering principles encompassing the use of field proven technology supported by rigorous qualification testing, minimization of potential leak paths, design simplicity and future intervention requirements.

### 18.2.1 Piping

The PLET will be modelled and analyzed in the piping analysis software AutoPIPE. The piping analysis shall consider the weight of the components (i.e., valves and flanges) and the interaction from the tie-in spools.

Table 7 presents stress criteria applicable to the PLET piping design under the operating conditions presented in Table 6. Installation and lifting conditions shall use loading criteria specified in API RP 2A-WSD. Stress criterion shall adhere to the operating condition design factors in Table 23.

The pipe straights and bends shall be 4.500"OD x 0.250"WT API 5L X65. All pipe sections designed for pigging operations shall require 5D (five times the nominal outer diameter) bends. All tees shall be barred.

### 18.2.2 Valves and Connectors

Valves shall comply with BP specifications and Subsea Specification - Pipeline Valves [Ref. 13] and API Spec 6D. Piping class line valves shall conform to the subsea specification for pipeline valves [Ref. 13]. Both 2in and 4in ball valves shall be full-bore. All 4in valves shall be ROV operable.

**Table 26: Valve Information**

| Size | Rating Schedule[1] | Typical Type | Est. Weight (lbs.) | End Config. | Qty. |
|---|---|---|---|---|---|
| 2in | Min. ANSI 600 class | Ball | 100 | BE x FE | 1 |
| 4in | Min. ANSI 600 class | Ball | 300 | BE x BE | 2 |
| 4in | Min. ANSI 600 class | Ball | 300 | BE x FE | 1 |

Note 1: Should ANSI 600 class valves be utilized in the final design, review and ensure that appropriate barriers are identified and utilized in the hydrotesting methodology. Use of all 900 class or other alternate arrangements may also be suitable and could be considered for COMPANY approval.


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The PLET piping shall incorporate a 6in (4in ID) Grayloc vertical connector with a ROV-removable long-term pressure cap from Oceaneering International, Inc. (OII).

**Table 27: Connector Information**

| Component | Size | Est. Weight (lbs.) |
|---|---|---|
| Grayloc Male Hub Assembly | 4in | 2,200 lbs. |
| Pressure Cap Assembly | 4in | 4,700 lbs. |

### 18.2.3 Flanges, Studs, Bolts and Gaskets

Flanges, stud bolts and gaskets to be selected in accordance with BP standard and Subsea Specification - Flange and Fittings [Ref. 14]. The flange material shall be compatible with the pipe material for the intended service.

Flanges for the 2in bypass and 4in spool isolation valve shall be welded. The fuel gas pipeline shall be attached with a swivel ring flange on the PLET side. Table 28 presents the typical flange type and sizes.

**Table 28: Piping Class Lines (Typical Flanges, Studs, Bolts and Gaskets)**

| Size | Specification | Rating Schedule[1] | Typical Type | Bolting | Gasket |
|---|---|---|---|---|---|
| 2in | ASME B16.5 | Min. ANSI 600 class | RTJ weld neck | 7/8in | R23 |
| 4in | ASME B16.5 | Min. ANSI 600 class | RTJ weld neck | 1-1/8in | R37 |
| 4in | ASME B16.5 | Min. ANSI 600 class | RTJ swivel ring | 1-1/8in | R37 |

Note 1: Should ANSI 600 class flanges be utilized in the final design, review and ensure that appropriate barriers are identified and utilized in the hydrotesting methodology. Use of all 900 class or other alternate arrangements may also be suitable and could be considered for COMPANY approval.

### 18.2.4 PLET Protection Frame

The protection frame shall be designed to support for the PLET piping kit, prevent accidental damage to the PLET piping by ROV impact, minimize the potential for snagging, and provide cathodic protection for the pipeline system near the hot tap assembly.

The protection frame shall include a locking, hinged cover that protects the Grayloc hub and pressure cap. This hinged cover should be opened during pigging operations.

API RP 2A and AISC 316-89 criteria shall govern analysis of structural framing. The structural materials and fabrication shall conform to criteria in Structural Offshore Materials [Ref. 15] and Fabrication of Offshore Structures [Ref. 16].

Analysis of lifting/installation/retrieval conditions shall consider dynamic amplification and loading within the fabrication rigging tolerances specified in API RP 2A-WSD. The PLET protection frame should be designed as an “open” structure to minimize hydrodynamic effects during installation. The lift/installation rigging is assumed to be a four-leg bridle utilizing soft slings in lieu of shackles and padeyes.

Analysis of in-place conditions shall consider the forces due to operation, ROV impact/snag loading, and environmental forces. Operational loads shall consider forces derived from the piping header analysis as well as the future pig launcher. The PLET assembly is assumed to be installed within 5° of level. The future pig launcher is assumed to have a submerged weight not more than 2.0 kips and a center of gravity not more than 3.5ft above the connector face. ROV impact/snag loading on the protection framing shall be assumed no greater than 5.0 kips. Evaluation of environmental forces shall consider marine growth (see Section 6.2.4) when computing the cross-sectional area of the structure for the application of current and wave forces.


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# 19 Fuel Gas Hot Tap

## 19.1 General

The purpose of the fuel gas hot tap assembly is to access an existing Shell 12in gas pipeline and provide fuel gas for power generation at the new SP89E platform. The hot tap assembly consists of a hot tap, a piping kit, and support clamps. The hot tap assembly will be supported by sand/cement bags and the support clamps to the 12in pipeline and protected by sand bags.

The piping kit is comprised of a 4in double-ball valve providing isolation and a 2in ball valve for bypass and diver intervention access. Make-up to the hot tap and the fuel gas tie-in spool will be through diver accessible flanges.

## 19.2 Design Requirements

All components of the hot tap shall be engineered and designed on a fit-for-purpose basis taking into consideration the project requirements concerning standardization and current technology. Designs shall take into account industry-proven engineering principles encompassing the use of field proven technology supported by rigorous qualification testing, minimization of potential leak paths, design simplicity and future intervention requirements.

### 19.2.1 Piping

The hot tap will be modelled and analyzed in the piping analysis software AutoPIPE. The piping analysis shall consider the weight of the components (i.e., valves and flanges) and the interaction from the tie-in spool.

Table 7 presents stress criteria applicable to the hot tap piping design under the operating conditions presented in Table 6. Installation and lifting conditions shall use loading criteria specified in API RP 2A-WSD. Stress criterion shall adhere to the operating condition design factors in Table 23.

The pipe straights and bends shall be 4.500”OD x 0.337”WT API 5L X65. All pipe bends shall be 3D (three times the nominal outer diameter).

### 19.2.2 Valves and Hot Tap

Valves shall comply with BP specifications and Subsea Specification - Pipeline Valves [Ref. 13] and API Spec 6D. Piping class line valves shall conform to the subsea specification for pipeline valves [Ref. 13]. Both 2in and 4in ball valves shall be full-bore. All 4in valves shall be ROV operable.

**Table 29: Valve Information**

| Size | Rating Schedule | Typical Type | Est. Weight (lbs.) | End Config. | Qty. |
|---|---|---|---|---|---|
| 2in | ANSI 900 class | Ball | 100 | FE x FE | 1 |
| 4in | ANSI 900 class | Ball (double block) | 300 | FE x FE | 2 |

The hot tap shall be ANSI 900 class with flange make-up to the 4in double block ball valves.

### 19.2.3 Flanges, Studs, Bolts and Gaskets

Flanges, studs, bolts and gaskets to be selected in accordance with BP standard and Subsea Specification - Flange and Fittings [Ref. 14]. The flange material shall be compatible with the pipe material for the intended service.

Flanges for the 2in bypass and 4in spool isolation valves shall be welded. The fuel gas pipeline shall be attached with a swivel ring flange on the PLET side. Table 28 presents the typical flange type and sizes.


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**Table 30: Piping Class Lines (Typical Flanges, Studs, Bolts and Gaskets)**

| Size | Specification | Rating Schedule | Typical Type | Bolting | Gasket |
|---|---|---|---|---|---|
| 2in | ASME B16.5 | ANSI 900 class | RTJ weld neck | 7/8in | R23 |
| 4in | ASME B16.5 | Min. ANSI 600 class[1] | RTJ weld neck | 1-1/8in | R37 |
| 4in | ASME B16.5 | ANSI 900 class | RTJ swivel ring | 1-1/8in | R37 |

Note 1: Should ANSI 600 class flanges be utilized in the final design, review and ensure that appropriate barriers are identified and utilized in the hydrotesting methodology. Use of all 900 class or other alternate arrangements may also be suitable and could be considered for COMPANY approval.

### 19.2.4 Support Clamps

The support clamps shall be designed mount to the concrete coated 12in Shell gas pipeline to support the vertical weight of the hot tap piping kit and loading from the fuel gas PLET tie-in spool.

The support clamps and associated bolting shall be designed to withstand loads exerted by the fuel gas system. The primary design code for the hang-off clamps and guide clamps shall be AISC 360-05/API RP 2A-WSD and Shell requirements [Ref. 24].

Design of the support clamps shall consider all loads induced by the hot tap piping and tie-in spool, environmental loading and internal temperature/pressure effects. Clamp design shall consider the following parameters:

- Adequacy of bolt closure load
- Stress in clamp shell due to load applied to close gap
- Stress around clamp shell due to bolt tension
- Clamping force capacity
- Shear, bending and combined stresses in the stiffener
- Flange plate capacity

The bolt preload should exceed the calculated prying force (per bolt) by a factor of safety of 1.2 for the support clamps under all environmental conditions [Ref. 12].


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