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オフショア石油・ガス生産活動の標準化アプローチに関する基礎的調査

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一般社団法人　日本中小型造船工業会
一般財団法人　日本船舶技術研究協会

はじめに

現在、石油ガスの海洋開発・生産の分野においては世界的に標準化、すなわち規格化が推進されています。この規格化の取組は大きく分けて以下の二つの取組に分類できます。

1. Unified Equipment JIP
   中心的な役割を果たすのは American Bureau of shipping（ABS）で、2015年に ABS の呼びかけで始まった[1]ものです。現在の作業は 2017 年 5 月に開始され、2018 年 6 月までの予定ですが、その後も継続的に作業は続くと見込まれています。この取り組みに参加する企業は、世界各地域の海洋石油ガスの開発・生産に携わるオペレーター、船級協会に加え、エンジニアリング企業、造船企業・団体、研究機関等[2]が含まれます。

2. IOGP JIP/ JIP-33 Standardization of equipment and packages
   World Economic Forum（WEF）、International Association of Oil and Gas Producers（IOGP）、及び IOGP の 10 members と呼ばれる石油ガスの開発・生産オペレーターの支援を得て進められています。既に終了したプロジェクト(Phase 1)は公募により KBR がプロジェクトマネジメント及び専門的知見の提供等のサービスを提供しましたが、現在のプロジェクトは 2017 年 7 月 公募で選出された Aker Solutions Ltd. がこれを行っています。[3]

このほかにも DNV-GL が進めるサブシーに特化した規格化の取組などがありますが、多くのステークホルダーを巻き込んだ作業は上記の二つです。

本報告書は、ABS の協力を得て上記 1.の取組について、規格化の背景、方針、要考慮事項等についての現状をまとめたものです。

とりわけ日本の造船産業及び舶用産業に従事される皆様にとって、本書が海洋石油・ガスの開発・生産のトレンドを把握する上でご参考となれば幸いです。

ジェトロ・ヒューストン事務所
（一般社団法人　日本中小型造船工業会　共同事務所）
ディレクター（船舶部長）　中川　直人

[1] https://ww2.eagle.org/en/news/press-room/ABS-Advances-Landmark-Standardization-JIP.html

[2] https://globenewswire.com/news-release/2016/05/18/841201/0/en/McDermott-Joins-14-Offshore-Companies-in-Signing-Joint-Offshore-Engineering-Standardization-Agreement.html

[3] http://www.iogp.org/jip33/

目　次

I. オフショア構造物の標準化（規格化）プロセスの概観

序文

オフショア構造物の規格化とは、オフショア EPC（設計・調達・建設）プロジェクトにおいて安全性を維持しつつコストを低減し効率を高めるために、業界全般で規格化された仕様書を使用することを提案するものである。本稿では規格化のプロセスを、構造、配管、電気系及び計装を含むオフショア開発用量産品目の設計及び製造手順に焦点を当てたものと、システム要求事項、素材選択及び品質管理、検査、試験並びにて検定手順を含む機能要求事項を規定する機器パッケージに焦点を当てたものに大別する。

オフショア構造物プロジェクトには様々な個別の規格及び要求事項が存在する。規格化の統合的プロセスはそれらの中で最低条件を満たす一致点を見出す取り組みである。例えば石油メジャーの多くが独自の安全基準、エンジニアリング慣行及び設計慣行を保持している。一方、様々な地域の業界団体が独自の規則、規格及び推奨事項を規定している。さらに複数の規制機関がオフショア構造物の建造について独自の規則を規定している。

これらの要求事項はすべて実績のある効果的な規格であるが、作成した組織に特有の考え方を反映したものであり、設計の最適化とは相入れず、それぞれのプロジェクトで独自の極めて複雑な建造仕様書が作成される傾向にある。この複雑さゆえに誤解やミスが発生し、手直しや変更指示書を通して最後は現場で是正することになる。

石油･ガス会社、エンジニアリング会社、造船会社、船級協会の代表が参加して、オフショア構造物建造とトップサイド機器パッケージ調達の標準仕様の開発に焦点を当てたJIP（産業合同プロジェクト）が進行している。標準仕様は必要に応じて業界に受け入れられ、効率的な調達とプロジェクト管理を通して建造コストを低減し、検査時間を短縮し、安全性と品質を向上させるためのガイドラインとなる。

1　規格化の分野

1.1 材料の規格化

高度に工学設計された船舶設計では、極めて限られた用途のために設計された微妙に異なるが似通った多様なコンポーネントが生み出される傾向にあり、製造プロセスを圧迫する。たとえば軽量化を最重視する設計では船舶の特定の部分に固有の要求事項を厳密に満たそうとして数多くのパイプ寸法やプレート厚が指定される傾向にある。

このような型式と寸法を最小限の現実的な数に減らすことにより、材料発注時のコストが減り、鉄鋼メーカーは規格化された製品を事前に準備することが可能となり、これらを将来のプロジェクトにも使うことができるため、余った材料を廃棄する必要がなくなる。

構造、配管、電気設計における材料の規格化のための典型的な規格品を Table 1 に示す。

Table 1- 材料の規格化

カテゴリー	グループ	規格品
1.構造用鋼材	鋼板	鋼板、縞鋼板
	H 形鋼	H 形鋼
	山形鋼	等辺山形鋼、不等辺山形鋼、逆付け山形鋼
	溝形鋼	溝形鋼
	棒鋼	平鋼、丸鋼、角鋼
	構造用鋼管	継目無鋼管、溶接鋼管
2.配管用鋼材	鋼管	継目無鋼管、溶接鋼管
	フランジ	閉止フランジ、ソケット溶接フランジ、突合せ溶接フランジ
	継手	エルボ継手、ティー継手
3.電気用品	ケーブル	高圧及び低圧電力ケーブル、アースケーブル、制御ケーブル、計装用ケーブル、光ファイバーケーブル、LAN ケーブル
	ケーブルラック[4]（トレイ型ケーブルラック）	はしご形トレイ、穴あきトレイ
	マルチケーブルトランジットフレームとインサートブロック	電線貫通フレーム、インサートブロック
	接続箱	電気用接続箱、計装用接続箱
	ケーブル付属品	束線バンド、ケーブルタグ
4.計装用品	チュービング	チューブ、チューブクランプ

1.2 設計の規格化

設計の規格化もコスト節減に大きく貢献する可能性がある。ほとんどの FPSO 及びオフショアプラットフォームは、世界中のオフショア構造物で大量に使用されている手摺り、梯子、格子、管支えのようなありふれた構造用品に独自の特殊な設計を施している。また電気用品であるケーブルラックや接続箱は、量産によるコスト節減の可能性があるもうひとつの例である。

このような品目について、安全及びリスク評価要求事項の全てに適合し、すべてとは言わずともほとんどのオフショア構造物で使用することができる十分な標準設計が定義されれば、製造者はこれを前もって製造し、保管しておくことができるようになり、多くの石油及び天然ガスプロジェクトが量産の恩恵を受けるであろう。

[4] 訳注：Cable Tray は日本では一般にケーブルラックと呼ばれていることから、ladder cable tray ははしご形ケーブルラック、ladder 形以外はトレイ形ケーブルラックと訳す。perforated cable tray はトレイ形ケーブルラックの底板が多孔構造になっているもの。

Table 2-設計の規格化

カテゴリー	グループ	規格品
1.構造	三次的構造	手摺り、はしご、階段、格子、ウィンドシールド、防熱板
	構造	クレーン基礎部、ヘリデッキ
2.配管	配管用品	管支持装置、配管支持具、管押え
3.電気系	電気系	はしご形ケーブルラック支持装置、穴あきケーブルラック支持装置、フィールドデバイス台、支柱(スタンチョン)型サポート
4.艤装	HVAC	HVAC ダクト、ダクト支持、HVAC 計器台
	建築	ユニットキャビン、壁、天井、家具

1.3 手順の規格化

これはプロジェクトマネジメント、エンジニアリング、建造、品質マネジメント、文書化、検査、認証を含む安全要求事項のベストプラクティス(最善慣行)に関連するものである。例えば、どの場所がどのような種類の検査を必要とするか、どの程度の非破壊試験を必要とするかなどの検査要求事項は、多くの場合建造者と施主との間の話し合いで決定される。

検査や非破壊試験を行う区画、回数、種類をカバーする標準手順があれば、交渉の時間を節約し、全体的な生産プロセスを明確化するのに役立つであろう。

プロジェクトマネジメント、エンジニアリング、建造、品質管理、安全要求事項における手順文書を Table 3 に挙げる。

Table 3 - 手順の規格化

カテゴリー	グループ	標準
1.プロジェクトマネジメント	プロジェクト制御	プロジェクト制御手順、進捗管理手順、変更管理手順
2.エンジニアリング	管理	文書管理手順
	構造	モノレールビームロード試験手順
	配管	パイプ支持設計手順
	機械	ループ試験手順
	コミッショニング	プロセス制御手順(PCS)
3.建造	配管	ボルト締付け手順、化学洗浄及びオイルフラッシング手順、製造及び取付け手順、流体圧試験手順
	構造	歪み補正手順、溶接手順仕様
	計装	計器校正手順、管体漏洩試験手順
	塗装	塗装手順

	足場	足場組立手順
4.品質マネジメント	品質保証(QA)	プロジェクト品質計画、プロジェクト品質監査手順、不適格品制御手順、是正及び防止措置手順、較正コントロール手順
	品質管理(QC)	構造及び配管の非破壊試験手順、寸法管理手順、検査及び試験手順、PMI 試験手順、機械的完了(メカニカルコンプリーション)手順
5.安全性	安全管理	HSE(労働安全衛生)管理計画、緊急対応手順、インシデント/事故報告及び調査手順、作業開始許可(PTW)手順
	建造安全手順	閉鎖区域立ち入り手順、高所作業手順、リギング及び検査手順、作業標準手順、訓練手順、個人用保護具手順

1.4 機器の規格化

オフショア開発プロジェクトの要求事項は極めて多様であり、オフショア開発用規格と舶用機器規格の間にはギャップがある。慣例的に、オフショア開発機器パッケージにはより保守的な要求事項、つまり造船業と比べて信頼性のより高いシステムが要求されてきた。

工業規格に加えて、通常プロジェクト要求事項は施主及びエンジニアリング会社の品質規定に従って指定される。オフショア開発機器パッケージに対する要求事項が多様かつ厳格であることが、オフショア開発プロジェクトの建造スケジュールの遅れやコスト超過のリスクを高めてきた。

機器の規格化の大きな目標のひとつは、適宜オフショア開発慣行の代わりに可能な限り舶用慣行を適用することである。例えば、いわゆるユーティリティ品目は、船上でもオフショア構造物上でも同様に機能するが、発注する際にオフショア構造物用と指定するか舶用と指定するかによって価格に差が出る。あるユーティリティ品目で行われたコスト比較では、同じ製品をオフショア構造物用と指定した場合、舶用と指定した場合の 2 倍近い価格となった。

Table 4 は機器の標準仕様を作成するプロセスにおいてオフショア開発プロジェクトに適用するための規格化が最も容易なユーティリティ品目をステージ 1 とし、最も困難な高圧炭化水素処理品目をステージ 5 として段階別に分類したものである。

Table 4 - 機器の規格化

ステージ 1	**ユーティリティ- 非炭化水素**
	計器エアコンプレッサ、窒素ガス発生装置、飲料水生成、塩素処理パッケージ、海水用粗フィルタ、一斉放水(Deluge)システム、圧力容器(空気タンク、脱気コラム、ヘッダータンク)、クレーン(ペデスタル式)、救命船、汚水処理パッケージ、海水汲み上げポンプ、ポンプスキッド(水圧入、冷却剤)、化学薬品注入パッケージ
ステージ 2	**ユーティリティ- 炭化水素**
	消火ポンプスキッド、ディーゼル遠心分離機、非常用/基幹発電システム、ガスタービン発電システム、航空機燃料補給パッケージ、ポンプ(クローズドドレイン、ディーゼルトランスファー等)、不活性ガス生成システム
ステージ 3	**処理- 非炭化水素**
	圧力容器(空気タンク、脱気コラム、ヘッダータンク、薬品貯蔵)、随伴水処理パッケージ(CFU、液体遠心分離機等)
ステージ 4	**低圧処理 - 炭化水素**
	圧力容器(フレアドラム、脱ガス装置、メタノール貯蔵等)、ピグ発射/受取装置パッケージ、燃料ガス処理パッケージ、ポンプ(石油送出、コンデンセート、熱媒体等)
ステージ 5	**高圧処理 - 炭化水素**
	圧力容器(セパレーター、サクションスクラバ、静電気コアレッサー/処理装置、気液コンタクター等)、ガス&石油計測パッケージ、燃料ガス処理パッケージ、ポンプ(石油送出、コンデンセート、熱媒体等)、ガスコンプレッサパッケージ(送出、リフトガス、フラッシュガス、蒸気回収ユニット(VRU)等)

1.5 監視及び制御システムの規格化

舶用産業及びオフショア開発産業では、データを資産として利用し始めている。これまで船舶やオフショア構造物のオーナー及びオペレーターの大きな関心事は、安全性、装備のインテグリティ(完全に整っている状態)の維持及び環境保護であった。サイバー空間を利用したデータシステムが台頭し、その利用が拡大するにつれて、データは安全上のリスクに対処することを可能にすると同時に、新たに懸念すべき分野を生み出している。船舶とその船上に搭載されたセンサーは複数のソースから大量のデータを生成する。オフショア開発産業向けのコンピューター支援制御システムの進歩とともに、制御システムと監視システム製品の要求事項に大きな隔たりが発生している。共通制御システム製品向けの要求事項を調整し、データ収集のための標準ガイドラインを策定することが規格化の取り組みの意図するところである。

制御システムのサンプルとしては、分散制御システム(DCS)、安全計装システム(SIS)、SCADA(設定値制御及びデータ収集)システム、プロセス制御システムPLC/RTU、プログラマブルロジックコントローラ(PLC/PAC)、コントローラとインジケ

ーター、ソフトウェアを含むデータ集積、パネルマウント型レコーダ、データアクイジションポータブル型レコーダ、データロガー、チャート式記録計、フィールド機器が挙げられる。

規格化では共通する法令要求事項を特定する。制御システムは、現地の安全規則に適合しなければならない。英国の安全衛生庁（HSE）のような政府機関が。オフショアプラットフォームの電気システム及び制御システムに関する多数のガイダンス文書を作成している。例えば HSE はプラットフォーム上で大事故が発生するリスクを軽減するために、防爆構造の電気設備、非接地配電システム、防爆範囲で使用される高圧モーターに関するガイダンス文書を作成している。米国の安全環境執行局（BSEE）もまた再充電バッテリーシステム、照明器具、架線及び接地に関する指令を含む「潜在的非適合インシデント」（PINC）検査項目を作成している。これを通して、電気設備の安全に関するいくつかの見識を提供している。また自動化システム及びプログラマブルロジックコントローラ（PLC）[5]のような制御冗長性システムへの継続電力供給の重要性が考察されている。

制御システム設計からは、オフショアプラットフォーム特有の電気設計の留意事項が特定された。例えば、スペースの制限、安全上の問題及び腐食性のオフショア環境に関するものである。オフショアプラットフォーム環境では、比較的隔離された軽量、耐水性、耐腐食性の電気系統及び制御システムが必要とされる。

1.6 掘削及びサブシー機器システムの規格化

掘削及びサブシー機器システムの規格化は、業界標準を統一し、様々な規制機関に共通する規格を作りあげることを目的としている。規格化作業スコープを5つのステージに分けて提案する。

Stage 1　ウェルコントロール（坑井制御）システム
Stage 2　デリックシステム
Stage 3　掘削流体（泥水）調整システム
Stage 4　パイプ/チューブラーハンドリングシステム
Stage 5　サブシー石油生産システム

(1)　ウェルコントロール（坑井制御）システム

ウェルコントロールシステムは以下の装置で構成されている。

- 防噴システムと機器
- ロアーマリンライザー
- チョーク＆キルシステムと機器
- 掘削マリンライザーシステム
- 補助坑井制御機器

(2)　デリックシステム

デリックシステムは以下の装置で構成されている。

- コンダクターテンショニングシステム

[5] 訳注：日本では一般にシーケンサと呼ばれている

- ドリルストリングコンペンセーター[6]
- デリック/マスト
- 巻上装置
- ライザーランニング機器

(3) 掘削泥水調整システム

掘削汚泥調整システムは以下の装置で構成されている。

- バルク貯蔵・移送システム
- 泥水リターン(調整)システム
- 泥水循環システム(高圧及び低圧)

(4) パイプ/チューブラーハンドリングシステム

パイプ/チューブラーハンドリングシステムは以下の装置で構成されている。

- 巻上げ機
- ハンドリング機器
- ロータリー機器
- その他の機器(例:パワースリップ[7]、トング[8]、キャットウォーク、メカニカルマウスホール[9]、掘削チューブラー及び掘削マリンライザーのロータリーテーブルと保管区域の間の移動を支援するために使用されるその他のハンドリング装置一般)

(5) サブシー石油生産システム/機器

サブシー石油生産システムには以下の装置が含まれる。

- 坑口装置、ツリー、チュービングハンガー
- フローライン、ジャンパーケーブル、ライザー
- HIPPS(高信頼性圧力保護システム)
- マニホルド/PLET(Pipe Line End Termination)/PLEM(Pipe Line End Manifold)及びテンプレート
- インジェクション及びサービスシステム
- アンビリカル/フライングリード
- 電気系統
- 制御及び監視システム
- キャッピングスタック
- 流量計

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[6] セミサブマーシブル型リグにおいて、潮流による船体の上下動を吸収し、ビットに一定の荷重をかけ続けるための装置　(出所:日本オフショア掘削)

[7] パイプが井戸のなかに滑り落ちるのを防ぐため、またはパイプをある位置にとどめて置くために使用される、金属で作られたくさび形の、片面に歯、または刻み目などの滑り止めがついている器具をいう。パワー・スリップは空気圧、水圧などで作動するスリップ　(出所:JOGMEC)

[8] 掘り管、ケーシング、チュービングなどのパイプ類をねじ締めしたり、ねじ戻しするための大きなレンチをいう　(出所:JOGMEC)

[9] マウスホールは，ロータリーテーブル周辺にドリルパイプの長さに合う鋼管を設置し，その中に追降用のドリルパイプを一時格納しておく場所として使われる。　(出所:石油技術協会)

- 遠隔操作ビークル（ROV）/遠隔操作ツール（ROT）インターフェース
- 基礎
- サブシー防護構造

1.6.1 規格化の方法論と手順

2.1 プロジェクト実施リスク評価

オフショア開発プロジェクトにはプロジェクトの成果に影響を与えうる複数の利害関係者が関与している。プロジェクトが成功するためにはそれぞれの関係者がプロジェクトのライフサイクルを通したすべての段階におけるニーズに対処しなければならない。

オフショア EPC プロジェクトの様々な段階で包括的な規格化を実現することにより、プロジェクトコストを目に見えて抑えることができると考えられる。プロジェクト評価は現在のオフショアプロジェクトの実施と管理に存在するリスクを特定し、規格化の適用が可能な分野を特定するものである。

Figure 1 はオフショア開発プロジェクトの典型的な局面とそれぞれの局面において探求すべきクリティカルコンポーネントを示したものである。評価プロセスを通してそれぞれの局面は関連リスクを特定するためにサブアイテムついて評価される。

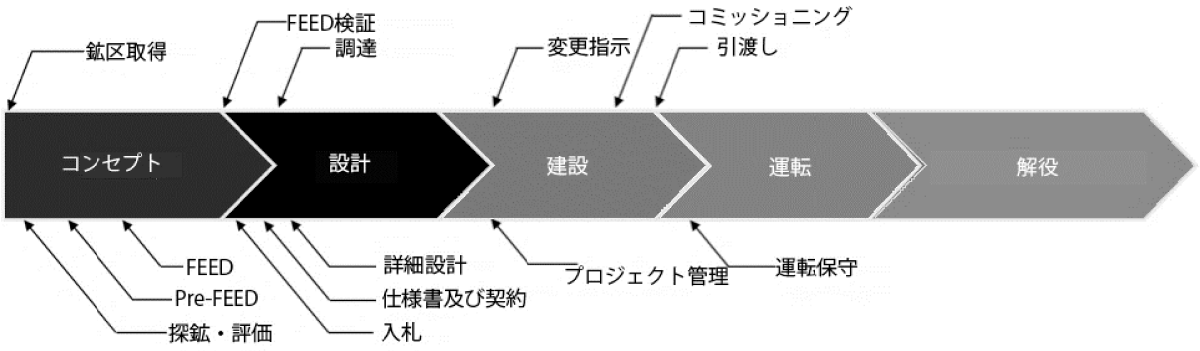


Figure 1 - オフショア開発プロジェクトの局面

2.2 提案される標準仕様のギャップ分析

ギャップ分析により新しい技術仕様と様々な施主の仕様、工業規格、地域に特定の要求事項、地元規制機関の要求事項、国際標準及び船級協会の要求事項の間のギャップを特定する。

ギャップ分析では業界及び監督官庁の要求事項に適合する他のプロジェクト仕様と比較して、提案される標準仕様の要求事項のレベルを特定する。

2.3 規格化された品目のリスク評価

リスク評価の目的は、提案される標準仕様に従って製造され、設置された場合に、標準仕様が同等の水準の安全性を提供するかどうかを識別することである。提案標準仕様それぞれについてその機能又は実行が要求される働きについて評価する。

クリティカルアイテムとはそれが故障した場合、本質的に制御不能または要員の危険暴露を引き起こす又はその一因となる、又はこのような影響を制限することを目的とするあらゆる品目または品目の一部でありえる。

2.4 費用便宜分析

費用便宜分析は同じ目的で使用される注文製品と比較した場合の標準製品の長所と短所を見極めるものである。費用便宜分析プロセスによりオフショア構造物向けに規格化された製品を採用することによる具体的なコスト節約について、労働、時間、重量、ベンダーコストといった様々なコスト要素を特定する。

互換性、ローカライゼーション、建設可能性、調達、プロジェクトマネジメント及び保守に関連するコスト要素の定性的見識が得るために無形便宜を評価する。

標準仕様には一般に認知されているという強みがある。造船所と施主の両方が熟知した文書として、プロジェクト開始から期待されるものの全てを双方が明確に理解してプロジェクトを進めるのに役立つ。造船所の立場からは手直しと変更指示書がなくなることにより時間とエネルギーの大きな節約となり、原材料の節減につながる。石油メジャーやエンジニアリング会社側では、標準仕様の採用により設計スパイラルが短縮され、エンジニアリング設計と解析にかかる工数が減る。

費用便宜分析の興味深い結果のひとつは、鋼管と鋼板のサイズの多様性を減らしたケースで全体の材料コストが微増したことである。これは主として平均的な特性の大きなグループを作成すると大型化（アップサイジング）が起こることによるものである。材料の規格化による鋼材重量の増加分は現在 1ー2％と推算されるが、コスト増加分は他の節約で十分に相殺される。

Figure 2 はギャップ分析、リスク評価、費用便宜分析を含む規格化検証手順を示したものである。

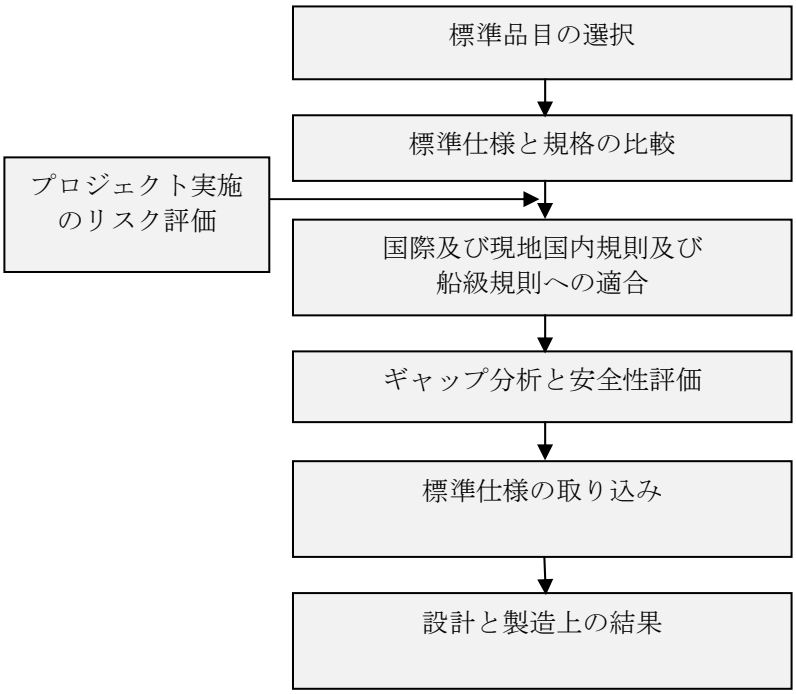


Figure 2 - 規格化検証手順

II. 炭素鋼鋼管材料の規格化

1　序文

1.1 作業スコープ

トップサイド配管用材料の規格化を提案する。オフショア開発プロジェクトにおいて製造業者は、様々な配管仕様に加えて石油･ガス会社の仕様が要求する業界標準よりも高い追加的な要求事項に直面する。これらの要求事項には適正用途が指定されているが、要求事項が多様であることから資材の互換性と製造の柔軟性が低下し、資材納入スケジュールの遅延を招いている。

このような多様な仕様を、製造業者の材料分類慣行に準じた要求仕様に規格化する。オフショア開発プロジェクトで使用された配管用材料を調査し比較することにより配管用材料の標準仕様を提案するものである。

本報告書では規格化プロセスの手始めとして炭素鋼鋼管のパイプ品質規定の規格化を選択する。

1.2 規則、コード、規格

本プロジェクトでは以下の文書を引用規格とする。

Table 1.1　引用規格

No.	タイトル
ASTM A106-14	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service 高温配管用継目無炭素鋼鋼管の標準規格
ASTM A333-13	Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness 低温配管用及び切欠靭性が要求されるその他の用途に使用される継目無及び溶接鋼管の標準規格
ASTM A671-14	Standard Specification for Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures 常温または低温用電気抵抗溶接鋼管の標準規格
ASTM A672-14	Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures 中温高圧用電気抵抗溶接鋼管の標準規格
ASTM A516-10	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service 中温及び低温用圧力容器用炭素鋼板の標準規格
ASME B31.3-2014	Process Piping プロセス配管

API 5L, 45 Edition	Specification for Line Pipe ラインパイプの規格
ABS Rules	Rules for Materials and Welding, 2015 材料及び溶接規則(2015年)
NORSOK M-630, Edition 6	Material data sheets and element data sheets for piping 配管用材料データシート及びエレメントデータシート
NACE MR0175	Petroleum and natural gas industries – Materials for use in H_2S-containing environments in oil and gas production 石油及びガス産業 – 硫化水素含有環境下での石油・天然ガス生産に用いる材料

2　産業標準と国際標準規格の比較

製造業者から収集したプロジェクト仕様書から炭素鋼鋼管の構造と材料を以下の 4 つのグループに分類した。

- 継目無炭素鋼鋼管
- 溶接炭素鋼鋼管
- 低温配管用継目無炭素鋼鋼管
- 低温配管用溶接炭素鋼鋼管

要求される仕様を次の項目について評価する。

- 標準規格
- ウェルディドアプリケーション
- 製法
- 寸法許容差
- 標準寸法
- 化学成分
- 機械的性質
- 熱処理衝撃試験
- 微小構造検査(ミクロ検査)
- NDE/NDT(非破壊評価/非破壊試験)
- NDE 試験技術者
- 供試材の採取
- 表示と識別
- 認証
- 水圧試験
- 追加試験
- 溶接
- HIC(水素脆性)試験

- 補修溶接
- NACE
- PED
- 表面処理
- その他

プロジェクト仕様を、ASTM(米国材料試験協会規格)、API(アメリカ石油協会規格)及び NORSOK(ノルウェー標準オフショア規格)を含む国際規格と比較した場合、一般にプロジェクト仕様は、特に化学成分について、国際標準規格に独自の要求事項を追加している。規格化を行うためにはプロジェクトごとの化学成分要求事項を比較する必要がある。

2.1 材料化学成分

炭素鋼鋼管について ASTM、API 規格の化学成分とプロジェクト仕様の化学成分を Table 2.1 にリストアップした。ASTM 規格はサワー環境(硫化水素含有環境)用鋼管をカバーしておらず、API 5L のみがサワー環境用鋼管の化学成分についての規範的情報を規定している。ASTM 規格では化学反応の点で水硫化物(H_2S)と類似するフッ化水素(HF)環境について追加要求事項が規定されている。ベースラインの仕様を定めるためにフッ化水素環境向けの化学成分規格の仕様を用いたが、これについてはさらなる議論と分析が必要である。

プロジェクト仕様と工業規格については、サワー環境用の材料規格を選んだ。

Table 2.1 鋼管仕様の化学成分

規格及びプロジェクト仕様	質量分率(%)							
	C (≤)	Si	Mn (≤)	P (≤)	S (≤)	Nb (≤)	V (≤)	Nb+V (≤)
A106 Gr. B (継目無)	0.30	≥0.10	1.06	0.035	0.100	-	0.080	-
A333 Gr. 6 (継目無)	0.30	≥0.10	1.06	0.025	0.025	-	-	-
API 5L Gr. B PSL 1(継目無)	0.28	-	1.20	0.030	0.030	-	-	0.06
API 5L GR. B PSL 2(継目無)	0.24	≤0.40	1.20	0.025	0.015	-	-	0.06
A671, A672 CC60 Cl.22(溶接)	0.21 - 0.27	≤0.45	1.30	0.025	0.025	-	-	-

規格及びプロジェクト仕様	質量分率（%）							
	C (≤)	Si	Mn (≤)	P (≤)	S (≤)	Nb (≤)	V (≤)	Nb+V (≤)
[プロジェクト D] A333 Gr. 6 に修正を施したもの（継目無）	0.20	–	1.06	0.025	0.01	–	–	–
[プロジェクト F] API 5L or A333 厳サワー環境（継目無、溶接）	0.20	≤0.35	1.30	0.020	0.010	0.005	0.005	–
[プロジェクト C] API 5L サワー環境（継目無、溶接）	0.15	≤0.35	1.20	0.010	0.003	0.020	0.020	0.03
[プロジェクト E] A671 に特別要求事項を追加したもの（溶接）	0.24	≤0.45	1.30	0.008	0.002	–	–	0.02
NACE MR0175（継目無）	–	–	–	–	0.010	–	–	–
NACE MR0175（圧延）	–	–	–	–	0.003	–	–	–

手短に言えば、プロジェクト仕様の材料成分構成にはばらつきがあり、配管の国際規格よりも高い要求事項を追加要求している。非サワー環境及びサワー環境用の共通仕様として、化学成分及び仮の値を提案する。標準仕様を提案する際には、継目無鋼管の仕様についてはサワー環境用と非サワー環境共通の要求事項をカバーし、溶接鋼管の仕様はサワー環境用と非サワー環境用に分けて 2 種類の仕様を規定する必要があるかもしれない。

2.2 NACE MR0175 の硫化水素含有環境用要求事項

H_2S による腐食リスクを最小限にとどめるために NACE MR0175 要求事項を標準仕様として採用し、提案される標準仕様に以下の要求事項を含むことを推奨する。

「すべての材料は NACE MR0175/ISO15156 に適合しなければならない。」

NACE MR0157 Appendix A に規定される炭素鋼鋼管要求事項を原本からの引用とともに簡潔に以下に記述する。

A.2.1.1.一般条項

炭素鋼及び低合金鋼は A.2.1.2 から A.2.1.9 に適合しなければならない。A.2 条項に適合する炭素鋼及び低合金鋼材、製品及びコンポーネントは所定の例を除いて、さらなる SSC(応力腐食割れ)試験を実施することなく ANSI/NACE MR0175/ISO 15156 の本パートに適合するものとみなされる。しかし、材料製造仕様の一部として SSC 試験が含まれている場合にはこれに合格し、その結果を報告しなければならない。

A.2.1.2 母材金属の組成、熱処理及び硬さ

炭素鋼及び低合金鋼はニッケル分 1%未満で、快削鋼ではなく、以下の熱処理条件のうちのひとつでも使用される場合の硬度の許容上限値はロックウェル硬さ 22 HRC とする。

a) 熱間圧延(炭素鋼のみ)
b) 焼きなまし(アニール)
c) 焼きならし(ノーマライズ)
d) 焼きならしと焼き戻し
e) 焼きならし、オーステナイト化、焼き入れ及び焼き戻し
f) オーステナイト化、焼き入れ及び焼き戻し

A.2.1.4. 溶接

溶接と溶接強度の測定は NACE MR0175 の要求事項に従って実施すること。炭素鋼、炭素マンガン鋼及び低合金鋼溶接部の許容硬度上限値は溶接ルート部でビッカース硬さ 250 HV、溶接部及び溶接熱影響部でロックウェル硬さ 22 HRC である。

A.2 条項に適合する炭素鋼及び低合金鋼材、製品及びコンポーネントは、さらなる SSC 試験を実施することなく ANSI/NACE MR0175/ISO 15156 の本パートに適合するものとする。規格化提案文書では、ANSI/NACE MR01075/ISO 15156 の B.1 条項に準拠して硫化水素含有環境下で用いられる溶接鋼管の適格性として耐水素誘起割れ(HIC)を提案することとする。

耐水素誘起割れ(HIC)は以下のカテゴリーで適格性を規定することとする。

- あらゆる使用環境において
- 特定の硫化水素含有環境における使用において

試験手順と判定基準は Table B.3.に従うこと。試験は常温[25℃±3℃(77°F ±5°F)]で行うこと。特記がない限り、試験要求事項は NACE 規格 TM0284 に準ずることとする。

Table B.3 HIC/SWC 試験手順と判定基準

製品タイプ	負荷	環境	H_2S 分圧	判定基準	適用条件
圧延鋼またはその製品	負荷なし	NACE TM0177-2005 Environment A（質量分率 5 % NaCl +質量分率 0.5 % CH3COOH）	100 kPa (15 psi)c	CLR ≤ 15 % CTR ≤ 5 % CSR ≤ 2 %	サワー環境での使用
		質量分率 5 % NaCl + 0.4 % 質量分率 CH3COONa、HCl 又は NaOH を使用して pH を必要値に調整	意図する用途に適する分圧	割れなし	特定の、またはそれほど過酷ではない環境での使用

2.3 パイプ肉厚の規格化

オフショア建設ではパイプ内部を流れる流体の設計圧力により様々なパイプ肉厚が指定される。例えば外径 1.5 インチ未満のパイプの場合、プラットフォーム全重量に与える影響は有意ではない。この点を考慮して、外径 0.75 インチ、1 インチ、1.5 インチの炭素鋼鋼管についてはスケジュール番号 SCH 160 を標準肉厚として採用することを提案する。特殊なケースではパイプ肉厚 XXS（ダブルエクストラストロング）を検討する。本規格化により推定される重量増は小径菅の積算重量の約 10％であるが、安全設計とエンジニアリング/施工工数の低減というメリットが期待できる。

3　炭素鋼鋼管の分類

炭素鋼鋼管の分類から、次の 4 つのグループの標準仕様を提案する。

- 継目無炭素鋼鋼管(CSN01):Table 3.1
- 溶接炭素鋼鋼管(CWS01 及び CWN11):Table 3.2
- 低温配管用継目無鋼管(CSS11):Table 3.3
- 低温配管用溶接鋼管(CWS11 及び CWN11):Table 3.4

3.1 継目無炭素鋼鋼管

Table 3.1　継目無炭素鋼鋼管の標準仕様（案）

	ASTM A106 に追加する基準(案)	ASTM A106
規格	ASTM A106 Gr. B 又は API 5L PSL1 Gr.B	ASTM A 106 Gr.B
継目無鋼管の用途		
標準寸法		
スケジュール番号	SCH 160(外径≤1.5 インチ) 規格化なし＞外径 1.5 インチ	
化学成分	プロジェクト仕様	C ≤ 0.30% Mn: 0.29ー1.06% P ≤ 0.035% S ≤ 0.035% Si ≥ 0.1% Cr ≤ 0.4% Cu ≤ 0.4% Mo ≤ 0.15% Ni ≤ 0.40% V ≤ 0.08%
機械的特性	プロジェクト仕様に準じた伸び	ASTM A106 Gr.B 伸び: ＞30.0(管軸方向) ＞16.5(管軸直角方向)
熱処理	ASME B31.3 の 610℃の PWHT(溶接後熱処理)の要求事項を満たす焼き入れと焼き戻し	
認定資格	EN 10204 Type 3.1	ASTM A530/A530M
NACE	NACE MR0175	要求せず

3.2 溶接炭素鋼鋼管(CWS01 及び CWN01)

Table 3.2 溶接炭素鋼鋼管の標準仕様（案）

	ASTM A672 に追加する基準(案)	ASTM A672
規格	ASTM A672 C60 CLASS 22	ASTM A672-C60
溶接鋼管の用途		
標準寸法		
製法	A672−EFW 溶接	A672-EFW 溶接
化学成分	A672 C60 に加えてプロジェクト仕様に従った要求事項	ASTM A516, Grade 60 Per ASTM A516, Grade 60 C : 0.21% to 0.27% Mn : 0.6 to 0.9% P ≤ 0.025% S ≤ 0.025% Si : 0.15 to 0.40%
機械的性質	伸び	
熱処理	ASTM A672 要求事項による熱処理	5.3.1 Class 20, 21, 22, 23 の鋼管は Table2 に示された溶接後熱処理温度範囲で最低肉厚 1 インチ毎に 1 時間[1cm 毎に 0.4 時間]又は 1 時間のいずれか長い方の時間一様に加熱されなければならない。
NDE	Class 22:圧力試験及び放射線透過試験。NDT 試験技術者は EN473 または同等の規定に従って資格認定されていること。	
認証	EN 10204 Type 3.1	特定されていないが ASTMA530/A530M
溶接	第三者機関による認定施工法に従って有資格の溶接工が行うこと	
NACE	NACE MR0175/ISO15156	該当せず

3.3 低温配管用継目無炭素鋼鋼管(CSS11)

Table 3.3 低温配管用継目無炭素鋼鋼管（CSS11）の標準仕様（案）

	ASTM A333 に追加する基準(案)	ASTM A333
規格	プロジェクト仕様	ASTM A333 Gr.6
継目無鋼管の適用		
標準長		
スケジュール番号	SCH 160(外径≤1.5 インチ) 規格化なし＞外径 1.5 インチ	
化学成分	A333 Gr.6 に加えてプロジェクト仕様に準じる	C ≤ 0.30 Mn : 0.29~1.06% P ≤ 0.025% S ≤ 0.025% Si ≥ 0.1% Ni ≤ 0.4% Cr ≤ 0.3% Cu ≤ 0.4% Nb ≤ 0.02% V ≤ 0.08% Mo ≤ 0.12%
機械的性質		ASTM A333 Gr.6 伸び: ＞30.0(管軸方向) ＞16.5(管軸直角方向)

	ASTM A333 に追加する基準(案)	ASTM A333
熱処理	ASTM A333 Gr.6 に従い、焼ならし又は焼き入れ/焼き戻し 焼き入れ/焼き戻し温度は ASME B31.3 の PWHT(溶接後熱処理)要求事項の 610℃を満たすこと。	4.3.1.1 1500° F [815℃] 以上の一定の温度に加熱、温度保持し、空中放冷又は雰囲気制御炉の冷却室で冷却することにより焼ならしする。 4.3.1.2 4.3.3.1 の規定に従って焼きならしし、製造者の裁量で焼き戻しに適した温度まで再加熱する。 4.3.1.3 継目無製法についてのみ、1550ー1750° F(845ー945℃)の熱間仕上げ温度範囲まで再加熱して熱間加工を行った後、1550° F (845℃)を下限とする初期温度から空中放冷または雰囲気炉内で冷却する。
衝撃試験	シャルピーV ノッチ試験	8.1 グレード 1、3、4、7、9、10 及び 11 について、肉厚 0.120 イン[3 mm]以上の溶接鋼管の溶接接合部の試験片を含む 3 個の衝撃試片 セットのそれぞれの切欠試片耐衝撃性は 14.1 に規定に適合した温度で試験された場合、Table 3 に規定された値を下回ってはならない。
認証	EM 10204 Type 3.1	ASTM A999 による
NACE	NACE MR0175/ISO15156	要求されない。

3.4 低温配管用溶接炭素鋼鋼管(CWS11 及び CWN11)

Table 3.4 低温配管用溶接炭素鋼管の標準仕様 (案)

	ASTM A671 に追加する基準(案)	ASTM A671
規格	ASTM A671 CC60 CLASS 22	ASTM A671-CC60
溶接鋼管の用途		

	ASTM A671 に追加する基準(案)	ASTM A671
標準長		
製造方法	A671-EFW 溶接	A671-EFW 溶接
化学成分	プロジェクト仕様に従って A671 CC60 の要求項目に追加	ASTM A516、グレード 60 成分規格 C ≤ 0.21ー0.27% Mn : 0.6~0.9% P ≤ 0.025% S ≤ 0.025% Si ≥ 0.1ー0.40%
熱処理	ASTM A671(NORSK M-630)に準拠する熱処理。Class 22 鋼管は ASTM A671 の溶接後熱処理温度(590ー650℃)範囲内で均一に加熱すること。	5.3.1 Class 20、21、22 及び 23 鋼管は最低限で肉厚 1 インチあたり 1 時間[1cm あたり 0.4 時間]又は 1 時間のいずれか長い方の時間 Table 2 に規定された溶接後熱処理温度範囲内で均一に加熱すること。
衝撃試験	シャルピーV ノッチ試験	試験方法ー試験片は試験方法と定義 A370 に準拠したシャルピーV Type A とする。試験片は試験方法と定義 A370 に従って試験しなければならない。
NDE	Class 22:圧力試験と放射線透過試験 NDT 試験者は EN473 又は同等の規定に従った資格を保有すること。	
認証	EN 10204 Type 3.1	明記されていないが、ASTM A530/A530M
溶接	第三者機関により承認された認定施工法に従って有資格の溶接工が行うこと。	
NACE	NACE MR0175/ISO15156	該当せず

4　炭素鋼継手及び鍛鋼品の規格化提案

炭素鋼鋼管材料と同様に、炭素鋼継手と鍛鋼品の規格化を提案する。

- 鍛錬継手:Table 4.1
- 鍛鋼品:Table 4.2

4.1 炭素鋼鍛錬継手及び鍛造(CF01)

Table 4.1　炭素鋼鍛錬継手及び鍛鋼品仕様

	基準(案)
規格	鍛錬継手:ASTM A234 WPB with S3 鍛鋼品:ASTM A105 with S4
化学成分	A234 WPB 及び A105 に加えてプロジェクト仕様
機械的性質	伸び
NDE	管状製品の溶接部を含むすべての溶接部は ASME Section V Article 2 に従ってそれぞれの溶接部の全長にわたって放射線透過検査を受けること。
供試材の採取	試験片は実際の供試鍛鋼品又は実際のパートの延長部分(プロロンゲーション)[10]から、及び製品を代表する部位から採取すること。
認証	EN 10204 Type 3.1 熱処理条件 NACE MR0175/ISO15156 HIC 試験

4.2 低温用炭素鋼鍛錬継手及び鍛鋼品

Table 4.2　低温用炭素鋼鍛錬継手及び鍛鋼品

	標準仕様(案)
規格	鍛錬継手:ASTM A420 WPL6 with S51、S53、S69 鍛鋼品:ASTM A350 with S6、S55
化学成分	A420 WPL 及び A35 LF2 に加えてプロジェクト仕様の要求項目を追加
機械的性質	伸び
衝撃試験	シャルピーV ノッチ試験
NDE	継手及び鍛鋼品には 10%磁粉探傷試験を行う。 管状製品の溶接部を含むすべての溶接部は ASME Section V Article 2 に従ってそれぞれの溶接部の全長にわたって放射線透過試験を受けること。

[10] 訳注: 鍛鋼製品を破壊することなく採取し、試験片として使用するためにお互いに合意できる部位に追加された余分の金属。

	標準仕様(案)
供試材の採取	試験片は実際の供試鍛鋼品又は実際のパートの延長部分(prolongation)から及び製品を代表する部位から採取すること。
認証	EN 10204 Type 3.1 熱処理条件 NACE MR0175/ISO15156 HIC 試験

5 まとめ

材料規格化により材料の互換性及び製造の柔軟性が高まり、材料の納入スケジュールが改善される。プロジェクト仕様と工業規格を比較することにより、炭素鋼鋼管材料仕様と炭素鋼継手材料仕様を提案した。

化学成分、サワー環境用仕様のような主要な可変要素とNDEを検討した。

炭素鋼鋼管と同様に、炭素鋼鍛錬継手及び鍛鋼品の材料仕様の調査を行った。

6 引用規格

[1] ASTM A106-14 高温用継目無炭素鋼鋼管の標準仕様

[2] ASTM A333-13 低温用及び切欠靭性を要求されるその他の用途向け継目無及び溶接鋼管の標準仕様

[3] ASTM A671-14 常温または低温用電気抵抗溶接鋼管の標準仕様

[4] ASTM A672-14 中温高圧用電気抵抗溶接鋼管の標準仕様

[5] ASTM A516-10 中温及び低温用圧力容器用炭素鋼板の標準仕様

[6] ASME B31.3-2014 プロセス配管

[7] API 5L, 45 Edition ラインパイプの仕様

[8] ABS Rules 材料と溶接規則(2015年)

[9] NORSOK M-630, Edition 6 配管用材料データシート及びエレメントデータシート

[10] NACE MR0175 石油及びガス産業 – 石油及びガス生産における硫化水素含有環境下での石油・天然ガス生産に用いる材料

III. 二相系ステンレス鋼鋼管の材料規格化

1　国際標準規格の比較

コントラクターからプロジェクト仕様を収集し、二相系ステンレス鋼鋼管を 2 つのグループに分類した。

- 二相系ステンレス鋼継目無鋼管
- 二相系ステンレス鋼溶接鋼管

要求される仕様は以下のカテゴリーで評価する。

- 規格
- 資格と製法
- 溶接鋼管の用途
- 化学成分
- 機械的性質
- 熱処理
- 衝撃試験
- 腐食試験
- 微小構造検査
- 機械的試験
- NDE/NDT（非破壊評価/非破壊試験）
- 認証
- 溶接
- 補修溶接
- NACE 必要条件
- 表示及び識別
- PED
- 表面処理
- その他

プロジェクト仕様を ASTM、API、NORSOK を含む国際規格と比較すると、概してプロジェクト仕様は国際標準規格に独自の要求事項を加えている。二相系ステンレス鋼鋼管の標準仕様案を作成するためにギャップ分析を行った。

1.1 標準規格

すべてのプロジェクト仕様が、継目無二相系ステンレス鋼鋼管について ASM A790 S31803 及び S32205 を準用している。S32205 と S31803 の唯一の違いは S32205 が規定する引張強度が 655 MPs と高いことである。塑性変形設計を要求されない通常のプロセス配管には標準規格として S31803 の採用を提案する。

二相系ステンレス鋼鋼管の溶接適用については、プロジェクト仕様で Class 1、3、5 の 3 つの溶接等級が指定されている。Class 1「あらゆる溶接パスで溶化材を使用することにより両面溶接し、完全に放射線撮影を行うこと」が絶対的要求事項であり、標準規格とすることを提案する。

1.2 化学成分

ASTM A790 に規定される S31803 二相系ステンレス鋼鋼管の基本的な化学成分を次表に示す。ASTM A790、S3183 の N 含有率 0.14ー0.2 パーセントの規格化学成分を予備的に採用した。

Table 1.2 二相系ステンレス鋼鋼管の化学成分

標準規格	質量含有率（%）、範囲指定がない場合は上限値								
	C	Mn	P	S	Si	Ni	Cr	Mo	N
ASTM A790 S31803	0.03	2.0	0.03	0.02	1.0	4.5 – 6.5	21.0 – 23.0	2.5 – 3.5	0.08 – 0.2
NORSOK M-630	–	–	–	–	–	–	–	–	0.14 – 0.2

もうひとつの化学組成として、塩化物含有環境においてステンレス鋼が孔食腐食にどれくらい強いかを示す耐孔食指数（PREN）がある。標準仕様（案）では最低 PREN を 34 に設定した。

1.3 機械的性質

ASTM A790 における S31803 二相系ステンレス鋼の標準機械的性質は以下の通りである。

- 引張強さ：620 MPa
- 降伏点：450 MPa
- 伸び（2 インチ）：25％
- 硬さ、上限：290 HBC 及び 30 HRC

プロジェクト仕様の大部分はより厳しい 28 HRC の最大硬さを要求していることから、標準上限硬さの値として 28 HRC を提案する。

1.4 腐食試験

プロジェクト仕様のなかには、ASTM G48 試験方法に準拠した塩化第二鉄腐食試験を品質検定として要求するものがある。

コンポーネントの本体並びに溶接部がある場合は溶接部の試験を行うこと。腐食試験手順は ASTM G48 Type A に準拠すること。暴露時間は 24 時間。試験は 25±1℃で実施する。

1.5 微細構造検査

ASTM E 562 に準拠した微細構造検査を行うこと。素案として、母材にはフェライト含有率 35ー55%、溶接金属にはフェライト含有率 35ー55%を提案する。

1.6 水圧試験と検査

一般に鋼管製品の水圧試験が要求される。検査要求事項として以下に挙げるような多くの種類の検査及び試験が存在する。すべての検査において、NDT 試験技術者は EN 473 又は同等の規定に従って認証されなければならない。

1) 外観試験
   ASME BPV Section V に準拠し、全表面の 100%
2) 浸透探傷試験
   ASME BPV Section V、Article 6 に準拠し、管開先加工端(ベベルエンド)の溶接部 100%
3) 放射線透過試験
   ASME BPV Section V、Article 2 に準拠し、継目溶接と補修溶接
4) 超音波探傷試験
   ASTM E213 に準拠し、各継目無鋼管及び溶接部の 100%
5) 渦電流探傷試験
   ASTM E309 又は ASME BPV Section V、Article 8、継目無鋼管及び溶接部に準拠

プロジェクト仕様からは、鋼管の水圧試験、外観試験及び超音波探傷試験が継目無鋼管に対し一般的に使用されていることが判明した。溶接鋼管についてはさらに放射線透過試験が要求される。例えば、プロジェクト F は「すべてのチューブ状コンポーネントは ASTM E213 に準拠して十分な超音波探傷試験を行うこと」そして「全ての管軸方向溶接は 100%超音波試験及び 100%放射線透過試験を行うこと」としている。

2　二相系ステンレス鋼鋼管の規格化の提案

以下の 2 つのカテゴリーについて、二相系ステンレス鋼鋼管の標準材料仕様を提案する。

- 二相系ステンレス鋼継目無鋼管（DSS01）:Table 2.1
- 二相系ステンレス鋼溶接鋼管（DSW01）:Table 2.2

2.1 二相系ステンレス鋼継目無鋼管（DSS01）

Table 2.1　二相系ステンレス鋼継目無鋼管の標準仕様（案）

	ASTM A790 に追加する基準案	ASTM A790
規格	ASTM A790　S31803 ＋追加要求事項	ASTM A790 S31803
製法	溶鋼はアルゴン酸素脱炭法（AOD 法）又は同等の方式で精錬すること。	
継目無の適用		
標準長		
化学成分	A790 S31803 に加えて N : 0.14 to 0.20 PREN ≥ 34	C≤0.03 Mn≤2.00 P≤0.03 S≤0.02 Si≤1.00 Ni: 4.5 to 6.5 Cr : 21.0 to 23.0 Mo : 2.5 to 3.5 N : 0.08 to 0.20
機械的性質	A790, S31803 に加えて 硬さ、上限: 28 HRC	引張強さ : 620MPa 降伏点 : 450MPa 伸び（2 インチ）: 25% 硬さ、上限 : 290 HBC 及び 30 HRC
熱処理	焼き入れ、空冷又は水冷により急冷する。 熱処理温度は 1020-1100° C	焼き入れ、空冷又は水冷により急冷する。 熱処理温度は 1020-1100° C

	ASTM A790 に追加する基準案	ASTM A790
衝撃試験	シャルピーV ノッチ衝撃試験(試験片 3 本) ASTM A 370 に準拠し肉厚 6 mm 以上の試験片の場合試験温度は-46℃が要求される。 吸収エネルギー下限値は試験片平均で 45 J/単一試験片で 35 J とする。 サブサイズ試験片を使用した場合のリダクション係数は、7.5mm-5/6 及び 5mm-2/3 とする。	規定なし
腐食試験	腐食試験手順は ASTM G48 Type A に準拠する。暴露時間は 24 時間。試験温度は 25±1℃。	規定なし
微細構造検査	フェライト含有率は ASTM E 562 又は同等の規定に従って測定し、母材について 35-55%の範囲内でなければならない。	規定なし
機械試験	管軸直角方向又は管軸方向引張試験 へん平試験 硬さ試験	S2.管軸直角方向又は管軸方向引張試験 S3. へん平試験 硬さ試験
NDE & 試験法	ASTM A999 に準拠する水圧試験及び ASTM E213 に準拠する超音波探傷試験/ASTM E309 に準拠する渦電流探傷試験	ASTM A999 に準拠する水圧試験 或いは、 E213 に準拠する超音波探傷試験 E309 に準拠する渦電流探傷試験
認証	EN 10204 Type 3.1.	ASTM A999

2.2 二相系ステンレス鋼溶接鋼管(DWS01)

Table 2.2 二相系ステンレス鋼溶接鋼管の標準仕様（案）

	ASTM A928 に追加する基準案	ASTM A928
規格	ASTM A928 S31803 Class 1 ＋追加要求事項	ASTM A928 S31803 Class 1
製法	溶鋼はアルゴン酸素脱炭法(AOD 法)又は同等の方式で精錬すること。	
溶接鋼管の用途		
標準長		
化学成分	A928 S31803 に加えて N : 0.14 to 0.20 PREN ≥ 34	C≤0.03 Mn≤2.00 P≤0.03 S≤0.02 Si≤1.00 Ni: 4.5 to 6.5 Cr : 21.0 to 23.0 Mo : 2.5 to 3.5 N : 0.08 to 0.20
機械的性質	A928 S31803 に加えて 硬さ、上限値: 28 HRC	引張強さ : 620MPa 降伏点 : 450MPa 伸び(2 インチ) : 25% 硬さ、上限値 : 290 HBC 及び 30 HRC
熱処理	焼き入れ、空冷又は水冷により急冷する。 熱処理温度は 1020-1100° C	焼き入れ、空冷又は水冷により急冷する。 熱処理温度は 1020-1100° C

	ASTM A928 に追加する基準案	ASTM A928
衝撃試験	シャルピーV ノッチ衝撃試験(試験片 3 本 ASTM A 370 に準拠し肉厚 6 mm 以上の試験片の場合試験温度は-46℃が要求される。 吸収エネルギー下限値は試験片平均で 45 J/単一試験片で 35 J とする。 サブサイズ試験片を使用した場合のリダクション係数は、7.5mm-5/6 及び 5mm-2/3 とする。	規定なし
腐食試験	腐食試験手順は ASTM G48 Type A に準拠する。暴露時間は 24 時間。試験温度は 25±1℃。	規定なし
微細構造検査	フェライト含有率は ASTM E 562 又は同等の規定に従って測定し、母材について 35-55%、溶接金属の 35-65%の範囲内でなければならない。	規定なし
機械試験	引張試験 硬さ試験	S2.引張試験及び曲げ試験 硬さ試験
NDE & 試験法	ASTM A999 に準拠する水圧試験 ASTM E213 に準拠する超音波探傷試験/ASTM E309 に準拠する渦電流探傷試験及び ASME BPV Section V、Article 2 に準拠する放射線透過試験 ASME BPV Section V、Article 6 に準拠する浸透探傷試験。管開先加工端(ベベルエンド)の 100%の溶接部。	ASTM A999 に準拠する水圧試験 或いは、 E213 に準拠する超音波探傷試験 E309 に準拠する渦電流探傷試験
認証	EN 10204 Type 3.1.	ASTM A999

3　二相系ステンレス鋼継手及び鍛鋼品の規格化の提案

二相系ステンレス鋼管材料と同様に、二相系ステンレス鋼継手及び鍛鋼品材料の規格化を提案する。

- 鍛鋼品（DF01）：Table 3.1
- 鍛錬継手（DF 02）：Table 3.2

3.1 二相系ステンレス鋼鍛鋼品(DF01)

Table 3.1 二相系ステンレス鋼鍛鋼品の標準仕様（案）

	標準仕様(案)
規格	ASTM A182, F51, S31803 ＋追加要件 S56 補足要求事項
製法	溶鋼はアルゴン酸素脱炭法(AOD 法)又は同等の方式で精錬すること。
化学成分	A182, S31803 に加えて N : 0.14 to 0.20 PREN ≥ 34
機械的性質	A182, S31803 に加えて 硬さ、上限値:28 HRC
熱処理	溶体化焼きなまし後に水焼き入れ 熱処理温度 1020-1100° C
衝撃試験	シャルピーV ノッチ衝撃試験(試験片 3 本) ASTM A 370 に準拠し肉厚 6 mm 以上の試験片の場合試験温度は-46℃が要求される。 吸収エネルギー下限値は試験片平均で 45 J/単一試験片で 35 J とする。 サブサイズ試験片を使用した場合のリダクション係数は、7.5mm-5/6 及び 5mm-2/3 とする。
腐食試験	腐食試験手順は ASTM G48 Type A に準拠する。 暴露時間は 24 時間。試験温度は 25±1℃。
微細構造試験	フェライト含有率は ASTM E 562 又は同等の規定に従って測定し、35-55%の範囲内でなければならない。
機械試験	引張試験 硬さ試験
NDE & 試験法	S56 規定に準拠する 100%浸透探傷試験 ASTM A388 に準拠する 100%超音波探傷試験 (NPS＞3 インチ)
試験片採取	試験片は実際の供試鍛鋼品又は実際のパートの延長部分 (Prolongation)から及び製品を代表する部位から採取すること。

	標準仕様(案)
認証	材料製造業者はISO 9001に準拠する品質管理システム認証をうけなければならない。システムは関連する材料に特定の評価を受けなければならない。 材料認証はEN 10204 Type 3.1に準拠し、以下の情報を含むこと。 - 鋼材製造事業者 - 溶鋼及び精製慣行 - 熱処理条件（溶体焼きなまし温度と保持時間を記載すること）

3.2 二相系ステンレス鋼鍛錬継手(DF02)

Table 3.2 二相系ステンレス鋼鍛錬継手の標準仕様（案）

	標準仕様(案)
規格	ASTM A815, S31803 ＋追加要件 WP-W、WP-S 又は WP-WX + S7 要求事項
製法	溶鋼はアルゴン酸素脱炭法(AOD 法)又は同等の方式で精錬すること。
化学成分	A182, S31803 に加えて N : 0.14 to 0.20 PREN ≥ 34
機械的性質	A185, S31803 に加えて 硬さ、上限値:28 HRC
熱処理	溶体化焼きなまし後に水焼き入れ 熱処理温度 1020-1100° C
衝撃試験	シャルピーV ノッチ衝撃試験(試験片 3 本) ASTM A 370 に準拠し肉厚 6 mm 以上の試験片の場合試験温度は-46℃が要求される。 吸収エネルギー下限値は試験片平均で 45 J/単一試験片で 35 J とする。 サブサイズ試験片を使用した場合のリダクション係数は、7.5mm-5/6 及び 5mm-2/3 とする。
腐食試験	腐食試験手順は ASTM G48 Type A に準拠する。 暴露時間は 24 時間。試験温度は 25±1℃。

	標準仕様(案)
微細構造試験	フェライト含有率は ASTM E 562 又は同等の規定に従って測定し、35-55%の範囲内でなければならない。
機械試験	引張試験 硬さ試験
NDE & 試験法	S7 規定に準拠する 100％浸透探傷試験 溶接継手は ASME ボイラー及び圧力容器規則の Division 1、セクション VIII、Paragraph UW-51 に準拠して全長で放射線透過試験を受けなければならない。
試験片採取	試験片は実際の供試鍛鋼品又は実際のパートの延長部分 (Prolongation)から及び製品を代表する部位から採取すること。
認証	材料製造業者は ISO 9001 に準拠する品質管理システム認証をうけなければならない。システムは関連する材料に特定の評価を受けなければならない。 材料認証は EN 10204 Type 3.1 に準拠し、以下の情報を含むこと。 - 鋼材製造事業者 - 溶鋼及び精製慣行 - 熱処理条件（溶体焼きなまし温度と保持時間を記載すること）

4　まとめと結論

材料規格化により材料の互換性と製造の柔軟性が高まり、材料納期が短縮される。規格化は、プロジェクト仕様と工業規格のギャップ分析に基づいて提案された。

化学成分、サワー環境仕様及び NDE(非破壊評価)のような変化を伴う項目を調査し、2 グループの二相系ステンレス鋼鋼管材料の標準仕様を第 3 章(二相系ステンレス鋼継手及び鍛鋼品の規格化の提案)で提案した。

5　引用規格

[1] ASTM A790-14A, Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe
継目無及び溶接フェライト系/オーステナイト系ステンレス鋼鋼管の標準仕様

[2] ASTM A928-14, Standard Specification for Ferritic/Austenitic (Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal
溶加金属電気溶解溶接フェライト系/オーステナイト系(二相系)ステンレス鋼鋼管の標準仕様

[3] ASTM A999-14, Standard Specification for General Requirements for Alloy and Stainless Steel Pipe
合金及びステンレス鋼鋼管の一般要求事項の標準仕様

[4] ASME B31.3-2014, Process Piping
プロセス配管

[5] ABS Rules, Rules for Materials and Welding, 2015
ABS 規則、材料及び溶接規則

[6] NORSOK M-630, Edition 6, Material data sheets and element data sheets for piping
配管用材料データシート及びエレメントデータシート

[7] NACE MR0175, Petroleum and natural gas industries - Materials for use in H2S-containing environments in oil and gas production
石油及び天然ガス産業 – H_2S 含有環境における石油及びガス生産用材料

IV. 電気及び計装の規格化

1　序文

材料選択のばらつきと個別の設計仕様数を最小化し、コスト効率と入手しやすさを改善するためにケーブルラック及び接続箱の規格化を提案する。

1.1　電気・計装の規格化のスコープとメリット

本稿は船級協会、業界慣行及び国際規格から電気・計装機器に関する情報を特定し、その特定された情報を電気・計装量産材料及び手順の規格化を目的とし文書化している。

電気・計装の規格化の取り組みにおいては、単一の標準型を策定することにより品種数を減らすのに役立つ製品の規格化に焦点を当てる。これはもっぱらコスト、互換性、生産性の向上、手に入れやすさ、製造コストダウンの点で評価することができる。このようなメリットは製品のエンドユーザーである石油･ガス会社にとってもメリットとなり、リードタイムが短縮され、オーナー又はオペレーターの運転コストの低減につながる。

電気・計装規格化のスコープに入る品目は以下の通りである。

a）ケーブルラック：直線型、金属ケーブルラック（はしご形及び穴あきトレイ形）

b）接続箱：計器のタイプ

1.2　過去のプロジェクトからの教訓

多くの工業及び商業電気ケーブル配線システムは、過剰な初期設備投資額と過剰なメンテナンスを必要とする。複数の異なる/馴染みのない工作規格及び規則に準拠する広範な材料が市場に溢れており、量産品材料の調達には長い時間がかかり、関係者すべてにとって骨の折れるプロセスとなっている。これまでコントラクターは、他のプロジェクトで使用できないコスト効率を下げる余剰の量産材料を発注してきた。時には非在庫品目の急ぎの注文の納入に長い時間がかかり、プロジェクトの引き渡しスケジュールに影響したこともある。

a）**直線型ケーブルラック**（はしご形及び穴あきトレイ型）は以下の条件を満たす必要がある。

- シンプルな設計
- 手頃な価格
- 耐食性
- 高い耐久性
- 設置作業が容易
- 最短納期

b）接続箱は以下の条件を満たす必要がある。

- 標準寸法
- 材料

1.3 用途

本規格化ガイドラインは、以下に挙げる様々な種類のオフショア構造物に適用することができる。

- 固定式プラットフォーム
- テンションレグプラットフォーム(TLP)
- FLNG(トップサイド)
- FPSO(トップサイド)
- セミサブ生産ユニット
- セミサブ掘削ユニット
- ジャッキアップ掘削ユニット
- ドリルシップ

1.4 規則、コード及び規格

電気ケーブルラック及び取り付けの工業規格を以下に挙げる。

Table 1 引用規格

番号	タイトル
NEMA VE 1-2009/CSA C22.2 No. 126.1-09	米国電気工業協会(NEMA):ANSI/NEMA-VE 1-2009、カナダ規格協会出版物 CSA C22.2 No. 126-09、金属ケーブルラック構造
NEMA VE-2-2009	米国電気工業協会(NEMA):金属ケーブルラックシステム;NEMA-VE 2-2009、ケーブルラック取り付けガイドライン
IEC-61537	ケーブル管理のためのトレイ形ケーブルラックシステムとはしご形ケーブルラックシステム向け国際電気標準会議(IEC)国際規格
BS EN 61537:2002	ケーブル管理のためのトレイ形ケーブルラックシステム及びはしご形ケーブルラックシステムの英国規格
EN 10088-1:1995	ステンレス鋼:ステンレス鋼のリスト
National Electrical Code ® (2005) Article 392	米国電気工事規程(NEC)適合が規定されている
ASME A653	薄板鋼板、溶融亜鉛めっき(ガルバナイズド)、構造(物理的)品質の標準仕様
ASTM A123/A 123M	溶融亜鉛めっき鉄及び鋼材料の標準仕様
ABS 規則	鋼船規則(2014)1-1-4/7.7、1-1-Appendix 3&$、4-8-4/21.9 オフショア支援船(2014)1-1-4/7.7、1-1-Appendix 3&4,

	4-8-4/21.9.2 MODU(2014)1-1-4/9.7、1-4-Appendix 2&3、4-3-3・5.9.1 一般にケーブルラックの型式承認のための規則
AISI Type 316L ステンレス鋼、UNS31630	ステンレス鋼 SS316L の標準仕様

1.5 略語及びシンボル

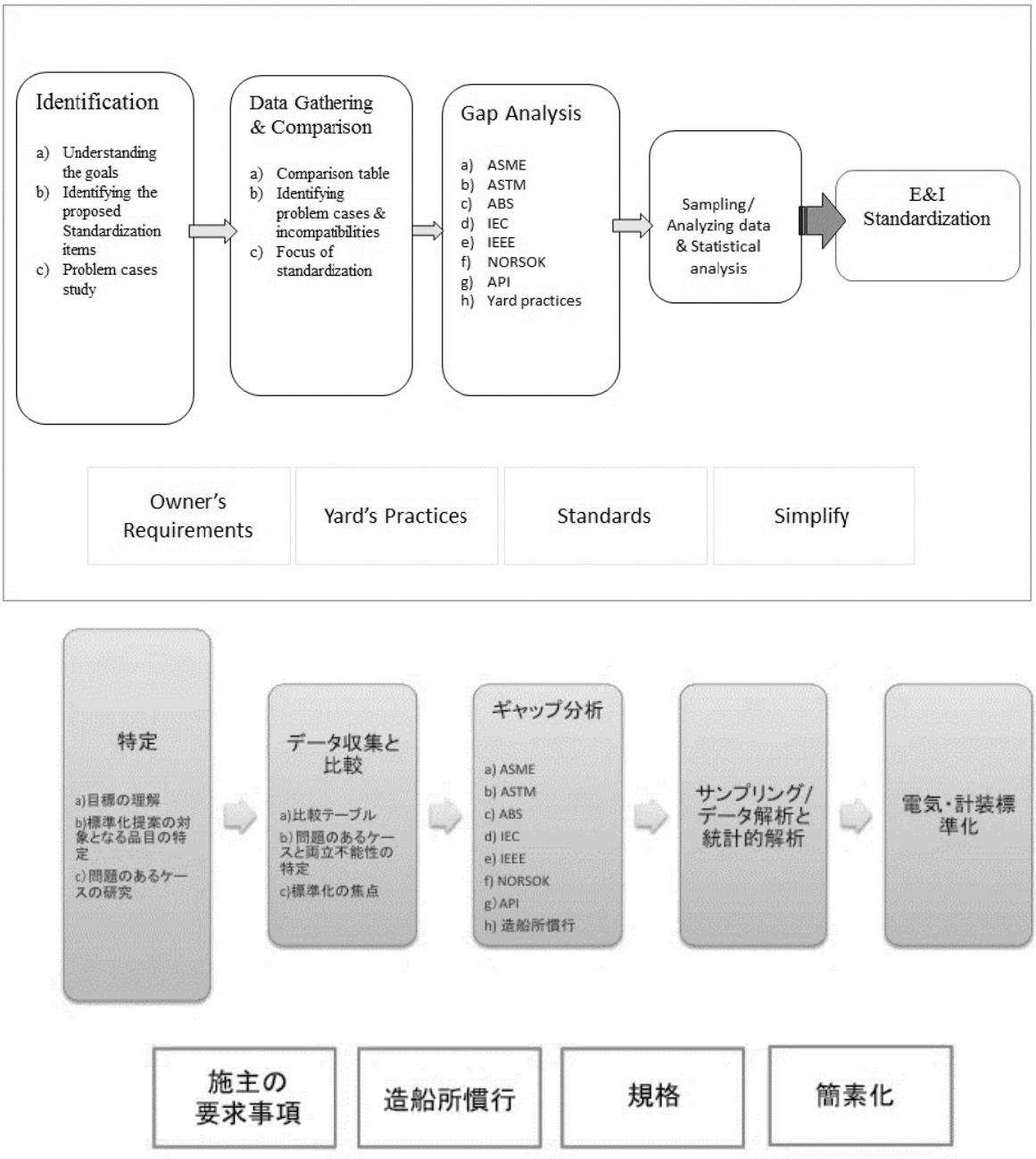
NEMA　全米電気工業協会 [National Electrical Manufacturers Association]
CSA　カナダ規格協会 [Canada Standard Association]
ISO　国際規格化機構 [International Standardization Organization]
IEC　国際電気標準会議 [International Standard for Electrotechnical Commission]
SS　ステンレス鋼、SS316
HDGS　溶融亜鉛めっき鋼、HDGS SS400
AS/NZ　オーストラリア/ニュージーランド規格
OSHA　労働安全衛生局
CEC　カナダ電気規定
NEC　米国電気工事規程

2　規格化の方法論

2.1 ワークフロー

規格化のワークフローは、Figure 1 に示すようにいくつかの連続的なステップに分割される。規格化はプロジェクト情報、エンジニアリング会社のデータシート、建造慣行、工業要求事項に基づいて行う。ギャップ分析を行うためにデータの検討・分析と国内及び国外規則との比較を行った。

Figure 1.　規格化プロジェクトワークフロー



技術的アプローチのロードマップは以下の通りである。

- 品目の特定
- 製作事業者からのデータ収集
- 国際規格の文献レビュー
- 船級協会のステータスと業界慣行
- データ比較とギャップ分析
- 施主の仕様書
- 関連するABS規則と型式承認プログラム
- 要求事項の評価の実施
- 必要に応じてオプション要求事項を作成
- 規格化案を作成

3　ケーブルラックの国際規格の比較

3.1 直線型金属ケーブルラック

データ収集と比較に基づき、最も一般的に使用されている金属製はしご形及び穴あきトレイ形ケーブルラックが、全米電気工業協会（NEMA）の製造及び試験基準に適合し、規格化の対象として特定された。NEMA 規格はケーブルラックの製造、試験、性能に関する技術要求事項を規定するものである。NEMA 規格が規定する試験要求事項は電気的導通試験及び負荷試験である。ケーブルラックの表示要件も規定されている。

a） 全米電気工業協会（NEMA）:ANSI/NEMA-VE 1-2009、金属ケーブルラックシステム;NEMA VE-2-2009 ケーブルラック取り付けガイドライン、NEMA-FG 非金属ケーブルラックシステム。米国ではNEMA、カナダではCSAにより出版されている米カナダ合同規格である「金属ケーブルラックシステム」は北米市場における重要なケーブルラック規格の一つである。

b） 国際電気標準会議（IEC）が、電気及び/又は通信系設備におけるケーブル或いは他の電気機器の支持及び収容を目的とするトレイ形ケーブルラックシステム及びはしご形ケーブルラックシステムの要求事項及び試験を指定している。必要に応じて、トレイ形ケーブルラックシステム及びはしご形ケーブルラックシステムは、ケーブルの区分、又はケーブルをグループ分けする目的で使用することができる。

c） 米国では米国電気工事規程（NEC）への適合が義務付けられている。本規格は、容認される又は容認されないワイヤーとケーブルの種類についての要求事項と、ケーブルラック内のケーブルの配置についての詳細な要求事項を規定している。カナダではカナダ電気規程（CEC）が使用されている。米国でNEC適合が義務付けられているのと同様にカナダではCECへの適合が義務づけられている。

d） AS/NZ 3000 架線工事規則がオーストラリアとニュージーランドで採択されている。本規則は架線規則を特定した詳細な要求事項を規定している。

ギャップ分析と直線型ケーブルラックの型と寸法を推奨するために実施した比較をTable 1 に示す。

Table 1: 直線型はしご形ケーブルラック製品の規格化仕様（案）

ケーブルラック設計パラメーター	規格					
	IEC	NEMA	BS	ASME	ASTM	API RP14F
材料	IEC EN 10088-1:1995	NEMA VE1-4.1	BS EN61537 BS EN 10088-2	ASME A 653	ASTM A123	API RP 14F 12.1.2.2
	IEC 61537 Table 1	NEMA VE-1 4.1	1.4404 マリングレードステンレス鋼(AISI 316L grade	ASME SA240 316L	ASTM A 240	API 14F
長さ(mm)	IEC 61537 6.7, 6.8 & 8	NEMA VE-1 4.3.2	EN 61537 6.7, 6.8 & 8			
幅(mm)	IEC 61537 sec. 8	NEMA VE-1 4.3.3	EN 61537 sec. 8			
高さ(mm)		NEMA VE-1 4.3.5				
子桁間隔(mm)	IEC 61537 sec.8	NEMA VE-1 4.3.5				
常用荷重(Kg/m)	IEC 61537 sec. 10.2	NEMA VE-1 4.8 & 5.2	EN 61537 sec. 7.3 & 10.2			
支持間隔(m)	IEC 61537 sec. D3.1 & D4.1	NEMA VE-1 5.4.4			ASTM A 123	
仕上げ金属	IEC 61537 Table 1	NEMA VE-1 4.2.1	EN 61537 sec 14.2			
NEMA		NEMA Table 1				

3.1.1 穴あきトレイ形ケーブルラック

穴あきトレイ形ケーブルラックはmコスト、時間、労力の点で効率的である。小束のケーブルを短い距離配線するために用いられ、一般に分岐に使用される。詳細はTable 2を参照。穴あきトレイ形ケーブルラックについて複数の設計パラメーターを考察した。推奨事項の根拠を次項で説明する。

Table 2：穴あきトレイ形ケーブルラックの推奨事項

ケーブルラック設計パラメーター	規格					
	IEC	NEMA	BS	ASME	ASTM	API
材料	IEC EN 10088-1:1995	NEMA VE1-4.1	BS EN61537 BS EN 10088-2	ASME A 653	ASTM A123	API 12.1.2.2
	IEC 61537 Table 1	NEMA VE-1 4.1	1.4404 マリングレードステンレス鋼（AISI 316L grade）	ASME SA240 316L	ASTM A 240	
長さ(mm)	IEC 61537 6.7, 6.8 & 8	NEMA VE-1 4.3.2	EN 61537 6.7, 6.8 & 8			
幅(mm)	IEC 61537 sec. 8	NEMA VE-1 4.3.3	EN 61537 sec. 8			
高さ(mm)						
常用荷重 (Kg/m)						
支持間隔						
仕上げ金属	IEC 61537 Table 1	NEMA VE-1 4.2.1	EN 61537 sec 14.2			
NEMA 分類						

3.1.2 ケーブルラック設計パラメーターの解釈と解析

3.1.2.1 材料

NEMA、IEC、NEC 及び英国規格[1-3]は、すべてケーブルラックの材料を耐食性金属(低炭素鋼、ステンレス鋼又はアルミニウム合金)又は耐食仕上げ(亜鉛又はエポキシ)を施した金属とすることを義務付けている。標準仕様(案)では、ステンレス鋼材と溶融亜鉛めっきを施したケーブルラックを使用、又は NEMA 規格に従うことと規定した。

3.1.2.2 寸法と分類

ケーブルラックの寸法は幅、長さ、深さにより明確に定義される。トレイ形ケーブルラックは多孔状で 20%の設備余力を保有しなければならない。ケーブルラックの長さは選択する際きわめて重要となる。長さは強度、負荷、径間及び取り扱いと取り付けの容易さを含む複数の基準に基づいて選択される。

3.1.2.3 ケーブルラックの NEMA 等級

NEMA 分類は、最大支持間隔に加えて常用荷重を間隔/荷重等級の選択に使用している。Table 3 と Table 4 は米国及びカナダ金属ケーブルラック規格である CSA、C22.2 No. 126.1-98 First による最も一般的な荷重/間隔等級を示したものである。

ケーブルラックを取り付けるための支持の間隔は通常「支持間隔」と呼ばれる。ケーブルラックの荷重と間隔の等級は以下の表に従って決定される[1]:

Table 3：NEMA VE1 金属ケーブルラックシステム（米）

Table 1
SPAN/LOAD CLASS DESIGNATION—USA
(See Clauses 4.8.1, 4.8.2 and 6.1.2 (c).)

Load, kg/m (lb/ft)	Span, m (ft)				
	1.5 (5)	2.4 (8)	3.0 (10)	3.7 (12)	6.0 (20)
37 (25)	5AA	8AA	10AA	12AA	20AA
74 (50)	5A	8A	10A	12A	20A
112 (75)	-	8B	-	12B	20B
149 (100)	-	8C	-	12C	20C

Note: These ratings are also used in Mexico

Table 4: NEMA VE1 金属ケーブルラックシステム（カナダ）

Load kg/m (lb/ft)	Span, m (ft)						
	1.5 (5)	2.0	2.5	3.0 (10)	4.0	5.0	6.0 (20)
37 (25)				A			
45 (30)			A				
62 (42)		A					
67 (45)							D
82 (55)						D	
97 (65)				C			
99 (67)	A						
112 (75)							E
113 (76)					D		
119 (80)			C				
137 (92)						E	
164 (110)		C					
179 (120)				D			
189 (127)					E		
259 (174)	C						
299 (200)				E			

3.1.2.4 試験

本項ではケーブルラックに関する様々な試験について説明する。最も重要なものは荷重試験と導通試験である。試験についてはセクション 4 の Table 6 に示す。ケーブルラックの試験は NEMA VE1/CSA C22.2 No.126.1-09、Method B（残留ひずみ発生荷重条項 5.2.9[1]及び IE61537[2]機械的強度試験）に従って実施する。

導通試験は、ケーブルラックの端部にマスキング（塗装無し）を施して NEMA VE 1 手順に従って実施する。これはケーブルラック部材間の接続を助けるものである。マスキング部分に粉体塗装を施されていないとは限らない。接触板としてスプライスが使用される。ケーブルラックの両端ともに接地に使用される。詳細についてはセクション 4 を参照。

ケース・バイ・ケースで機械的損傷を減らすためにケーブルラックカバーを使用してケーブルラックの遮蔽を行う。一般に最大高 2m まで立型設置されるケーブルラックにはカバーが使用される。詳細はセクション 4 を参照。

3.1.2.5 仕上げ材

ケーブルラックの仕上げ材を Table 5 に示す。

Table 5: ケーブルラックの仕上げ材[2-3]

仕上げ材	規格	設置場所
電気亜鉛めっき	ASTM B633	屋内
クロム亜鉛	ASTM F-1 136-88	屋内/屋外
プレガルバナイズド亜鉛	ASTM A653SS G.33 G90（CSA Type）	屋内
製造後溶融亜鉛めっき	ASTM A123（CSA Type 1）	屋内/屋外

ほとんどのオフショア開発プロジェクトではペイント塗装又は粉体塗装が施されたケーブルラックが採用されている。粉体塗装はリン酸亜鉛で前処理をした上に静電気スプレーで塗布するポリエステルタイプの表面処理である。黒色粉体塗装表面処理は電

着亜鉛めっきの上に ASA 61 黒色ポリエステル塗装を使用する。ケーブルラックでは電着亜鉛めっきの上に注文色の粉体塗装表面処理を行うことがよくある。

ケーブルラックの仕上げの主な目的は耐食性を高めることである。さらに仕上げ材には次のような長所がある。

- 屋内用ケーブルラックは屋内の壁のペイントの色と合わせ、美観を保つように粉体塗装される。
- ケーブルラックを溶接スラグから保護する。
- 屋外用ケーブルラックは耐光性及び耐候性を持たせるために粉体塗装される。
- 耐食性
- 耐擦傷性、指紋付着防止
- 物理的な損傷に対する耐性
- 清潔で光沢がある

ケーブルラックの試験及び安全性は検討すべきもうひとつの重要な側面であり、セクション 4 でこれを論じる。

4　ケーブルラックの安全性と試験

ケーブルラックは屋内、屋外及び可燥区域に取り付けられる。次の Table 6 はケーブルラックに関する安全基準をまとめたものである。

Table 6:ケーブルラック安全要求

項目	標準	リスクと問題点	緩和措置
耐食性	NEMA NEMA VE-1 4.2.1; IEC 61537 Table 7	環境による腐食	屋外ケーブルラックは粉体塗装またはペイント塗装する
十分な通気	NEMA VE-1 6.1; NEC 2005	ケーブルのたわみ	システムが小径多芯コントロールケーブル及び計装用ケーブルを支持するためにはしご型ケーブルラックの使用を避けようとする場合に、通気トラフ型ケーブルラックがしばしば使用され、スッキリした外観の設置となる。
機械的強度試験	NEMA VE 1 sec. 5 IEC 61537 sec.8	荷重と間隔の機械抵抗の不整合、剛性破壊	予期される荷重及び間隔に応じた機械抵抗;重ね継接続部において保証されなければならない。
遮蔽	NEMA VE2 4.5.6	石油及び化学物質の流出及び太陽光の遮蔽	ケーブルラックを取り外し可能な上蓋でカバーすること。
電気的通導(ケーブル荷重が大きい場合と3m を超える長尺をカバーする場合に使用する耐久型ケーブルラックについてのみ)	NEMA VE1 Sec 5; IEC61537 sec 11; NEC318-3(c)	短絡、接地の問題	ケーブルラックを接地電路として使用する。さらにケーブルラックはボルト接合の際に切れ目なく連続すること。またケーブルラックを NEC Article 318.60 に従って接地電路として使用する。
取り付け	NEMA VE2, DSME, SHI , HHI 造船所取り付け手順		

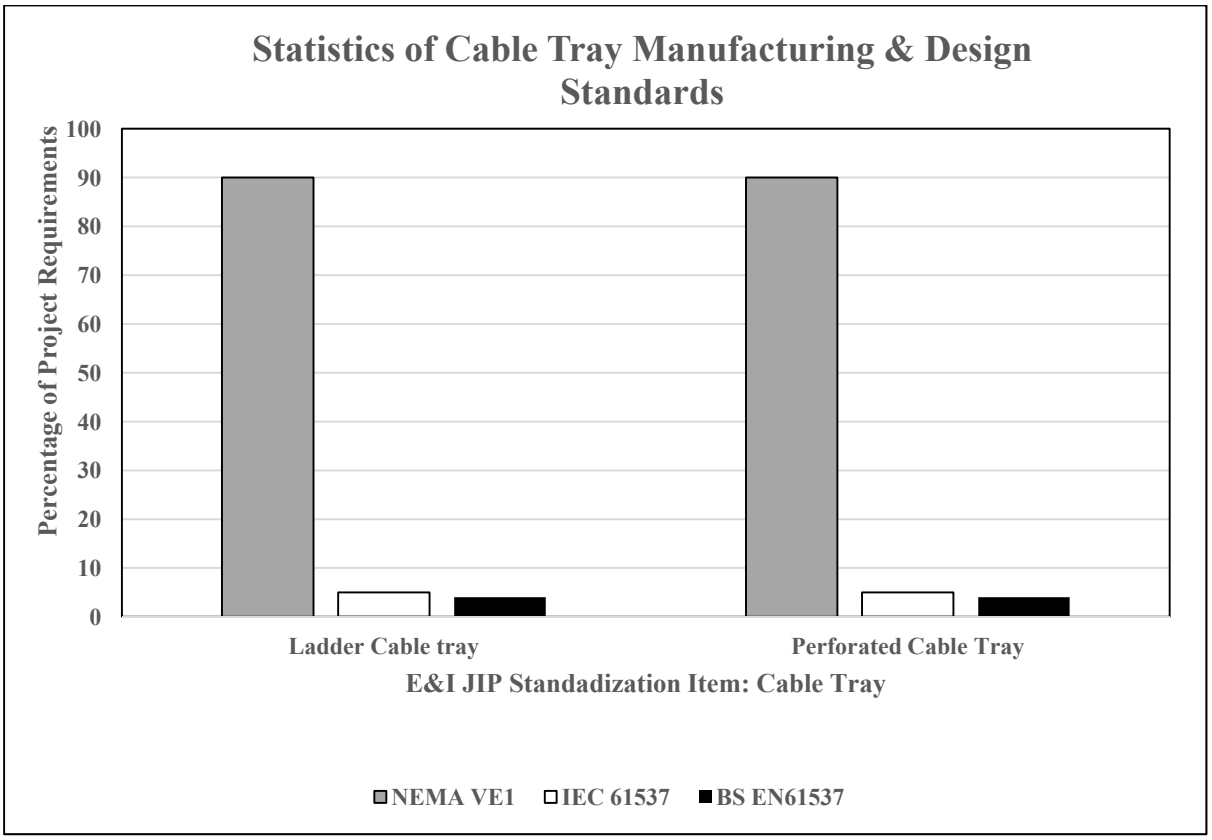
項目	標準	リスクと問題点	緩和措置
炎及び火災の潜在的危険性(非金属ケーブルラックのみ)	IEC61537 sec 13; NEC318-3(c); NEC Section 392.3(D); OSHA 29 CFR 1910.305(a)(3)(iv); IEC 60695-2-11:2000, Clauses 4 to 10	加熱状態或いは火災又は電気事故或いは電撃; 可燃区画内のケーブルラック	耐火性被包及び繊維ガラス材試験。ただし金属ケーブルラックは試験を受ける必要はない。
荷重又は安全常用荷重試験	NEMA VE 1 Table 1; NEC Sections 392.8, 392.9, 392.10, and 392.12.	ケーブルラックのブレークダウン;ケーブル充填率に基づいてアンペア容量と電圧定格が決定される。	NEMA 要求事項又はIEC61537と同等の要求事項に準拠した荷重試験 ケーブルトレイ研究所(The Cable Tray Institute)によれば、ケーブルラックはトレイの内側部分の40−50%又はケーブルラック仕様に基づく最大重量を超えて充填するべきではない。 NEMA VE-1/CSA 22.2に準拠し耐荷重=試験荷重15分。荷重試験には2つの手法がある(安全率1.5): • 破壊荷重: 破壊荷重/1.5=定格耐荷重＝試験荷重 • 残留たわみが発生するまで加重: 1.5 x 間隔 x 定格荷重 合計試験荷重を取り除いた後に残留たわみ量を計測する。
熱伸縮	NEMA Standards Publication No. VE 2, Section 4.3.2. NEMA VE-2 Table 4-2 NEC® Section 300.7(B)	加熱 電撃	熱伸縮を補正する必要のある場所では管路に伸縮継手を使用すること。 熱伸縮に関するある文書は鋼製ケーブルラックとアルミニウム製ケーブルラックの伸縮継手間の温度差による許容長を示している。

ABS の推奨事項:Table 6 に示すようにケーブルラックの安全性と試験は製造者にとって重要事項である。

5　評価及び結論

さまざまな形状、寸法、設計、材料のケーブルラックが入手可能である。それぞれの製造業者が様々な規格に適合する多種多様なケーブルラックを提供しており、必要以上に高品質の製品を調達することによりコスト増を招き、情報のやりとりと承認を繰り返すという非効率性を招く結果となっている。このような状況で工業規格を収集し、製品としてのケーブルラックを規格化するための評価が行われた。Figure 2 に示すようにオフショア開発プロジェクトの大部分がケーブルラック製造及び構造に NEMA VE 1 規格を使用していることが判明した。オーストラリア又はヨーロッパのプロジェクトは NEMA 規格に加えて IEC 61537 又は BS EN61537 適合を要求している。NEMA 規格の要求事項はより厳格であると考えられている。

Figure 2. オフショア開発プロジェクトが採用するケーブルラック規格の統計



本報告書は構造、労働安全、電気保安、設計及び適用性を考慮して推奨要求事項を策定することを目的とする。安全基準を比較する取り組みとして OSHA、HEC、NEMA 及び IEC 規格を検討した。セクション 3.4 の説明と解析に基づいて、はしご形/穴あきトレイ形ケーブルラック製品ガイドラインを Table 7 及び Table 8 に提案する。

Table 7: はしご形ケーブルラックの規格（案）

	パラメーター	コメント
直線はしご形ケーブルラック	材料	費用効率の高い耐久性のある防食仕上げの鋼。いずれの材料も耐食性にすぐれ高温に耐えることができる。安定した構造的性質、非磁性
	幅	最も一般に使用されている幅
	長さ	最も一般に使用されている長さ。試験しやすく、保守及び迅速な補修が行えるように厚みを減らす必要がある。
	高さ	最も一般的に使用されている高さ
	仕上げ	クリーンで、耐食性があり、耐擦傷性にすぐれ、光沢のある、耐光性及び耐候性の、耐久性にすぐれたもの
	安全常用加重	NEMA Table 1 及び Table 2 の要件
	電気的導通	NEMA VE1 に準拠する試験
	荷重試験	NEMA Classification 10C に準拠する試験
	標準分類	NEMA Table 1
	間隔	NEMA Table 1

Table 8：穴あきトレイ形ケーブルラックの規格（案）

	パラメーター	コメント
直線穴あき/パンチトレイ形ケーブルラック	材料	費用効率の高い、耐久性のある防食仕上げの鋼。いずれの材料も耐食性にすぐれ高温に耐えることができる。安定した構造的性質、非磁性。
	幅	ほとんどのプロジェクトで使用されている一般的な幅
	長さ	最も一般に使用されている長さ。取り扱いが簡単な長さ。
	高さ	最も一般的に使用されている高さ
	仕上げ	クリーンで、耐食性があり、耐擦傷性にすぐれ、光沢のある、耐光性及び耐候性の耐久性に優れたもの。

3.1.3「解釈と分析」の項で論じたように、ケーブルラックガイダンスは製品としてのケーブルラックを規格化するために選ばれたものである。これはオフショア開発会社が特にケーブルラックについて直面する問題点を克服する一助となる。一般に、はしご形ケーブルラックはトレイ形（ベタ底のもの、底が通気構造になっているものも含め）ケーブルラックよりも低コストである。また穴あきケーブルラックは製造がしやすくコスト効率が良い。経済的に見て、ケーブルラックの規格化は実行可能であり、余剰ストックは様々なプロジェクトに使用することが可能であり、製造が円滑化される。一旦規格化されると設計及びモデリングコストが低減され、エンジニアリング工数も低減され、現地でベンダーを確保又は現地製造することが可能となり、納期が短縮される。ケーブルラッ

クの規格化により選択及び据付が迅速に行われるようになり、オフショア開発産業にとってメリットとなると考えられる。

6 引用規格

[1] NEMA VE1: National Electrical Manufacturers Association (partnered with CSA) Standard for Metal Cable Tray Systems, 2009.
全米電気工業協会(カナダ規格協会と協力)「金属ケーブルトレイシステム規格」2009 年版

[2] IEC 61537: International Electro technical Contractors Standard for Cable Tray Systems and Cable Ladder Systems for Cable Management second ed. 2006-2010.
ケーブル管理のためのケーブルトレイシステム及びケーブルラダーシステムの国際電気標準会議規格、2006-2010 年版

[3] BS EN 61537:2002, IEC 61537:2001 - Cable tray systems and cable ladder system for cable management.
ケーブル管理のためのケーブルトレイシステム及びケーブルラダーシステム

[4] ASTM B633-13 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
鉄及び鋼への電着亜鉛被膜の標準仕様

[5] ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
鉄及び鋼製品への亜鉛(溶融鍍金)被膜の仕様

[6] ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
溶融亜鉛鍍金鋼板の仕様

[7] EN 10088-1:1995, Stainless steels. List of stainless steels.
ステンレス鋼、ステンレス鋼リスト

[8] EN 10326:2004, continuously hot-dip coated strip and sheet of structural steels – Technical delivery conditions.
連続的溶融めっきされた構造帯鋼及び鋼板—TEC(品質要求事項)

[9] EN 10327:2004, continuously hot-dip coated strip and sheet of low carbon steels for cold forming - Technical delivery conditions.
連続的に溶融めっきされた低間加工用低炭素鋼帯鋼及び鋼板—TEC(品質要求事項)

[10] ABS Steel Vessel Rules (2014) 1-1-4/7.7, 1-1-Apendix 3 & 4, 4-8-4/21.9.
ABS 鋼船規則(2014 年)1-1-4/7.7, 1-1-Apendix 3 & 4, 4-8-4/21.9.

[11] ABS Offshore Support Vessels (2014) 1-1-4/7.7, 1-1-Appendix 3 & 4, 4-8-4/21.9.
ABS オフショア支援船(2014 年)1-1-4/7.7, 1-1-Appendix 3 & 4, 4-8-4/21.9.
[12] ABS Mobile Offshore Drilling Units (2014) 1-1-4/9.7, 1-1-Appendix 2 & 3, 4-3-3/5.9.1.
ABS MODU(2014 年)1-1-4/9.7, 1-1-Appendix 2 & 3, 4-3-3/5.9.1.
[13] AS/NZ 3000, Electrical Installation (Australia/ New Zealand Wiring Rules).
架線工事規格(オーストラリア/ニュージーランド配線規則)
[14] NEMA VE2: National Electrical Manufacturers Association Standard for Cable Tray Installation Guidelines NECA/NEMA 105 Recommended Practice for Installing Cable Trays, 2009.
NEMA VE2:ケーブルトレイ取り付けガイダンスの全米電気工事協会規格
NECA/NEMA 105 ケーブルトレイ取り付け推奨慣行
[15] IEC 61892 Mobile & Fixed Offshore Units: Electrical Installations.
移動式及び固定式オフショアユニット:架線工事
[16] NEC, The National Electrical Code 317 and NEC 318 article
米国電気工事規程 317 及び 319 条項
[17] NFPA 70: National Fire Protection Association's Standard
アメリカ防火協会規格
[18] IEEE Std 1202, Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies.
工業及び商業施設におけるケーブルトレイで使用するケーブルの火炎試験についてのアメリカ電気電子技術協会規格
[19] ISO 14713:1999, Protection against corrosion of iron and steel in structures – Zinc and aluminum coatings – Guidelines
鉄及び鋼構造物の防食-亜鉛及びアルミニウム被膜—ガイドライン
[20] IEC 60204: International Electro technical Contractors Standard for Safety of Machinery/Electrical Equipment with Machinery
国際電気標準会議の機械の安全性-機械の電気装置規格
[21] National Electrical Code® (2005) Article 392 (See also NEC® Handbook).
NEC 規格(2005 年)392 条(NEC ハンドブック参照)
[22] OSHA Fact Sheet - Electrical Safety Hazards of Overloading Standard Cable Trays & 29 CFR 1910.305(a)(3).
労働安全衛生局ファクトシート-標準ケーブルトレイの負荷過重の電気安全上の問題及び 29 CFR 1910.305(a)(3)
[23] IEEE Std 1202, Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies

工業及び商業施設におけるケーブルトレイで使用するケーブルの火炎試験についてのアメリカ電気電子技術協会規格

[24] API RP 14F Recommended Practice for Design and Installation of Electrical Systems for fixed and floating offshore Petroleum Facilities. July 2008
米国石油協会規格 API RP 14F 固定式及び浮体式オフショア石油施向け電気系の設計及び設置の推奨慣行

7　接続箱の国際規格の比較

接続箱(ジャンクションボックス)は、あらゆる電気系、制御系、計装系の設置に不可欠な部分である。制御系及び計装系においては、処理/生産区域のフィールドデバイス(フィールド計器)と通常制御室に設置されている制御/監視機器の間の相互接続に使用される筐体である。接続箱は一般的に、一般区域の共通システムの複数のフィールドデバイスの端子箱として使用される。計器接続箱は設置場所の環境に適した設計でなければならず、適切な異物侵入防止機能と防爆を実証する検定を取得しなければならない。

接続箱の規格化には以下の点を考慮する必要がある。

- 筐体材料
- 開き戸
- 安全等級
- 保護の程度
- 筐体の寸法
- 後板
- グランドプレート
- 接地用スタッド
- ブリーザ/ドレンプラグ
- ラベル

計器接続箱は多くのシステムで必要であり、湿潤環境や乾燥環境、安全区域や危険区域といった様々な作業ロケーションに設置される。通常、計器接続箱は安全かつ効率的環境で保守される必要がある。それぞれのオフショア開発プロジェクトで何百もの接続箱が必要となることから、要求事項を規格化する意義がある。

7.1 規則、コード及び規格 － 接続箱

計器接続箱及び取り付けについての施主/設計者の仕様書には一般的に以下の文書が含まれる。

Table 1　引用規格

規格番号	タイトル
AS/NZS 2381	Electrical Equipment for Explosive Atmospheres Selection, Installation and Maintenance 防爆電気機器、取り付けと保守
AS/NZS 3000	Electrical Installation (Australia/ New Zealand Wiring Rules) 架電工事(オーストラリア/ニュージーランド配線規則)
AS/NZS 60079 IEC 60079	Electrical Apparatus for Explosive Gas Atmospheres -Explosive Protection

	Technique (All relevant parts) 爆発性ガス環境向け電気器具ー防爆テクニック
AS 60529 IEC 60529	Degree of Protection Provided by Enclosures (IP Code) 筐体による保護等級(IP コード)
ASTM A193/A 193M	Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications 高温又は高圧用及びその他の特殊用途向け合金鋼材とステンレス鋼ボルト締めの標準仕様
EN 10088-1:1995	Stainless steels. List of stainless steels ステンレス鋼:ステンレス鋼リスト
BSI BS EN 10204	Metallic Products Types of Inspection Documents 金属製-検査文書の種類
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) 衝撃保護等級試験(IK コード)
ABS Rules	Steel Vessel Rules (2015) 4-8-1/5.3.4; 4-8-3, 9.21;4-8-4,21.25 鋼船規則(2015 年) Offshore Support Vessels (2015) 4-8-1/5.3.4, 4-8-3/21.25 オフショア支援船(2015 年) Mobile Offshore Drilling Units (2015) 4-3-3/1.5, 4-3-3/5.1.1; 5.25 MODU(2015 年) Generally for Type Approval of junction Box 一般に接続箱の型式承認規則
AISI Type 316L ステンレス鋼 UNS31630	Standard Specification of Stainless Steel SS316L ステンレス鋼標準仕様 SS316L

7.2 略語

JB	接続箱、ジャンクションボックス
ATEX	欧州防爆指令
ASTM	米国試験材料協会
ISO	国際規格化機構
IEC	国際電気標準会議
SS	ステンレス鋼
GRP	ガラス繊維強化プラスチック
OSHA	労働安全衛生曲
IP	外郭による保護
IS	本質安全
BS	英国工業規格
AS/NZ	オーストラリア及びニュージーランド規格
IECEx	IEC 規格に基づく防爆機器の国際検定スキーム

8 技術要求事項と比較

8.1 計器接続箱

計器接続箱は多くの用途で必要とされる。

- プロセス制御システム
- 安全計装システム
- 火災ガスシステム
- 高完全性保護システム
- 電気通信システム
- 構内放送非常警報システム(PAGA)

上の表は様々な船舶と様々な造船所の様々なプロジェクトから収集したデータを示している。比較によるギャップ分析を実施し、計装用接続箱についての推奨事項をTable 3 に示した。一般に、様々な造船所のプロジェクトで最も頻繁に推奨されている規格は次の通りである。

- IEC 60078-0 設備の一般規定
- IEC 60079-7 安全性"e"向上による機器保護
- NEC 500/NEMA 4、4X/ICE 60529
- ATEX/IECEx

Table 3: 接合箱設計基準提案のための比較

パラメーター	規格					
	IEC	NEMA	BS/AS/NZ	ASME	ASTM	その他
材料	EN/IEC 60079-0; 60079-1; 60079-7; 60079-11	NEMA 4X	1.4404 marine grade Stainless Steel (AISI 316L grade	ASME SA240 316L	ASTM A 240, Grad 316 L	Norsok Z010 sec.13
安全等級	IEC60079-7		AS/NZS 60079; clause 5 of AS/NZS 60079-14 BS EN 60079			
保護等級	IEC60529 3.4, Table 1 & Table 2;	NEMA IEC 60529	BS EN 60529; AS 60529.			Norsok Z010 Sce.4.2
端子タイプ	IEC 60947-7-1					UL600
ケーブル導入口						
ケーブル導入装置	IEC 60423					
接合箱接地						Norsok Z010 Sec.10.5
温度等級 & ガスグループ	CENELEC 規格					

ブリーザプラグ		AS/NZS 60079				
寸法						
ドアタイプ					ANSI/SDI A250.8-2014	
後板						
ラベリング						Norsok Z010 sec.12

9　引用文献

[1] IEC 60529 Ed. 2.2 b: 2013: Degrees of protection provided by enclosures
外郭による保護等級

[2] IEC 60079-0 Equipment- General Requirements
設備の一般規定

[3] IEC 60079-7 Equipment protection by Increased Safety “e”
安全性”e”向上による機器保護

[4] UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations
電気機器のエンクロージャー、非防爆容器

[5] IEC 61892 Mobile & Fixed Offshore Units: Electrical Installations
移動式及び固定式オフショアユニット:電気設備

[6] AS/NZS 60079.10.1:2009 Explosive atmospheres - Classification of areas explosive gas atmospheres
爆発環境 –爆発ガス環境区域の等級

[7] IEC 60204: International Electro technical Contractors Standard for Safety of Machinery/Electrical Equipment with Machinery
機械類の安全性/機械の電気装置についての国際電気標準会議規格

[8] National Electrical Code® (2005) 500 (See also NEC® Handbook)
電気配線・電気設備設置規定

[9] NORSOK Z010, Electrical, Instrumentation and Telecommunication Installation
電気、計装及び電気通信設備

[10] AS/NZ Electrical Installation (Australia/ New Zealand Wiring Rules)
AN/NZ 電気架設(オーストラリア/ニュージランド配線規則)

V. 検査要求事項の　規格化

検査要求事項規格化

1. 序文

2. 用語・定義

3. 略語

4. 検査要求事項の概説

5. 相違点分析

6. 参考文献

1　序文

構造物の艤装品に対する検査要求事項の規格化が提案されている。 本文書の主目的は、各種オフショアプロジェクトの事例からプロジェクト要求事項の多様性と厳しさを調査し、業界基準と比較して構造物艤装品の検査に対する標準要求事項を提案することである。

1.1 調査範囲

構造物の艤装品に対する検査要求事項は、オフショアプロジェクトに対しても業界基準においても調査をしている。プロジェクト特有の要求事項を業界基準と比較し、相違点分析の結果に基づき規格化要求事項を提案する。本報告書で提案されている規格化要求事項は、オフショア構造物における構造物の艤装品検査のベースライン要求事項として利用でき、トップサイドの第二次・第三次の構造物艤装品の検査にも限定的だが適用可能である。

1.2 規制・規約・基準

下記の文書が本プロジェクトで規範的に引用されている。

TABLE 1:　規範的参考文献

基準	題目
ISO19901-3	石油・天然ガス業界ーオフショア構造物に対する特定要求事項ーPART 3 トップサイド構造物
ISO 19902	石油・天然ガス業界ー固定スチールオフショア構造物
NORSOK, M-101	構造物用スチール組立製作

基準	題目
NORSOK, N-004	スチール構造物の設計
NORSOK, M-120	構造物用スチール用資材データシート
ABS MODU	建築物・分類の規定ー可動式オフショア掘削ユニット、PART 3 船体建造・機器
	建築物・分類の規則ー可動式オフショア掘削ユニット、PART 7 測量
EN ISO 14122-1	機械の安全性ー恒久的機械利用手段ーPART 1:2レベル間通路の固定手段の選択
EN ISO 14122-2	機械の安全性 － 恒久的機械利用手段－ PART 2: 作業用プラットホームと通路
EN ISO 14122-3	機械の安全性ー恒久的機械利用手段ーPART3:階段・段梯子・手すり
EN ISO 14122-4	機械の安全性ー恒久的機械利用手段ーPART4:固定梯子
NORSOK, M-101	作業環境
NORSOK, N-004	建築用部品・機器
ANSI/ASSE A1264.1	作業現場の歩行/作業表面の安全要求事項及びそれら経路;作業現場、床、壁、屋根開口部;階段;手すりシステム
ANSI A14.3	梯子ー固定ー安全要求事項
AS 1657	固定プラットホーム、通路、階段、梯子ー設計、建造、設置
BS 4592-1	工業用床・階段の踏み板:グレーチングー仕様書
NORSOK, R-002	吊上げ機器
EN 1991-3	構造物への作用－ PART 3: クレーンや機械装置に起因する作用
EN 1993-6	スチール構造物の設計 - PART 6: クレーン支持構造物

2　用語・定義

非破壊検査(NDE):　NDE は損傷することなく、資材あるいは製品の特性を検査する技術・技法である。非破壊テスト(NDT)や非破壊インスペクション(NDI)、非破壊エバリュエーション((NDE)の用語も使用され、NDE には目視テスト(VT)、放射線透過テスト（RT)、超音波テスト（UT)、磁粉探傷検査/テスト（MPI 或は MT)、液体深傷テスト（PT) などが含まれる。

負荷試験:　負荷試験は、通常構造物の使用適正を確認するために行われる。本文書では、負荷試験という用語は、目付金属板とモノレールにテスト用負荷を与えることによりデザインと組立製作の適正を証明するテスト手順を述べる目的で使用されている。

3　略語

CJP	完全継手溶込み
DC	設計クラス
IC	点検カテゴリー
MT（MPI）	磁粉探傷テスト(磁粉探傷点検)
NDE（NDT）	非破壊検査(非破壊テスト)
PJP	部分的継手溶込み
RT	放射線透過テスト
SWL	安全使用荷重
UT	超音波テスト
VE（VT）	目視検査(目視テスト)
WLL	使用荷重限度

4　検査要求事項の概説

オフショアプロジェクトにおいて、構造物の臨界性・重要性の故にそれぞれの構造物や取付け部品に対する検査要求事項は当然である。依って、検査要求事項は構造物カテゴリーに類別される。構造物艤装品は通常二次と三次の構造物カテゴリーに類別されている。類別には所有主と請負業者の間で相違点があった。

4.1 構造物カテゴリー

オフショア装置の構造物構成部品は、ABS MODU における特別・一次・二次適用構造物などのグループに分けられる。NORSOK 基準によると、構造部分の設計クラス（DC）は同様に示されている。通常構造物カテゴリーは構造物構成部分あるいは継手の複雑な故障の重大性を考慮して決定される。構造物カテゴリーは、資材適用カテゴリーと検査カテゴリーに密接に関係している。

4.2 検査カテゴリー

検査カテゴリーは、構造物カテゴリーまたは設計クラスに従って定義される。目視検査、放射透過検査、超音波テスト、磁粉探傷検査が通常行われ、これらの検査方法の最低範囲が検査カテゴリーで一般的とされている。範囲は溶接継ぎ手の臨界性・重要性（資材靭性・部材の冗長性・構造物の全体的な完全性への影響）、応力レベル、負荷のタイプに影響される方角、併用中テストの可能性などに基づき定義される。

4.3 プロジェクト仕様書

建築物カテゴリーと検査要求事項は、通常プロジェクト仕様書で正当性が示されるもので、これは業界基準と地元規定要求事項と所有主基準仕様書に基づいている。参加造船所のオフショアプロジェクト経験が構造物艤装品検査の各種プロジェクト要求事項を調査する目的で収集されている。

5　相違点分析

オフショアプロジェクトの検査要求事項を互いに比較する。二次・三次構造物部品の検査要求事項は、主に構造物艤装品検査の基準要求事項を提案することに焦点をおいている。

5.1 構造物カテゴリー

構造物艤装品の構造物カテゴリーは、多種のオフショアプロジェクト用に集められている。幾つかの品目の構造物類別化に相違点があることが判明。ほとんどのオフショアプロジェクトでは、手すり、梯子、階段、格子は三次構造物とみなされている。他方、モノレール、目付金属板、プラットホーム、クレーン・ブームレストに対しては分類が多様である。

5.2 検査カテゴリー

構造物艤装品の検査カテゴリーを、各種オフショアプロジェクトに対して調べた。二次・三次構造物に対して、多様な検査要求事項があることが判明。オフショアプロジェクトは二種類ある。

検査要求事項の代わり NORSOK 基準に従わねばならないプロジェクトがあり、また検査要求事項の代わりにプロジェクト仕様書に従わねばならないプロジェクトもある。

次に、NORSOK 基準に従わねばならないプロジェクトにおいて異なった適用がある。二次構造物に対し、幾つかのプロジェクトは検査カテゴリーB と C と D を必要とするが、他のプロジェクトは検査カテゴリーB と C のみを必要とする。三次構造物に対し、幾つかのプロジェクトは検査カテゴリーE のみを必要とするが、他は NORSOK 基準に基づき検査カテゴリーD と E を必要とする。加えて、所有会社は通常詳細設計及び建造段階中に、最高要求事項すなわち二次構造物に対し検査カテゴリーB と C と D の内カテゴリーB を、また三次構造物に対し検査カテゴリーD と E の内カテゴリーE を必要とする。品質の向上と比較すると、非効率かつコスト増加となるかもしれない。コスト効率の点では、検査カテゴリーは適正に管理されなければならない。

第3に、プロジェクト仕様書に従わねばならないプロジェクトの検査範囲に対しては広範囲に渡る多様な要求事項がある。幾つかのプロジェクトの要求事項は比較的厳しい。例えば三次構造物に対し MT の 10～100% また UT の 10～20%。最も控えめな要求事項は三次構造物に対し VE100%のみで NDE は必要ない。所有会社は三次品目の幾つかが安全性と密接な関係にあるために厳格な仕様を求めることがある。必要品目のみに対し個別に厳格な要求事項を求めるのがより効率的かもしれない。それよりも、一般的な要求事項を開発することがコスト効率的には良いかもしれない。

最後に、実施方法は検査範囲の点で正確に定義されてはいない。検査の最低限範囲のパーセンテージは、検査対象の溶接の全長に対する最低の割合を意味する。溶接の長さの推定が難しい場合、溶接継ぎ手の数が広く使用されている。しかし、検査の理論的範囲は容易に推定できるが、三次構造物の溶接継ぎ手に対し NDE を実施することは容易ではない。例えば、格子、手すり、梯子、階段、プラットホームなどの構造物艤装品には通常多数の溶接継ぎ手がある。

5.3 検査範囲に対する実施方法

3種類の方法が検査範囲を定義する上で勧められている:

i) 長さベースの方法
ii) 継ぎ手ベースの方法
iii) 装置ベースの方法

製造業者が検査範囲を定義するために所有会社に適切な方法を提案することになっており、所有会社が提案された方法を検討し確認することになっている。

検査は同じ製造工程によって同じ工場で製造された製品に対して実施されるべきである。

5.3.1 長さベースの方法

溶接線が比較的長く連続している場合、検査範囲は長さで決められる。長さは、検査される溶接全長と検査カテゴリー基準で定義された NDE 範囲に基づいて推定される。

例えば、検査される甲板上の別組立モジュールでは、モジュールの突き合わせ継ぎ手の溶接の全長が 1,000m で UT と MT の 20%が妥当な検査要求事項により求められている場合、200m 以上の突き合わせ溶接が目視検査を通して無作為に選ばれ、対応する NDE が実施されなければならない。この方法は板金で組立製作された構造物に適用可能であろう。

5.3.2 継ぎ手ベースの方法

溶接部分が比較的小さく連続している場合、検査範囲は継ぎ手の数で決められる。継ぎ手の数は、溶接継ぎ手の総数と検査カテゴリー基準で定義された NDE 範囲に基づいて推定される。例えば検査対象のトップサイドの別組立モジュールの場合、甲板構造物までの手すり継手数が 100 であり MT の 5%が妥当な検査要求事項によって必要とされるなら、甲板構造物までの手すりの 5 つの継ぎ手が目視検査中に無作為に選ばれ、対応する NDE が実施されなければならない。この方法は、梁やパイプ、チューブなどの形状スチールによって組立製作された構造物に適用可能であろう。

5.3.3 装置ベースの方法

類似の設計と数量で組立制作された検査対象の構造物が比較的大量にあることがしばしばある。手すり、格子、梯子がその例である。この場合、検査範囲は製品の数で決定されることがある。その製品の数は、製品の総数と検査カテゴリー基準で定義された NDE 範囲を基にして推定される。

例えば、検査対象の手すりが 200 セットあり各手すりにつき約 20～25 の溶接継ぎ手がある場合、MT の 5%が関連検査要求事項により求められ、目視検査中に 10 以上の手すりが無作為に選定される。選定された各手すりあたりの溶接継ぎ手は無作為に選ばれ、対応の NED が実行される。検査対象の溶接継ぎ手数は検査前にステークホルダーにより決められることになっている。

6 参考文献

1. ISO 19901-3, PETROLEUM AND NATURAL GAS INDUSTRIES（石油・天然ガス業界） – SPECIFIC REQUIREMENTS FOR OFFSHORE STRUCTURES(オフショア構造物の特殊要求事項) – PART 3: TOPSIDE STRUCTURES（トップサイド構造物）, SECOND EDITION, 2014
2. ISO 19902, PETROLEUM AND NATURAL GAS INDUSTRIES(石油・天然ガス業界) – FIXED STEEL OFFSHORE STRUCTURES(固定スチールオフショア構造物), FIRST EDITION, 2007
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VI.　溶接手順の規格化

溶接手順の規格

1. 調査範囲

2. 用語・ 定義

3. 略語

4. 溶接手順認定要求事項

5. WPQ の要求事項の相違点分析

6. 参考文献

1　調査範囲

溶接手順認定の要求事項は、オフショアプロジェクトを対象として調査した。本報告では、溶接手順認定要求事項はトップサイド構造物の二次・三次構造物部品に限られている。

1.1 規制・規約・基準

下記の文書が本プロジェクトで規範的に引用されている。

TABLE　1：規範的参考文献

NO.	タイトル
AWS D1.1	構造物溶接規約 － スチール
IACS UR W	資材・溶接に関する要求事項
BS EN ISO 15614-1	金属資材の溶接手順の仕様・認定 － 溶接手順テスト － PART 1 スチールのアーク・ガス溶接及びニッケル・ニッケル合金のアーク・ガス溶接
ISO/TR 15608	金属資材の分類システムのための指針
ASME SECTION IX	溶接・蝋付け手順、溶接工、蝋付け工、溶接・蝋付け操作員のための認定基準
ABS RULES	資材・溶接の規定 PART 2
ABS MODU	建築物・階級分類の規定- 可動式オフショア掘削装置、 PART 3 船体建造・機器
ABS FPI	建築物・階級分類の規定 － 浮動式生産設備
NORSOK M-101	構造物用スチール組立制作

2　用語・定義

事前溶接手順仕様書(PWPS):　造船所あるいは製造業者は、溶接手順認定テスト(WPQT)に先立ち事前溶接手順仕様書(PWPS)を準備する。PWPS は、業界基準とプロジェクト仕様書に基づいて定義されねばならない。WPQT は PWPS に従って実施されることになる。テスト結果が容認できない場合、PWPS は造船所と製造業者によって調整されることとなり、更新された PWPS に従って WPQT が実施される。

溶接手順認定テスト(WPQT):　WPQT は、製造中に施された溶接が安定かつ高水準の性能をもたらすのに適切であることを確認する。WPQT は PWPS に基づいて実施され、多様な機械的試験が実施され、検査結果は納得のいくものであれば記録される。

手順認定記録(PQR):　PQR は、WPQT からの溶接見本の試験記録である。WPQT の完了と機械的試験と検査の満足いく結果に基づいて、試験記録が文書に記録され認可される。

溶接手順仕様書(WPS):　WPS は、多様な全ての溶接の手順を記述する公式文書である。WPS は、溶接工あるいは溶接操作員に対して認可 WPQT と PQR に基づいた安定かつ高水準の製造溶接に向けたガイドラインを提供している。

3　略語

AWS	AMERICAN WELDING SOCIETY　米国溶接協会
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION　国際規格化機構
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS　米国機械技師協会
CEQ (CE OR CEV)	炭素等量或は炭素等価量 $C_{eq} = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}(\%)$
PCM	低温亀裂感受性 $P_{cm} = C + \frac{Si}{30} + \frac{Mn}{20} + \frac{Cu}{20} + \frac{Ni}{60} + \frac{Cr}{20} + \frac{Mo}{15} + \frac{V}{10} + 5B(\%)$
SMYS	特定最低耐力強度

PWHT	溶接後の熱処理
WPQ	溶接手順認定
WPQT	溶接手順認定テスト
WPQR	溶接手順認定記録
WPS	溶接手順仕様書
QT	焼入れ・焼戻し
TMCP	加工熱制御工程
FCAW	フラックス芯金属アーク溶接
GMAW	ガス・メタルアーク溶接

4　溶接手順認可要求事項

造船所や製造会社で行われる溶接操業は、オフショアプロジェクトの船級協会あるいは所有主によって適格とされなければならない。WPQT は、造船所や製造会社の溶接手順が適格であると立証するために実施される。WPQT は、溶接機器、内部あるいは外部組立製作、溶接準備、予熱処理・溶接後熱処理そして NDT を考慮して組立製作状態を反映すべきである。

4.1 WPQ に対する本質的不確定要素

WPQ は、溶接部分を容認可能とするために重要である。例えば、溶接手順を開発し WPQT を母材金属、溶接処理加工、継ぎ手設計などによって実施するべきである。仮に厚さや傾斜など母材金属の状態が変わる場合、変更状態に対する溶接手順の再認可が必要である。本報告書では、下記カテゴリーの要求事項を考察する。

i)　基材の化学的成分
ii)　基材のスチール等級
iii)　仕上げ方法
iv)　厚さ
v)　溶接継ぎ手・位置
vi)　継ぎ手の形状
vii)　その他：溶加金属、機械的試験要求事項、溶接方法、溶接寸法、入熱、余熱温度、層間温度、溶接後熱処理

5　WPQ の要求事項の相違点分析

業界規格における WPQ に対する要求事項を、この JIP に参加している造船所が行なっているオフショアプロジェクトと比較した。必要な認定条件についての比較はそれぞれの本質的不確定要素に対してなされた。

5.1 基材の化学的成分

ほとんどのオフショアプロジェクトにおいて、同じ資材でも認可は各スチールメーカーに求められる。更に、認可は同じスチールメーカーでも各製造ベースに求められる。理論的には、スチールメーカーによっては、化学的成分と仕上げ方法の違いのために機械的性能や溶接性に差がある。しかし、化学的成分の差異がわずかである場合、溶接手順認可は、スチールメーカーに関係なく資材証明書に基づいて容認できる。例えば、炭素と低合金炭素スチールの化学的成分の違いは、スチールメーカーによっては重要ではない。特殊・一次構造物部品に関して、建造段階での設計変更は比較的少ない。主要構造物部品は、主に造船所によって組立製作され、造船所は資材供給元と密接に情報交換をすることによって設計変更に迅速な対応をしている。従って、WPQ の厳格な要求事項にも関わらず、主要構造部品に対する WPS の問題は比較的少ない。しかしながら、建造段階で二次・三次の部品に対する WPS の問題は比較的多い。二次・三次構造物の設計変更は頻繁に発生する。そのほとんどは外注されており、設計変更を考慮すると単一部品毎の資材供給元を管理するのは造船所にとって困難である。

5.2 資材等級

資材等級の要求事項を要約する。いくつかのプロジェクト仕様書は、各スチール等級毎の特別要求事項がある。幾つかのプロジェクト仕様書は、標準強度・高度強度のスチールであっても各スチール等級毎に WPQ を求めている。

AWS D1.1 と ISO15614 によると、認定範囲は資材カテゴリー次第である。溶接認定は標準強度とより高い強度のスチールに対するテストの様に同等強度とより低い強度等級に適用可能てある。高強度 QT スチールに関しては、認可溶接手順は試験済資材にのみ適用可能である。逆に、認可範囲は IACS UR W における資材等級レベルに基づいて定義される。認可溶接手順は、標準強度とより高い強度のスチールに対するテストと同等の等級と 2 等級下のレベルのスチール、そして高強度 QT スチールに対するテストと同等の等級と 1 等級下のレベルに適用可能である。

5.3 仕上げ方法

仕上げ方法に対する要求事項を要約する。各仕上げ方法毎に特有な要求事項がある。通常 TMCP スチールの溶接性は、圧延のままの(as-rolling)スチールと焼準スチールよりも勝る。よって、圧延のままの(as-rolling)スチールと焼準スチールのカバーに対する認定溶接手順は、TMCP スチールに適用可能である。しかし、プロジェクト仕様書は各仕上げ方法ごとに WPQT を求めている。この要求事項は溶接の品質向

上を意図していると思われる。厚い資材で組立制作される特殊・一次構造物に関しては、TMCP とその他の方法との間の溶接性の相違点は、より薄い資材と比較して炭素含有量の増加のために減少する。したがって、要求事項の適用可能性が、薄い資材で組立製作される二次・三次構造物に限定されるなら、業界基準での仕上げ方法に対する要求事項は認容可能である。

5.4 厚さ

AWS D1.1 によると、25mm の見本片が認可されている時、認可溶接手順は 3mm から無制限の厚さまでの平板に適用可能である。他の基準によると、厚さの範囲は 4 段階の厚さとされている。

しかし、認定範囲の厚さは 0.7t から 1.25t 内と限定されている。WPQT の実際的に必要とされる数は構造物の設計にかかっている。あらゆる厚さをカバーするには認可テストに多種類の厚さが必要である。

5.5 溶接継ぎ手・位置

溶接継ぎ手と位置に関して、プロジェクト仕様書において問題が見受けられる。例えば、開先溶接部分に対する WPQT は隅肉溶接部分に対する溶接手順を認定できないことや、WPQT は全ての溶接位置に必要とされるということ等がある。

ほとんどの業界基準では、開先溶接部分の認定手順は隅肉溶接部分に適用できる。一方、プロジェクト仕様書は開先継ぎ手と隅肉継ぎ手に対し個別に WPQT を要求するかもしれない。

AWS D1.1 によると、平板溶接で 3G 垂直−上がり位置は CVN 適用の場合、溶接位置の全てを包含する。その他の適用では、2G+3G+4G が全溶接位置をカバーするのに適格とされる。しかし、認定溶接手順は IACS UR W によって試験したのと同じ溶接位置に対して適用できる。

5.6 継ぎ手の形状

継ぎ手の形状に関しては、いくつかのプロジェクト仕様書は裏当て或は削りの変更に対して再認可を要求する。一方業界基準は通常裏当てや削りの省略あるいは削除に対して再認可を要求している。

5.7 その他の WPQ に対する不確定要素

5.7.1 埋め金

埋め金は通常業界基準に基づき選ばれる。溶加材は pWPS と認定試験で検討される。

いくつかのオフショアプロジェクトでは、造船所内で製造に使用される溶加材に対して溶接試験の実施が求めている。

各スチールメーカーに対する WPQT 要求事項と同様に、溶接消耗品のブランド名や製造場所の変更はいくつかのオフショアプロジェクトに対して再認定を求める。

5.7.2 硬さ試験要求事項

IACS UR W28 によると、硬さ試験は資材等級が SMYS>355MPa のみに対して求められる。幾つかのオフショアプロジェクトでは硬さ試験を全ての WPQT に対し求めている。

加えて、硬さ値の容認可能判定基準に相違点がある。DNV-OS-C401 によると、350HV10 が最高容認可能判定基準である。場合によっては、業界基準より一層保守的な判定基準が求められ、プロジェクトスケジュールに影響を及ぼした。

5.7.3 溶接工程

認可 WPQT で適用される溶接工程は生産中においてのみ適用できる。幾つかの所有会社は環境事情に敏感なため、生産への FCAW と GMAW の適用の回避を望んでいる。幾つかのプロジェクト仕様書は、FCAW の適用に対し所有会社の正式承認を必要としている。この場合、製造業者によってバッチ試験や生産試験などの追加試験が製造業者により実施されることになる。また製造業者が生産に GMAW を適用することを禁止した所有主がいる。しかし、FCAW と GMAW は基準溶接工程として AWS D1.1 に記載されており、本質的多様性に対する要求事項も AWS D1.1 で定義されている。

5.7.4 溶接寸法

溶接寸法は、業界基準と作業場慣例を考慮して設計される。幾つかのプロジェクト要求事項は WPQT と比較してより悪い状態へ、例えば開先角度やルート間隙の減少またルート面の増加などの変更に対して再認定を必要とする。

しかし、ルート間隙寸法に問題がある。いくつかの所有会社は裏当て材自体の使用の回避を望んでいる。裏当てが入手不能の場合、最高 3mm のルート間隙が許容される。建造の観点では、3mm の許容は組立製作の正確性を達成するには厳しすぎる判定基準である。裏当て材の適用は一般的組立製作方法の一つであるため、適切な認可が行われるなら、これが適用可能なはずである。

5.7.5 入熱

許容入熱は通常各種の業界基準に基づき±25%である。幾つかのオフショアプロジェクトでは厳しい許容値例えば±10%が求められている。

5.7.6 予熱・層間温度

予熱・層間温度の許容値は業界基準で定義されている。溶接工程によるが、通常は -15℃ (or -55℃)から +55℃である。プロジェクトによっては多様な要求事項がある。しかし、予熱・層間温度のプロジェクト要求事項は重要ではない。これは溶接技師が特定の要求事項を考慮して WPQT を実施し、また造船所が予熱・層間温度を制御し損なうことはほとんどないためである。

しかし、幾つかのプロジェクトの要求事項は AWS D1.1 勧告のみの適用を求めている。例え溶接技師が最適化した予熱・層間温度を開発できても、プロジェクト仕様書は AWSD1.1 の勧告表に拘束されている。WPQT と AWS 勧告との間の条件は

時々異なる。WPQT での認定加熱温度を WPS に適用することがより妥当であるかもしれない。

5.7.7 後加熱

後加熱温度の許容温度と時間は業界基準で定義されており、また基材に適用される資材タイプと仕上げ方法による。プロジェクトによって多様の要求事項があるが、後加熱のプロジェクトごとの要求事項は重要ではない。これは特定の要求事項を考慮して溶接技師が WPQT を実施および造船所が溶接後加熱の温度と時間の制御をし損なうことはほとんど無いからである。

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VII. 機器の規格化

1　序文

主なトップサイド機器パッケージは、オフショアプロジェクトにおける炭化水素等がどの品目（ユーティリティー用非炭化水素・炭化水素の品目から、プロセス用非炭化水素・高圧炭化水素の品目まで）に適用可能かどうかによって分類される。それぞれの機器は主要な規格化手順と判定基準に従って精査される。

2　計器用空気圧縮機

計器用空気パッケージはオフショア・オンショアでの設置のニーズを満たすべく、特に安全地帯と危険地帯の分類が必要とされる場合には度々特別注文で作られる。典型的な計器用空気架台パッケージは主要弁の圧搾空気制御・作動から緩衝密封ガスまでの広範囲な適用のために高品質の乾燥空気を提供するドライヤーと濾過システムを備えた多数の圧縮機を備えている。

規格化は動力伝導トレイン上の電気モーターや結合回路と歯車によって駆動される回転型容積式圧縮機（無含油）を考慮に入れている。また空気圧縮機架台上に設置される補助機器及びシステムの構成部品も含まれる。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Instrumentation Air Compressor Package developments for offshore applications with safety as critical factor while still being economic.	This specification of instrument air compressor defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 10440-2:2001 Rotary Type Positive Displacement Compressors for Petroleum, Petrochemical and Natural Gas Industries, Part 2: Packaged Air Compressors (Oil-Free).	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This specification covers the Rotary-type Positive Displacement Compressor (oil free) driven by an electrical motor as well as couplings and gears on the power transmission train. Also included are auxiliary equipment and system components installed on the air compressor skid.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification is not applicable to: 1. oil injected rotary compressors 2. compressors with discharge pressure above 20 bar 3. compressors with flowrates above 6000 Nm3/h 4. high voltage electric motors (nominal voltage (phase to phase)) exceeding 11 kV) 5. variable-speed electric motors 6. compressors on process gas duties 7. Hazardous area installation.	N/A
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.

Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	ISO 10440-2 Rotary Type Positive Displacement Compressors for Petroleum, Petrochemical and Natural Gas Industries, Part 2: Packaged Air Compressors (Oil-Free) ISO 1328 cylindrical gears — ISO system of flank tolerance classification ISO 1217 Displacement Compressors - Acceptance tests ISO 8573 Compressed Air-Part 1: Contaminants and Purity Classes and Part 2 to Part 9 for Test Methods ISO 1328-2 Cylindrical Gears - ISO System of Accuracy - Part 2: Definitions and allowable values of deviations relevant to radial composite deviations and runout information ISO 5011 Inlet air cleaning equipment for internal combustion engines and compressors -- Performance testing ISO 6336 Calculation of Load Capacity of Spur and Helical Gears ISO 10441 Petroleum and Natural Gas Industries - Flexible couplings for mechanical power transmission - special purpose applications ISO 281 Rolling Bearings - Dynamic load ratings and rating life ISO 7005-1 Metallic flanges - Part 1: Steel flanges ISO 9329-2 Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2:	N/A

	Unalloyed and alloyed steels with specified elevated temperature properties ISO 9329-4 Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 4: Austenitic stainless steels ISO 2151 Acoustics Noise test code for compressors and vacuum pumps engineering method ISO 9614-2 Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning ISO 1940 Mechanical vibration -- Balance quality requirements for rotors in a constant (rigid) state. ISO 1996-2 Acoustic – Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels EN 13445 Unfired Pressure Vessels EN 13480 Metallic Industrial Piping ASME Boiler and Pressure Vessel Code ASME B31.3 Process Piping ASME B16.5 Pipe Flanges and Flanged Fittings IEC 60034 Rotating Electrical Machines IEC 60092 Electrical Installations in Ships IEC 60332-3 Tests on Electrical and	

	Optical Fiber Cables under fire conditions IEC 60364 Low-voltage Electrical Installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors IEC 61672-1 Electro Acoustics - Sound Level Meters – Part 1: Specifications API STD 541 Form-wound Squirrel-Cage Induction Motors-500 Horsepower and Larger API STD 547 General-purpose Form-wound Squirrel Cage Induction Motors-185 kW (250 hp) through 2240 kW (3000 hp) AGMA 6013 Standard for Industrial Enclosed Gear Drives	
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the instrument air package	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the instrument air compressor package.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on	Global reach and standard	N/A

stakeholders	harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	

3　窒素発生機

窒素ガスの使用は、石油・ガスのプラットフォーム、強制石油回収、精製、石油・ガスの抽出及び破砕などへの石油適用に理想的である。散水パイプの腐食、製品劣化・汚染を効果的に遅速化あるいは防止し、また最も重要なのは爆発や火災の危険を除くことである。掘削操業を支えるのに使われる窒素は計器パネル不活性ガス置換・焼棄ガス不活性ガス置換、そして圧力システムの浄化・テストに利用可能である。また、窒素はエンジン始動機、制御装置、大型乾燥積荷の移動・吊り上げシステム用にも供給される。乾燥給気により、窒素はいくつかのシステムの耐用期間を延ばし、また故障を防止することができる。

規格化に向け考慮されている窒素発生パッケージは下記に限らないが、下記のものを含めて架台上に設置される補助機器を含む皮膜処理に基づくものである。

- 全濾過(2x100%);
- 電気ヒーター(2x100%units);
- 微粒子フィルター(2x100%units);
- 膜層;
- 連動配管、バルブ、菅類
- パッケージ計器装備・配線
- パッケージ全体用の構造用スチール架台

この規格化は下記の窒素発生パッケージには適用されない:

- 窒素発生用の皮膜以外の技術を使用するもの;
- 船体内の主積荷タンクを覆うのが主要機能であるもの;
- 設計圧力が 2.0MPa より高いもの

Procedure	Criteria	Process
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Nitrogen Generator developments for offshore applications with safety as critical factor while still being economic.	This specification of Nitrogen Generators define the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 8573-1 Compressed Air-Contaminants and Purity classes	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	This specification defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packaging, installation, commissioning and documentation of membrane based nitrogen generation packages for use on an offshore facility. This specification covers nitrogen generation packages based on the membrane process including auxiliary equipment installed on-skid including, but not necessarily limited to: - Pre-Filtration (2x100%); - Electrical Heaters (2x100 % units); - Particulate Filters (2x100 % units); - Membrane banks. - Interconnecting piping, valves and tubing; - Package Instrumentation and cabling; - Structural steel skid for entire package; This specification is not applicable to nitrogen generation packages which: - use a technology other than membranes for generating nitrogen; - have the primary function of blanketing main cargo tanks in a hull; - have design pressures above 2.0 MPa This specification can be applied to nitrogen generation packages installed inside enclosures subject to agreement between the purchaser and manufacturer. Special consideration shall be given to the risks associated with oxygen deficient and enriched atmospheres for packages installed inside an	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

	enclosed space.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	Interconnecting piping and cabling between skids, where more than one skid is required. Nitrogen storage vessels and compressors are excluded from the scope of this specification. Non-return valves in the inert gas header will be supplied by the project. Nitrogen generation package supplier shall include non-return valves, as necessary, to protect the nitrogen generation package and permit safe operation.	N/A
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.

Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Normative References	ISO 7005-1:1992 Metallic flanges — Part 1: Steel flanges ISO 9329-2:1997 Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Unalloyed and alloyed steels with specified elevated temperature properties ISO 9614-2 Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning ISO 9329-4:1997 Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Austenitic stainless steels IEC 60092 Electrical Installations in Ships IEC 60079-0 Explosive atmospheres – Part 0: Equipment – General requirements IEC 60079-14 Explosive atmospheres – Part 14: Electrical installations design, selection and erection IEC 60079-17 Explosive atmospheres - Part 17: Electrical installations inspection and maintenance IEC 60331 Tests for electric cables under fire conditions – Circuit integrity IEC 60032 Tests on Electrical & Optical Fiber Cables under fire conditions EN 13445 Unfired pressure vessels EN 13480 Metallic Industrial Piping BS EN ISO 15614-1 Specification and qualification of welding procedures for metallic materials -Welding procedure test BS EN ISO 3834 Quality requirements for fusion welding of metallic materials BS EN ISO 9000 Quality management System BS EN ISO 9001 Quality Systems	N/A

	PD 5500 Specification for unfired, fusion welded pressure vessels ASME IX Welding, Brazing, and Fusing Qualifications ASME V Non-Destructive Examination ASME VIII Boiler and Pressure Vessel Code: Rules for Construction of Pressure Vessels ASME B16.20 Metallic Gaskets – Ring Joint, Spiral Wound and Jacketed ASME B16.21 Non-metallic Flat Gaskets for Pipe Flanges ASME B16.5 Pipe Flanges and Flanged Fittings ASME B31.3 Process Piping AWS D1.1 Structural Welding Code+E1:E5	
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the instrument air package	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the instrument air compressor package.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

4　可搬式水発生装置

真水は一般に蒸発方法あるいは逆浸透（RO）を利用して船上で作られる。
船上で使用されている多種類の真水発生装置のうち主なものは:

- 水没菅式真水発生装置
- プレート式真水発生装置、そして
- 逆浸透設備一式

一般に船上の真水発生装置の本体部分は 2 つの区画部分を持つ大きな円筒体より構成されている。区画部分の一方は復水器であり、他方は蒸発器である。真水発生装置はまた熱交換器、隔離体そして必要な真空状態を発生させる排気装置より成る。真水ポンプと排出装置ポンプは水を真水発生器までまた真水発生器から移動させる。プレート式真水発生装置の作動原理は水没菅式のものと同じである。唯一の違いは使用する熱交換器の型式である。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Potable Water Generators for offshore applications with safety as critical factor while still being economic.	This specification of Potable Water Generators defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 15748-1:2002 Ships and marine technology - Potable water supply on ships and marine structures - Part 1: Planning and design	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	This part of ISO 15748 applies to the planning, design and configuration of potable water supply systems on ships, stationary or floating marine structures and inland navigation vessels. This part of ISO 15748 specifies the minimum requirements for potable water supply systems to be met in order to protect the potable water and to maintain its quality.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification is not applicable to: 1. oil injected rotary compressors 2. compressors with discharge pressure above 20 bar 3. compressors with flowrates above 6000 Nm3/h 4. high voltage electric motors (nominal voltage (phase to phase)) exceeding 11 kV) 5. variable-speed electric motors 6. compressors on process gas duties 7. Hazardous area installation.	N/A
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.

Normative References	ISO 7-1, Pipe threads where pressure-tight joints are made on the thread — Part 1: Dimensions, tolerances and designation ISO 65, Carbon steel tubes suitable for screwing in accordance with ISO 7-1 ISO 161-1, Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series ISO 228-1, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation ISO 274, Copper tubes of circular section — Dimensions ISO 426-2, Wrought copper-zinc alloys — Chemical composition and forms of wrought products — Part 2: Leaded copper-zinc alloys ISO 1127, Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length ISO 1635, Wrought copper and copper alloys — Round tubes for general purposes — Mechanical properties ISO 4200, Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length ISO 5620-1, Shipbuilding and marine structures — Filling connection for drinking water tanks — Part 1: General requirements ISO 14726-1, Ships and marine technology — Identification colours for the contents of piping systems — Part 1: Main colours and media ISO 14726-21), Ships and marine technology — Identification colours for the contents of piping systems — Part 2: Additional colours for different media and/or functions ISO 15748-2, Ships and marine technology — Potable water supply on ships and marine structures — Part 2: Method of calculation SOLAS 1974, International Convention for the Safety of Life at Sea, 1974	N/A

Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the instrument air package	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the instrument air compressor package.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

5　塩素処理パッケージ

石油・ガス業界の上流プロセスにおける主な課題の一つはパイプラインと処理機器を生物学的汚損から守ることである。海水処理保護に関わる工学技術分野が果たす役割はマクロ・ミクロの汚損結果に因する生産中止期間を防止する上で不可欠である。冷却水流量の制約、腐食の加速化、処理機器の全体的耐用期間の短縮は全て塩素処理パッケージの効果的な設計によって制御することが可能である。

海水塩素処理システムは一般的に中核の電解槽電池配列とそれに関連した変圧器/整流器、自動配水ポンプ、貯蔵タンク、処理配管で構成されている。このシステムは海水循環回路への直接注入用次亜塩素酸ナトリウムの安全な希釈液をその場で製造する。

Procedure	Criteria	Process
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Chlorination Package developments for offshore applications with safety as critical factor while still being economic.	This specification of Chlorination Packages defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on MEPC.227(64), MEPC.157(55))	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This specification covers the Chlorination Packages. Also included are auxiliary equipment and system components installed on the air compressor skid. This includes a core electrolyzer cell arrangement with associated transformer/rectifier, dosing pumps, storage tanks and process piping.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	N/A	The limitation will be determined after Gap analysis
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the	N/A

	common requirements.	
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	N/A	N/A
Application	Offshore Utility Non-Hydrocarbon	
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Chlorination package	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Chlorination Package	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

6　海水粗目フィルター

海水はシリカ固形物から有機物や特に粘質のプランクトンまでに及ぶ汚染物質を含んでいる。これら汚染物質はその他のゴミとともに濾過サイクル中にフィルタースクリーンにへばりつき究極的に除去が非常に難しくなり得る。

粗目フィルターの目的は処理機器に沈着し湯垢や腐食部分を引き起こし得る粗い浮遊固形物を除去することである。

粗目フィルターでの濾過は一般に 50 ミクロンから 2,0002,000 ミクロンの範囲で可能である。フィルターの洗浄は自動逆洗を利用して達成され、ユニットの差圧が最高値まで増加したりあるいは流量が過度に妨げられた場合に必要となる。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Sea Water Coarse Filter developments for offshore applications with safety as critical factor while still being economic.	This specification of sea water coarse filters defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	N/A	The baseline spec is to be identified by the workgroup after a gap analysis between various operator specifications.
Scope	N/A	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard	N/A

	6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	N/A	The limitation will be determined after Gap analysis
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	N/A	N/A
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Sea Water Coarse Filter	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Sea water coarse filter.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A

Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

7　散水架台

散水システムは水冷での適用、水供給から泡だてシステムや人員保護まで固定式防火システムで不可欠な要素である。

固定式防消火システムの一部としての散水架台はシステムへの水の供給量制御装置を備えている。これはオン/オフ制御から圧力制御装置にまで及ぶ。消火システムの重要な部分として、散水架台が用途に最適であるよう設計されていることが不可欠である。

散水架台の各種の型式や機器構成が基準化プロセスで考慮されている。

散水架台は散水バルブ・下流散水システムの適切な作動のための機器のパッケージである。散水システムは自動か手動で作動する固定パイプシステムであり水供給装置と作動される散水バルブの下流に接続されており、一定の範囲への水または水泡液を均等な量放出できるように配列された複数の先端が開いた噴霧ノズルが備わっている。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Deluge Skid developments for offshore applications with safety as critical factor while still being economic.	This specification of Deluge Skids define the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 13702:2015 Petroleum and natural gas industries — Control and mitigation of fires and explosions on offshore production installations — Requirements and guidelines (oil-free)	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This specification defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing,	The intent of selection of scope is to include all aspect of the equipment such as:

	installation, commissioning and documentation of a deluge skid for use on an offshore facility. This specification covers the various types and configurations of deluge skids utilized on offshore installations.	design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	N/A	The limitation will be determined after Gap analysis
Gap Analysis	A Gap analysis is to be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.

Normative References	ISO 6182-5 Fire Protection- Automatic sprinkler systems – Part 5: Requirements and test methods for deluge valves- Third Edition BS EN 12259-9 (DRAFT) Fixed firefighting systems - Components for sprinkler and water spray systems NORSOK STANDARD S-001 Technical Safety API RP 14G Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms NFPA 13 Standard for the Installation of Sprinkler System NFPA 15 Standard for Water Spray Fixed Systems for Fire Protection NFPA 16 Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems IMO FSS Code - Fire Safety Systems – Resolution MSC.98(73) MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 –Resolution A.1023(26) UL 260 Standard for Dry Pipe and Deluge Valves for Fire-Protection Service FM 1011-1012-1013 Deluge and Preaction Sprinkler Systems	N/A
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the instrument air package	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Deluge Skid Packages.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the	N/A

	Vendor.	
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

8　ユーティリティー圧力容器

圧力容器は大気圧力と大幅に異なる圧力でガス又は液体を保持するよう設計された容器あるいはタンクである。空気受けタンク、脱気塔、ヘッダータンクなどのユーティリティー目的/適用に設計された圧力容器のみがステージ1のユーティリティー圧力容器の範囲に含まれる。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pressure Vessels developments for utility application developments with safety as a critical factor while still being economic.	This specification for Pressure Vessels defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on ASME Boiler and Pressure Vessel Code Section VIII/ISO16528-1.	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	The scope of this specification includes the following: a) welding end connection for the first circumferential joint for welded connections; b) first threaded joint for screwed connections; c) face of the first flange for bolted, flanged connections;	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

	d) first sealing surface for proprietary connections or fittings; e) safety accessories, where necessary.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification does not apply for nuclear components, railway and marine boilers, gas cylinders or piping systems or mechanical equipment, e.g. turbine and machinery casings	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	API Std. 527 - Seat Tightness of Pressure Relief Valves ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form) ANSI/ASME B1.20.1 - Pipe Threads, General	N/A

	Purpose (Inch) ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250 ASME B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 Through NPS 24 Metric/Inch Standard ASME B16.9 - Factory-Made Wrought Buttwelding Fittings ASME B16.11 - Forged Fittings, Socket-Welding and Threaded ASME B16.15 - Cast Copper Alloy Threaded Fittings, Classes 125 and 250 ASME B16.20 - Metallic Gaskets for Pipe Flanges — Ring-Joint, Spiral– Wound, and Jacketed ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500, and 2500 ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300 ASME B16.47 - Large Diameter Steel Flanges, NPS 26 Through NPS 60 Metric/Inch Standard ASME B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) ASME B36.10M - Welded and Seamless Wrought Steel Pipe ASME PCC-1 - Guidelines for Pressure Boundary Bolted Flange Joint Assembly ASME PCC-2 - Repair of Pressure Equipment and Piping ASME PTC 25 - Pressure Relief Devices ASME QAI-1 - Qualifications for Authorized Inspection ACCP - ASNT Central Certification Program ANSI/ASNT CP-189 - ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel ASNT SNT-TC-1A - Recommended Practice	

	for Personnel Qualification and Certification in Nondestructive Testing ASTM D56 - Standard Test Method for Flash Point by Tag Closed Tester ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester ASTM E3 - Standard Guide for Preparation of Metallographic Specimens ANSI/API Std. 521 - Pressure Relieving and Depressuring Systems ASTM E125 - Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings ASTM E140 - Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness ASTM E186 - Standard Reference Radiographs for Heavy-Walled [2 to 41/2-in. (51 to 114-mm)] Steel Castings ASTM E208 - Standard Test Method for Conducting Drop-Weight Test to Determine Nil– Ductility Transition Temperature of Ferritic Steels ASTM E280 - Standard Reference Radiographs for Heavy-Walled [41/2 to 12-in. (114 to 305-mm)] Steel Castings ASTM E446 - Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness ANSI/UL-969 - Marking and Labeling Systems ISO 148-1 - Metallic Materials — Charpy Pendulum Impact Test Part 1: Test Method ISO 148-2 - Metallic Materials — Charpy Pendulum Impact Test Part 2: Verification of Testing Machines ISO 148-3 - Metallic Materials — Charpy Pendulum Impact Test Part 3: Preparation and Characterization of Charpy V-Notch Test Pieces for Indirect Verification of Pendulum	

	Impact Machines ASME B1.13M - Metric Screw Thread — M Profile ASME B1.21M - Metric Screw Thread — MJ Profile ASME B18.2.3.3M - Metric Heavy Hex Screws ASME B18.2.3.5M - Metric Hex Bolts ASME B18.2.3.6M - Metric Heavy Hex Bolts ASME B18.2.6M - Metric Fasteners for Use in Structural Applications ASTM C695 - Standard Test Method for Compressive Strength of Carbon and Graphite ASTM C709 - Standard Terminology Relating to Manufactured Carbon and Graphite ASTM E4 - Standard Practices for Force Verification of Testing Machines ASTM E177 - Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods ASTM E691 - Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method ANSI/AWS A4.2M - Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal	
Application	Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of Pressure Vessels for utility applications	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Pressure Vessels for utility applications	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the	N/A

	Vendor.	
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

9　柱脚取付けクレーン

柱脚取付けクレーンは物資や人員を船舶やバージや建造物へまたはこれらから移動させるために使用される上昇・回転・吊り上げ装置用に設計されたオフショアクレーンと定義されている。

規格化範囲に入る典型的な適用は:

- オフショア石油探索・生産への適用;これらのクレーンは概して掘削・生産操業中に使用される固定(底部が支えられている)建造物、浮動プラットホームあるいは船体艇上に取り付けられる。
- 船上適用:クレーンは港や屋根のついた場所にあるが、これらのクレーンは表面形の船舶上に取り付けられ、貨物・コンテナ・その他の物資の移動に使用される。
- 重量物適用;重量物吊り上げ適用のクレーンはバージ、自動上昇船舶あるいはその他の船舶に設置され、港又は屋根のついた場所内もしくは限られた(穏やかな)環境状態での建設・引揚げ操業に使用される。
- 水中吊り上げリフト適用;重量物吊り上げオフショアクレーンは無人物体の水中吊り上げのために使用される。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pedestal Mounted Crane developments for offshore applications with safety as critical factor while still being economic.	This specification of Pedestal Mounted Cranes define the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

Baseline Standard	This specification is based on API 2C, Specification for Offshore Pedestal Mounted Cranes	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	This specification details the requirements for design, construction, and testing of offshore pedestal mounted cranes. Offshore cranes are defined herein as pedestal mounted elevating and rotating lift devices of the types for transfer of materials or personnel to or from marine vessels and structures. Offshore cranes are typically mounted on a fixed (bottom supported) or floating platform structure used in drilling and production operations.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	API Spec 2C is not intended to be used for the design, fabrication, and testing of davits and/or emergency escape devices. API Spec 2C is also not intended to be used for shipboard cranes or heavy lift cranes.	N/A
Gap Analysis	A Gap analysis is to be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A

Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Normative References	API RP 2A Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design API RP 2D Recommended Practice for Operation and Maintenance of Offshore Cranes API Spec 2H Specification for Carbon Manganese Steel Plate for Offshore Platform Tubular Joints API RP 2N Recommended Practice for Planning, Designing, and Constructing Structures and Pipelines for Arctic Conditions API RP 2X Recommended Practice for Ultrasonic Examination of Offshore Structural Fabrication and Guidelines for Qualifications of Technicians API Spec 9A Specification for Wire Rope API RP 14C Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms API RP 14F Recommended Design and Installation for Unclassified and Class I, Division 1 and Division 2 Locations API RP 500 Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2 API RP 505 Classification of Locations for Electrical Installations at Petroleum Facilities Classified	N/A

	as Class I, Zone 0, Zone 1 and Zone 2 ABMA Std 9 Load Ratings and Fatigue Life for Ball Bearings ABMA Std 11 Load Ratings and Fatigue Life for Roller Bearings AGMA ANSI 6010-F97 Standard for Spur, Helical, Herringbone and Bevel Enclosed Drives AGMA ANSI 2001-C95 Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth AGMA 908-B89 Information Sheet—Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical, and Herringbone Gear Teeth AISC Manual of Steel Construction— Allowable Stress Design, 9th Edition ANSI A14.3 Safety Requirements for Fixed Ladders ANSI A1264.1 Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems ANSI B18.2.1 Square and Hex Bolts and Screws (Inch Series) ASME Boiler and Pressure Vessel Code, Section IX—Welding and Brazing Qualifications ASNT SNT-TC-1A Recommended Practice SNT-TC-1A ASTM A 295 Standard Specification for High-Carbon Anti-Friction Bearing Steel ASTM A 320/A 320M Standard Specification for Alloy/Steel Bolting Materials for Low-Temperature Service ASTM A 578/A 578M Standard Specification	

	for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications ASTM A 770/A 770M Standard Specification for Through-Thickness Tension Testing of Steel Plates for Special Applications ASTM E 23 Standard Test Methods for Notched Bar Impact Testing of Metallic Materials ASTM E 45 Standard Method for Determining the Inclusion Content of Steel AWS D1.1 Structural Welding Code—Steel AWS D14.3/D 14.3M Specification for Welding Earthmoving and Construction Equipment ISO Roller bearings—Dynamic load ratings and rating life ISO TS 13725 Hydraulic fluid power—Cylinders— Method for determining the buckling load SAE J115 Safety Signs for Construction Equipment SAE J429G Mechanical and Material Requirements for Externally Threaded Fasteners SAE J919 Sound Measurement—Off-Road Work Machines—Operator—Singular Type	
Application	Offshore Application	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of Pedestal Type Cranes	The baseline requirements will be verified with the vendors for existing practices
Inspection and testing	Provides baseline requirement for inspection, and testing for pedestal mounted cranes.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the	N/A

	Vendor.	
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

10　救命艇

救命艇は非常事態で退船時から乗り込んだ人員の生命を支えることができる小型船である。「救命ボート」あるいは「救命ラフト」と呼ばれている。この基準範囲は救命艇/救命ボート/救命ラフトの統一した要求事項と共通要求事項を規定することを含む。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Survival Craft developments for offshore applications with safety as critical factor while still being economic.	This specification of Survival Craft defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	46 CFR 119.100, 46 CFR 108.540, 45CFR 133.130, SOLAS 1974	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	N/A	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	In the case of passenger ships which are employed in special trades for the carriage of large numbers of special trade passengers, such as the pilgrim trade, the Administration, if satisfied that it is impracticable to enforce compliance with the requirements of this chapter, may exempt such ships from those requirements, provided that such ships comply fully with the provisions of: .1 the rules annexed to the Special Trade Passenger Ships Agreement, 1971; and .2 the rules annexed to the Protocol on Space Requirements for Special Trade Passenger Ships, 1973. (SOLAS Reg. III/2.2) Not Applicable to Vessels under 500 gross tons	N/A
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an	N/A

	acceptable level of safety.	
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	DNV Rules for Classification of Ships Part 3 Chapter 6 Life Saving Appliances and Arrangements	N/A
Application	Offshore Utility Non-Hydrocarbon	
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Survival Craft	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Survival Craft.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

11　汚水処理パッケージ

船上で発生する汚水は長期間船上で保管できず、海に廃棄せねばならない。汚水は汚水廃棄に関して従わねばならない幾つかの規制があるため船から直接廃棄できない。

海上の汚水は一般にトイレ、小便器、手洗い場甲板排水口から生ずる排泄物である。規則では、汚水は汚水処理後にのみ海水中に廃棄でき、また船から最短の陸までの距離は4海里なければならない。

市場には様々な汚水処理法があるが、それらの最も一般的なのは生物学的なタイプのもので、通気室、沈降タンク、塩素処理・回収室より構成されている。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Sewage Treatment Packages developments for offshore applications with safety as critical factor while still being economic.	This specification of Sewage Treatment Packages defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on MEPC.227(64), MEPC.157(55))	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This specification covers the Sewage Treatment Packages.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	The limitations for the standardized spec will be identified after a gap analysis.	N/A
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	The Normative references will be finalized after the gap analysis.	N/A
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Sewage Treatment Packages	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.

Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Sewage Treatment Package.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

12　海水汲み上げポンプ

海水汲上げポンプの主な機能は水噴射などのトップサイド処理用や居住部用に海水を供給することである。

規格化の範囲にはオフショア施設用の海水汲上げポンプの設計、製造、組立て、製品検査、設置、テストに対して最少の要求事項が含まれている。それらは:

- 船体の外側に(外部パイプか船体金属板の外側の潜函によって支えられて)設置される。
- 導管/潜函の不可欠部として船体内に建造される内部導管/潜函の中に設置される。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Sea Water Lift Pump developments for offshore applications with safety as critical factor while still being economic.	This specification of Sea Water Lift Pumps defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

Baseline Standard	This specification is based on ASME B31.1 Power Piping	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	The scope covers the minimum requirements for the design, manufacturing, assembling, product inspection, installation and testing of Sea Water Lift Pumps for offshore facilities	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	N/A	The limitation are to be determined after Gap analysis
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.

Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Normative References	ISO 7 Pipe threads where pressure-tight joints are made on the threads. ISO 281 Rolling bearings — Dynamic load ratings and rating life ISO 7005-1 Metallic flanges — Part 1: Steel flanges European Standards ISO 9329-4 Seamless steel tubes for pressure purposes ISO/R 228, Pipe threads where pressure-tight joints are not made on the threads (1/8 inch to 6 inches). ISO 496, Driving and driven machines — Shaft heights. ISO/R 775, Cylindrical and 1/10 conical shaft ends. ISO 3069, End-suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing. ISO 76 Rolling bearings — Static load ratings. ISO 2372 Mechanical vibration of machines with operating speeds from 10 to 200 rev/s — Basis for specifying evaluation standards. ISO 2548 Centrifugal, mixed flow and axial pumps — Code for acceptance tests — Class ISO 3069 End suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing. ISO 3555 Centrifugal, mixed flow and axial pumps — Code for acceptance tests — ISO 7005-1 Metallic flanges — Part 1: Steel flanges. ISO 7005-2 Metallic flanges — Part 2: Cast iron flanges. ISO 7005-3 Metallic flanges — Part 3: Copper alloy and composite flanges. ISO 9905:—1), Technical specifications for centrifugal pumps — Class I. ISO 9906, Rotodynamic pumps - Hydraulic performance acceptance tests ISO 11342 Mechanical Vibrations - Methods and Criteria for the Mechanical Balancing of Flexible Rotors.	N/A

	ISO 21049 Pumps - Shaft sealing systems for centrifugal and rotary pumps. ISO 228-1 Pipe threads where pressure-tight joints are not made on the threads ISO 261 ISO general-purpose metric screw threads - General plan. ISO 262 ISO general-purpose metric screw threads - Selected sizes for screws, bolts, and nuts. ISO 1940-1, Mechanical vibration - Balance quality requirements of rigid rotors - Part 1: ISO 5753 Roller bearings- Radial internal clearance. ASME B31.1 Power Piping ASME B16.5 Pipe Flanges and Flanged Fittings ANSI B73.1 or B73.2 ASME B1.1 Unified inch screw threads, UN and UNR thread form. ASME B15.1 Mechanical power transmission apparatus. ASME B 16.1 Cast iron pipe flanges and flanged fittings. ASME B16.5, Pipe flanges and flanged fittings. ASME B16.11 Forged steel fittings, socket-welding and threaded. ASME B16.42 Ductile iron pipe flanges & flanged fittings. ASME B16.47 Large diameter steel flanges. ASME B17.1 Keys and key seats. ASME Boiler and pressure vessel code, Section V, "Non destructive examination" ASME Boiler and pressure vessel code, Section VIII, "Pressure vessels" ASME Boiler and pressure vessel code, Section IX, "Welding and brazing qualifications". IEC 60034 Rotating Electrical Machines API 670 Machinery Protection Systems API 6AF2 Technical Report on Capabilities of API 6L1 TR - Elastomer Life Estimation Testing Procedures API 15 HR - Specification for High Pressure Fiberglass Line Pipe API 15LR SPEC Pipes Fiber Glass API 15TL4 Care of FG Tubulars API 520 Part I Pressure relief devices API 520 Part II Pressure relief device Installation API 521 - Guide for pressure relief systems	

	API 526 Pressure relief valves flanged API 540 electrical installations API 541 electric motors squirrel cage large API 551 Process instrumentation API 578 Alloy piping Matl. Verif. Program API 580 Risk-based Inspection API 610 Centrifugal pumps API 682 Pumps Shaft Sealing API 684 Rotors balancing API 685 Pumps Seal Less centrifugal API 686 Machinery installation RP	
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Seawater Lift Pump	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Seawater Lift Pump.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

13　ポンプ架台パッケージ

ポンプ架台はポンプと電気モーター又はかディーゼルエンジン等と連結した駆動装置を含み、共通スチールベースに取り付けられる。このステージに含まれる共通ポンプ架台の適用は水と廃水と冷媒である。

共通ポンプ架台の構成部分には下記が含まれる:

- スチール架台フレーム;
- 配管;
- ポンプ;
- 手動/駆動ボール/仕切り弁;
- 自動操作制御装置/HMI

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pump Skid developments for offshore applications with safety as critical factor while still being economic.	This specification of Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ASME B31.1 Power Piping	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	The scope covers the minimum requirements for the design, manufacturing, assembling, product inspection, installation and testing of Pump Skids for offshore facilities	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification is not applicable to:	N/A
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Normative Reference	ISO 7 Pipe threads where pressure-tight joints are made on the threads. ISO 281 Rolling bearings — Dynamic load ratings and rating life ISO 7005-1 Metallic flanges — Part 1: Steel flanges European Standards ISO 9329-4 Seamless steel tubes for pressure purposes ISO/R 228, Pipe threads where pressure-tight joints are not made on the threads (1/8 inch to 6 inches). ISO 496, Driving and driven machines — Shaft heights.	N/A

	ISO/R 775, Cylindrical and 1/10 conical shaft ends. ISO 3069, End-suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing. ISO 76 Rolling bearings — Static load ratings. ISO 2372 Mechanical vibration of machines with operating speeds from 10 to 200 rev/s — Basis for specifying evaluation standards. ISO 2548 Centrifugal, mixed flow and axial pumps — Code for acceptance tests — Class ISO 3069 End suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing. ISO 3555 Centrifugal, mixed flow and axial pumps — Code for acceptance tests — ISO 7005-1 Metallic flanges — Part 1: Steel flanges. ISO 7005-2 Metallic flanges — Part 2: Cast iron flanges. ISO 7005-3 Metallic flanges — Part 3: Copper alloy and composite flanges. ISO 9905:—1), Technical specifications for centrifugal pumps — Class I. ISO 9906, Rotodynamic pumps - Hydraulic performance acceptance tests ISO 11342 Mechanical Vibrations - Methods and Criteria for the Mechanical Balancing of Flexible Rotors. ISO 21049 Pumps - Shaft sealing systems for centrifugal and rotary pumps. ISO 228-1 Pipe threads where pressure-tight joints are not made on the threads ISO 261 ISO general-purpose metric screw threads - General plan. ISO 262 ISO general-purpose metric screw threads - Selected sizes for screws, bolts, and nuts. ISO 1940-1, Mechanical vibration - Balance quality requirements of rigid rotors - Part 1: ISO 5753 Roller bearings- Radial internal clearance. ASME B31.1 Power Piping ASME B16.5 Pipe Flanges and Flanged Fittings ANSI B73.1 or B73.2 ASME B1.1 Unified inch screw threads, UN	

	and UNR thread form. ASME B15.1 Mechanical power transmission apparatus. ASME B 16.1 Cast iron pipe flanges and flanged fittings. ASME B16.5, Pipe flanges and flanged fittings. ASME B16.11 Forged steel fittings, socket-welding and threaded. ASME B16.42 Ductile iron pipe flanges & flanged fittings. ASME B16.47 Large diameter steel flanges. ASME B17.1 Keys and key seats. ASME Boiler and pressure vessel code, Section V, "Non destructive examination" ASME Boiler and pressure vessel code, Section VIII, "Pressure vessels" ASME Boiler and pressure vessel code, Section IX, "Welding and brazing qualifications". IEC 60034 Rotating Electrical Machines API 670 Machinery Protection Systems API 6AF2 Technical Report on Capabilities of API 6L1 TR - Elastomer Life Estimation Testing Procedures API 15 HR - Specification for High Pressure Fiberglass Line Pipe API 15LR SPEC Pipes Fiber Glass API 15TL4 Care of FG Tubulars API 520 Part I Pressure relief devices API 520 Part II Pressure relief device Installation API 521 - Guide for pressure relief systems API 526 Pressure relief valves flanged API 540 electrical installations API 541 electric motors squirrel cage large API 551 Process instrumentation API 578 Alloy piping Matl. Verif. Program API 580 Risk-based Inspection API 610 Centrifugal pumps API 682 Pumps Shaft Sealing API 684 Rotors balancing API 685 Pumps Seal Less centrifugal API 686 Machinery installation RP	
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Pump Skid	The baseline requirements will be verified with the vendors for existing practices and cost benefit

		analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Pump Skid.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

14　化学物質注入パッケージ

化学物質注入システムは一般的に石油･ガス業界での生産施設内で使用される。化学物質注入システムは各種適用に通常必要とされる特注設計のために厳しい必須条件の対象とされている。又オフショアプラットフォーム上や極度の高温あるいは低温の環境下での信頼性や簡易な整備保守への需要は非常に大きい。化学物質注入システムは概して単一のあるいは複数の隔室貯蔵タンクか圧力容器に関連した複数の化学物質サービス装置により構成される。化学物質は化学物質注入ポンプによってタンクから注入地点にまで送られるが、一方流量度は正確な量の化学物質の注入を確実にするために現場でか遠隔で調整される。

この規格化の範囲に関しては、トップサイド水処理システムに使用される化学物質注入システムが考慮されている。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Chemical Injection Package developments for offshore applications with safety as critical factor while still being economic.	This specification of Chemical Injection Packages defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ASME B31.1 Power Piping	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	The scope covers the minimum requirements for the design, manufacturing, assembling, product inspection, installation and testing of Chemical Injection Packages for offshore facilities	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification is not applicable to:	
Gap Analysis	A Gap analysis is performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format will be developed and attached as an Appendix to the specification.
Normative Reference	ISO 7 Pipe threads where pressure-tight joints are made on the threads. ISO 281 Rolling bearings — Dynamic load ratings and rating life ISO 7005-1 Metallic flanges — Part 1: Steel flanges European Standards ISO 9329-4 Seamless steel tubes for pressure purposes ISO/R 228, Pipe threads where pressure-tight joints are not made on the threads (1/8 inch to 6	N/A

	inches). ISO 496, Driving and driven machines — Shaft heights. ISO/R 775, Cylindrical and 1/10 conical shaft ends. ISO 3069, End-suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing. ISO 76 Rolling bearings — Static load ratings. ISO 2372 Mechanical vibration of machines with operating speeds from 10 to 200 rev/s — Basis for specifying evaluation standards. ISO 2548 Centrifugal, mixed flow and axial pumps — Code for acceptance tests — Class ISO 3069 End suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing. ISO 3555 Centrifugal, mixed flow and axial pumps — Code for acceptance tests — ISO 7005-1 Metallic flanges — Part 1: Steel flanges. ISO 7005-2 Metallic flanges — Part 2: Cast iron flanges. ISO 7005-3 Metallic flanges — Part 3: Copper alloy and composite flanges. ISO 9905:—1), Technical specifications for centrifugal pumps — Class I. ISO 9906, Rotodynamic pumps - Hydraulic performance acceptance tests ISO 11342 Mechanical Vibrations - Methods and Criteria for the Mechanical Balancing of Flexible Rotors. ISO 21049 Pumps - Shaft sealing systems for centrifugal and rotary pumps. ISO 228-1 Pipe threads where pressure-tight joints are not made on the threads ISO 261 ISO general-purpose metric screw threads - General plan. ISO 262 ISO general-purpose metric screw threads - Selected sizes for screws, bolts, and nuts. ISO 1940-1, Mechanical vibration - Balance quality requirements of rigid rotors - Part 1: ISO 5753 Roller bearings- Radial internal clearance. ASME B31.1 Power Piping	

	ASME B16.5 Pipe Flanges and Flanged Fittings ANSI B73.1 or B73.2 ASME B1.1 Unified inch screw threads, UN and UNR thread form. ASME B15.1 Mechanical power transmission apparatus. ASME B 16.1 Cast iron pipe flanges and flanged fittings. ASME B16.5, Pipe flanges and flanged fittings. ASME B16.11 Forged steel fittings, socket-welding and threaded. ASME B16.42 Ductile iron pipe flanges & flanged fittings. ASME B16.47 Large diameter steel flanges. ASME B17.1 Keys and key seats. ASME Boiler and pressure vessel code, Section V, "Non destructive examination" ASME Boiler and pressure vessel code, Section VIII, "Pressure vessels" ASME Boiler and pressure vessel code, Section IX, "Welding and brazing qualifications". IEC 60034 Rotating Electrical Machines API 670 Machinery Protection Systems API 6AF2 Technical Report on Capabilities of API 6L1 TR - Elastomer Life Estimation Testing Procedures API 15 HR - Specification for High Pressure Fiberglass Line Pipe API 15LR SPEC Pipes Fiber Glass API 15TL4 Care of FG Tubulars API 520 Part I Pressure relief devices API 520 Part II Pressure relief device Installation API 521 - Guide for pressure relief systems API 526 Pressure relief valves flanged API 540 electrical installations API 541 electric motors squirrel cage large API 551 Process instrumentation API 578 Alloy piping Matl. Verif. Program API 580 Risk-based Inspection API 610 Centrifugal pumps API 682 Pumps Shaft Sealing API 684 Rotors balancing API 685 Pumps Seal Less centrifugal API 686 Machinery installation RP	
Application	Offshore Utility Non-Hydrocarbon	N/A
Impact on Design and	Provides baseline requirement for the designing and manufacturing of the Chemical Injection	The baseline requirements will be verified with the

Manufacturing	Package	vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Chemical Injection Package.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

15　消防用水ポンプ架台

オフショア石油･ガス業界では、消防ポンプは FSOs と FPSOs、LNGs そして FLNGs に設置されている。原油、石油、化学製品あるいはその他あらゆる可燃性物質を扱うタンクターミナルはターミナル据付の消火機器により危険にさらされる可能性のある機器を守るよう勧告されている。

典型的な消火ポンプの仕様は圧力がかかった状態で 30－3000m3/h から 150mWC までの範囲となっており、該当する船舶の必要性に応じて設計され、要求される仕様書のニーズを満たすために特別注文される。一般に、消火ポンプは 2 つのポンプを装備している;主ポンプと供給ポンプ。主ポンプはディーゼルエンジンか電動モーターで駆動され、供給ポンプは油圧駆動である。

Procedure	Criteria	Process
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Firewater Pump Skids developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	API Recommended Practice 14G Fourth Edition, April 2007, Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This publication presents recommendations for minimizing the likelihood of having an accidental fire, and for designing, inspecting, and maintaining fire control systems. It emphasizes the need to train personnel in fire fighting, to conduct routine drills, and to establish methods and procedures for safe evacuation. The fire control systems discussed in this publication are intended to provide an early response to incipient fires to prevent their growth. However, this discussion is not intended to preclude the application of more extensive practices to meet special situations or the substitution of other systems which will provide an equivalent or greater level of protection. This publication is applicable to fixed open-type offshore production platforms which are generally installed in moderate climates and which have sufficient natural ventilation to minimize the accumulation of vapors. Enclosed areas, such as quarters buildings and equipment enclosures, normally installed on this type platform, are	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

	addressed.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	Totally enclosed platforms installed for extreme weather conditions or other reasons are beyond the scope of this RP. This specification does not include diesel centrifuge packages.	N/A
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.

Normative References	**API:** RP 14C Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms RP 14E Design and Installation of Offshore Production Platform Piping Systems RP 14F Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1, and Division 2 Locations RP 14FZ Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1 and Zone 2 Locations RP 14J Design and Hazards Analysis for Offshore Production Facilities RP 75 Development of a Safety and Environmental Management Program for Offshore Operations and Facilities RP 500 Recommended Practice for Classification of Locations for Electrical Installations at Petroleum	N/A

	Facilities Classified as Class I, Division 1 and Division 2 RP 505 Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2 RP 520 Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries RP 521 Guide for Pressure-relieving and Depressurizing Systems RP 2003 Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents Publ 2030 Application of Fixed Water Spray Systems for Fire Protection in the Petroleum and Petrochemical Industries Publ 2218 Fireproofing Practices in Petroleum and Petrochemical Processing Plants RP T-1 Orientation Programs for Personnel Going Offshore for the First Time **NFPA:** National Fire Codes	

	Fire Protection Handbook **ASTM:** B 163 Standard Methods of Fire Tests of Window Assemblies D 2996 Standard Specifications for Filament Wound Reinforced Thermosetting Resin Pipe D 4024 Standard Specification for Reinforced Thermosetting Resin (RTR) Flanges E 84 Standard Methods of Test for Surface Burning Characteristics of Building Materials E 119 Standard Test Methods for Fire Tests of Building Construction and Materials E 152 Standard Methods of Fire Tests of Door Assemblies E 814 Standard Methods of Through Penetration Fire Stops **UL:** UL 711 Classification, Rating, and Fire Testing of Class A B, and C Fire Extinguishers and for Class D Extinguishers or Agents for Use on Combustible Metals UL 1709 Rapid Rise Fire Tests of Protection Materials for Structural	

	Steel	
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Firewater Pump Skid	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Firewater Pump Skid.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

16　ディーゼル遠心分離パッケージ

規格化範囲は消火用水ポンプなどのディーゼルエンジン駆動のポンプを含む。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Diesel Centrifuge Package developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	N/A	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	N/A	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard	N/A

	for the selected equipment	
Limitation	The limitations for the standardized specification will be identified after the gap analysis	N/A
Gap Analysis	Gap analysis is performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	API STD 610 Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries	N/A
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Diesel Centrifuge Package.	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Diesel Centrifuge Package.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders,	N/A

	vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	

17　非常時/必須発電

石油・ガス業界に対して発電機を規定する場合常に考慮すべきいくつかの重要要素がある。殆どの石油・ガス掘削・生産操業が過酷な環境下であるために、環境の厳しさに耐える耐久性のある発電機システムを選択する傾向が強い。

この規格化の意図は将来の開発に向けて個別の石油会社の仕様書に代わって、非常時発電機の設計、工学技術、材料選択、組立て、テストに関連する

建造スケジュールやコストに影響するであろう不確実性を削減する共通の判定基準を採用することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Emergency / Essential Generation developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on IS/ISO 8528-1:2005 Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This part of ISO 8528 defines various classifications for the application, rating and performance of generating sets consisting of a Reciprocating Internal Combustion (RIC) engine, Alternating Current (a.c.) generator and any associated controlgear, switchgear and auxiliary equipment. For some specific applications (e.g.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

	essential hospital supplies, high-rise buildings) supplementary requirements may be necessary. The provisions of this part of ISO 8528 should be regarded as the basis for establishing any supplementary requirements. For other reciprocating-type prime movers (e.g. sewage-gas engines, steam engines), the provisions of this part of ISO 8528 should be used as a basis for establishing these requirements. Generating sets meeting the requirements of this International Standard are used to generate electrical power for continuous, peak-load and standby applications. The classifications laid down in this part of ISO 8528 are intended to help understanding between manufacturer and customer.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification applies to A.C generating sets driven by RIC engines for land and marine use, excluding generating sets used on aircraft or to propel land vehicles	N/A

	and locomotives.	
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	ISO 3046-1, Reciprocating internal combustion engines — Performance — Part 1: Declarations of power, fuel and lubricating oil consumptions, and test methods — Additional requirements for engines for general use ISO 8528-2, Reciprocating internal combustion engine driven alternating current generating sets — Part 2: Engines ISO 8528-3, Reciprocating internal combustion engine driven alternating current generating sets — Part 3: Alternating current generators for generating sets ISO 8528-4, Reciprocating internal	N/A

	combustion engine driven alternating current generating sets — Part 4: Controlgear and switchgear ISO 8528-5, Reciprocating internal combustion engine driven alternating current generating sets — Part 5: Generating sets	
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Emergency / Essential Generation.	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Emergency / Essential Generation.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

18　ガスタービン発電

ガスタービンは空気ー燃料の混合物が燃焼し電力を発生用タービンを回す高温ガスを生じさせる内燃機関（ＩＣ）の１型式である。ガスタービンは

天然ガスや燃料油や合成燃料を含め多様な燃料を使用でき、それを機械エネルギーに転換し、ついで電気エネルギーを発生させる発電機を駆動する。

規格化は機械的駆動、発電機駆動又はプロセスガス発生のサービス用開路の単純な再生サイクル燃焼ガスタービンユニットに対する最少要求事項を含んでいる。ガスタービンユニットの操作・始動・制御のために又タービン保護のために必要とされる全ての補助機器は範囲内にある。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Gas Turbine Generation developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 19859:2016, Gas turbine applications — Requirements for power generation	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This International Standard specifies the minimum technical and documentation requirements for the evaluation and procurement of gas turbine systems for electrical power generation. It applies to simple cycle and combined cycle gas turbines for both onshore and offshore applications, where applicable. It also applies to gas turbines used in cogeneration (see ISO 11086:1996, Annex B). Testing of the gas turbine in combination with a generator is included in the scope. This International Standard defines the requirements for gas turbine power generation from an international perspective based on the content of existing, recognized ISO and IEC standards to the greatest extent practical. Nonetheless, it is recognized that	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

	within the industry other codes or standards are used, some of which are included in the text of this International Standard. The use of other such codes and standards is permissible provided an appropriate and acceptable level of requirements, functional design and safety is achieved and agreement has been reached for their use between the Purchaser and Contractor and such use is suitably documented. Consideration should be given to applying/using standards in the following hierarchical order: international; regional; national; local. This International Standard identifies the requirements for both the Purchaser and Contractor attributable to the design and procurement of a gas turbine power generation package. The defined requirements apply to the scope of supply, except where excluded, encompassing the following equipment and the associated selected options, located within the power generation package, (see 3.14), listed below: — gas turbine package; — load shaft coupling and clutch, as applicable; — air inlet system; — exhaust system; — fuel equipment; — control equipment; — electrical equipment; — additional auxiliary systems,	

	including starting, lubrication, barring, compressor wash, pipework, drains and vents; — fire and gas protection; — cooling water equipment. Where applicable to the integrity of the gas turbine package, the interface and applicable design requirements are included for equipment, utilities and supplies that interface with the power generation package. Data sheets in Annex A of this International Standard are provided for defining requirements and exchanging information between the Purchaser and the Contractor. The Purchaser fills in the data sheets for the tender and forwards them to the Contractor. The Contractor responds by completing the applicable data sheets for their tender. Annex A identifies the different types of data sheets and how they are to be used. Where the Contractor does not comply with a selected requirement of this International Standard, this is detailed as an exception, referencing the applicable clause and describing the deviation and any alternatives available in a document listing all the exceptions taken. Where the text in this International Standard requests procedures and operating, maintenance and	

	commissioning manual information or equipment that would require the disclosure/supply of proprietary information/equipment which the Contractor is not prepared to release, such exceptions are listed. Where this situation exists, the Contractor will be prepared to release appropriate personnel and equipment to undertake all the tasks that otherwise would be undertaken by the Purchaser.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification is not applicable to gas turbines used for all types of propulsion including aircraft, mobile barges, floating production vessels and marine propulsion applications and micro turbines. The following equipment is excluded from the scope of supply, but references are included where required for interface or performance measurement: — generator and auxiliary systems, except the module control option; — steam turbine and auxiliary systems; — equipment external to the power generation	N/A

	package.	
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	ISO 128-1, Technical drawings — General principles of presentation — Part 1: Introduction and index ISO 1461, Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods ISO 1940-1:2003, Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances ISO 2314:2009, Gas turbines — Acceptance tests ISO 2409, Paints and varnishes — Cross-cut test	N/A

	ISO 2533, Standard Atmosphere ISO 2592, Determination of flash and fire points — Cleveland open cup method ISO 2909, Petroleum products — Calculation of viscosity index from kinematic viscosity ISO 2954, Mechanical vibration of rotating and reciprocating machinery — Requirements for instruments for measuring vibration severity ISO 3016, Petroleum products — Determination of pour point ISO 3104, Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity ISO 3448, Industrial liquid lubricants — ISO viscosity classification	
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Gas Turbine Generation.	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Gas Turbine Generation.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon	N/A

	by the purchaser and the Vendor.	
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

19　航空機用燃料補給パッケージ

燃料補給パッケージは燃料の積み下ろしアーム・燃料ポンプ吸引・計量・濾過架台の設計・製作・委託を含む。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Aviation Refueling Packages developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	To be determined during gap analysis. The proposed specification is CAP 437	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	To be determined during gap analysis.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	To be determined during gap analysis.	N/A
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	2010 MODU Code 2014 SOLAS	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	To be determined during gap analysis.	N/A
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Aviation Refueling Packages.	The baseline requirements are verified with the vendors for existing practices and cost benefit

		analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Aviation Refueling Packages.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

20　ユーティリティー用炭化水素ポンプ

この規格化の意図は将来の開発に向けて個別の石油会社の仕様書に代わって、ディーゼル移送ポンプや閉路排水システムなどのユーティリティー炭化水素適用にために設計されるポンプの設計・工学技術・材料選択・組み立て・テストに関連する建造スケウールやコストに影響するであろう不確実性を削減する共通の判定基準を採用することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pumps developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on API STD 610 Centrifugal Pumps for Petroleum, Petrochemical and	The baseline spec was identified by the workgroup after a gap analysis between various operator

	Natural Gas Industries	specifications.
Scope	This International Standard specifies requirements for centrifugal pumps, including pumps running in reverse as hydraulic power recovery turbines, for use in petroleum, petrochemical and gas industry process services. This International Standard is applicable to overhung pumps, between-bearings pumps and vertically suspended pumps (see Table 1). Clause 9 provides requirements applicable to specific types of pumps. All other clauses of this International Standard are applicable to all pump types. Illustrations are provided of the various specific pump types and the designations assigned to each specific type. Relevant industry operating experience suggests pumps produced to this International Standard are cost effective when pumping liquids at conditions exceeding any one of the following: - discharge pressure (gauge) 1 900 kPa (275 psi; 19,0 bar) - suction pressure (gauge) 500 kPa (75 psi; 5,0 bar) - pumping temperature 150 °C (300 °F) rotative speed 3 600 r/min - rated total head 120 m (400 ft) - impeller diameter, overhung pumps 330 mm (13 in)	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Standardization Methodology	The methodology for standardization Process followed is:	N/A

	1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	For sealless pumps, reference can be made to API Std 685. For heavy duty pump applications in industries other than petroleum, petrochemical and gas processing, reference can be made to ISO 9905.	N/A
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	**ISO 7-1**, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions,	N/A

	tolerances and designation **ISO 228-1**, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation **ISO 261**, ISO general purpose metric screw threads — General plan **ISO 262**, ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts **ISO 281:2007**, Rolling bearings — Dynamic load ratings and rating life **ISO 286 (all parts)**, ISO system of limits and fits **ISO 724**, ISO general-purpose metric screw threads — Basic dimensions **ISO 965 (all parts)**, ISO general-purpose metric screw threads — Tolerances **ISO 1940-1**, Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances **ISO 3117**, Tangential keys and	

	keyways **ISO 4200**, Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length **ISO 5753**, Rolling bearings — Radial internal clearance **ISO 7005-1**, Metallic flanges — Part 1: Steel flanges for industrial and general service piping systems **ISO 7005-2**, Metallic flanges — Part 2: Cast iron flanges **ISO 8501 (all parts)**, Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness **ISO 9606 (all parts)**, Approval testing of welders — Fusion welding) **ISO 9906**, Rotodynamic pumps — Hydraulic performance acceptance tests) **ISO 10438:2007 (all parts)**, Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries **ISO 10441**, Petroleum,	

	petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications **ISO 10721-2**, Steel structures — Part 2: Fabrication and erection **ISO 11342**, Mechanical vibration — Methods and criteria for the mechanical balancing of flexible rotors **ISO 14120**, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards **ISO 14691**, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications **ISO 15156-1**, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials	

	ISO 15609 (all parts), Specification and qualification of welding procedures for metallic materials — Welding procedure specification **ISO 15649**, Petroleum and natural gas industries — Piping **ISO/TR 17766**, Centrifugal pumps handling viscous liquids — Performance corrections **ISO 21049:2004**, Pumps — Shaft sealing systems for centrifugal and rotary pumps **IEC 60034-1**, Rotating electrical machines — Part 1: Rating and performance **IEC 60034-2-1**, Rotating electrical machines — Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles) **IEC 60079 (all parts)**, Electrical apparatus for explosive gas atmospheres) **EN 953**, Safety of machinery — Guards — General requirements for the design and construction of fixed and	

	movable guards **EN 13445 (all parts)**, Unfired pressure vessels **EN 13463-1**, Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements **ANSI/ABMA 7**, Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plan) **ANSI/AGMA 9000**, Flexible Couplings — Potential Unbalance Classification5) **ANSI/AGMA 9002**, Bores and Keyways for Flexible Couplings (Inch Series) **ANSI/AMT B15.1**, Safety Standard for Mechanical Power Transmission Apparatus) **ANSI/API Std 541**, Form-Wound Squirrel-Cage Induction Motors — 500 Horsepower and Larger **ANSI/API Std 611**, General-Purpose Steam Turbines for Petroleum, Chemical, and Gas	

	Industry Services **ANSI/API Std 670**, Machinery Protection Systems **ANSI/API Std 671/ISO 10441**, Special Purpose Couplings for Petroleum, Chemical and Gas Industry Services **ANSI/ASME B1.1**, Unified Inch Screw Threads, UN and UNR Thread Form) **ANSI/ASME B16.1**, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250 **ANSI/ASME B16.5**, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard **ANSI/ASME B16.11**, Forged Steel Fittings, Socket-Welding and Threaded **ANSI/ASME B16.42**, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300 **ANSI/ASME B16.47**, Larger Diameter Steel Flanges: NPS 26 Through NPS 60 **ANSI/ASME B18.18.2M**, Inspection and Quality Assurance for High-Volume Machine	

	Assembly Fasteners **ANSI/ASME B31.3**, Process Piping **ANSI/HI 1.6**, Centrifugal Tests8) **ANSI/HI 2.6**, American National Standard for Vertical Pump Tests **API Std 547**, General-Purpose Form-Wound Squirrel Cage Induction Motors — 250 Horsepower and Larger **API Std 677**, General-Purpose Gear Units for Petroleum, Chemical and Gas Industry Services **ASME, Boiler and pressure vessel code BPVC, Section V**, Nondestructive Examination **ASME, Boiler and pressure vessel code BPVC, Section VIII**, Rules for Construction of Pressure Vessels **ASME, Boiler and pressure vessel code BPVC, Section IX**, Welding and Brazing Qualifications **DIN 910**, Heavy-duty hexagon head screw plugs) **IEEE 841**, IEEE Standard for Petroleum and Chemical Industry — Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors — Up to and Including 500	

	hp) **MSS SP-55**, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities) **NACE MR0103**, Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments) **NFPA 70:2008**, National Electrical Code) **SSPC SP 6**, Commercial Blast Cleaning)	
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Pumps	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Pumps.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors.	N/A

	Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	

21　不活性ガス発生装置

不活性ガスとは可燃性炭化水素ガスの燃焼を抑えるには不十分な量の酸素（通常8％を下回る）を含むガスである。不活性ガス発生装置は、ガス発生装置と洗浄システムにより構成されている。不活性ガスシステムの典型的な構成部分は：

- 排気ガス源、
- 不活性ガス遮断弁、
- 洗浄塔、
- デミスター（曇り除去器）
- ガス送風機、
- 圧力調整弁、
- 機械的逆止弁、
- 安全・警報システム

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Inert Gas Generation developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 13577-3:2016, Industrial furnaces and associated processing equipment — Safety — Part 3: Generation and use of protective and reactive atmosphere gases	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This part of ISO 13577 specifies safety requirements for generation and use of protective and reactive atmosphere gases that are part of industrial thermo-processing	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection,

	equipment (TPE). NOTE The general safety requirements common to TPE are provided in ISO 13577-1 (see Introduction). This part of ISO 13577 deals with significant hazards, hazardous situations and events relevant to the generation and use of protective and reactive atmosphere gases created by thermochemical reactions and their use in TPE that are part of TPE as listed in Clause 4 and Clause 5, when used as intended and under the conditions foreseen by the manufacturer. This part of ISO 13577 covers • pipework downstream of and including the manual isolating valve, • equipment for the generation of atmosphere gases, • additional equipment for the use of atmosphere gases in TPE, • safety devices, and • functional requirements for safety related control system for the generation and use of protective and reactive atmosphere gases. It applies to the supply of atmosphere gas, source gas, inert gas and process liquids to TPE and their removal from TPE, confined to equipment integrated in the TPE. This part of ISO 13577 also details the anticipated significant hazards associated with atmosphere gas	testing, packing, installation, commissioning and documentation for use on an offshore facility.

	systems and their use in TPE and specifies the appropriate preventative measures for the reduction or elimination of these hazards. The pressure hazard of the piping and components covered by this standard is within the maximum pressure/size relationship of group I as described in Annex C. A table of typical protective and reactive gases is given in Annex B.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This part of ISO 13577 • specifies the requirements to be met to ensure the safety of persons and property during installation, commissioning, start up, operation, shutdown and maintenance, • does not cover the relevant risks involved in the flue gas ducting system when it is not considered a part of TPE,	N/A

	• is not applicable to utility supply upstream of the TPE main disconnects, • does not apply to TPE for semi-conductor devices, • does not apply to TPE with atmosphere, such as air and flue gas from an over stoichiometric combustion, • does not cover the decommissioning of the TPE, • does not cover vacuum furnaces, • does not deal with the hazard of noise which is covered in ISO 13577-1, • is not applicable to generation and use of atmosphere gas in TPE and associated plant which is manufactured before the date of its publication, and • gives the necessary requirements for the information for use. A TPE designed according to this part of ISO 13577 does not create any potentially explosive atmosphere in the area around the TPE and is not designed to be located in an area with a potentially explosive or hazardous atmosphere.	
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.

Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	**ISO 7-1**, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation **ISO 228-1**, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation **ISO 5817**, Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections **ISO 7005-1**, Metallic flanges — Part 1: Steel flanges **ISO 7005-2**, Metallic flanges — Part 2: Cast iron flanges **ISO 8434-1**, Metallic tube connections for fluid power and general use — Part 1: 24 degree cone connectors **ISO 8434-2**, Metallic tube connections for fluid power and general use — Part 2: 37 degree flared connectors **ISO 8434-3**, Metallic tube connections for fluid power and	N/A

	general use — Part 3: O-ring face seal connectors **ISO 12100**, Safety of machinery — General principles for design — Risk assessment and risk reduction **ISO 13574:2015**, Industrial furnaces and associated processing equipment — Vocabulary **ISO 13577-1:2012**, Industrial furnaces and associated processing equipment — Safety — Part 1: General requirements **ISO 13577-2:2014**, Industrial furnaces and associated processing equipment — Safety — Part 2: Combustion and fuel handling systems **ISO 13577-4**, Industrial furnace and associated processing equipment — Safety — Part 4: Protective systems **ISO 13849-1**, Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design **ISO 19879**, Metallic tube connections for fluid power and general use — Test methods for hydraulic fluid power connections **ISO 23551-1**, Safety and control devices for gas burners and gas-	

	burning appliances — Particular requirements — Part 1: Automatic and semi-automatic valves **ISO 23551-2**, Safety and control devices for gas burners and gas-burning appliances — Particular requirements — Part 2: Pressure regulators **IEC 60730-2-5:2011**, Automatic electrical controls for household and similar use—Part 2-5: Particular requirements for automatic electrical burner control systems **IEC 60730-2-6:2007**, Automatic electrical controls for household and similar use—Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements	
Application	Offshore Utility Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Inert Gas Generation	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Inert Gas Generation.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on	Global reach and standard harmonized spec for worldwide use.	N/A

stakeholders	Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	

22　プロセス非炭化水素用圧力容器

圧力容器とは、大気とかなり異なる圧力でガスを収容するために設計された容器もしくはタンクである。空気受けタンク、脱気塔、ヘッダータンク、化学物質貯蔵装置などのプロセス非炭化水素適用のために設計された圧力容器のみがステージ3プロセス非炭化水素の規格化範囲に含まれている。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pressure Vessels developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification is based on ISO 16528-1:2007 Boilers and pressure vessels — Part 1: Performance requirements	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	This part of ISO 16528 defines the performance requirements for the construction of boilers and pressure vessels. It is not the intent of this part of ISO 16528 to address operation, maintenance and in-service inspection of boilers and pressure vessels.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.

	In relation to the geometry of the pressure-containing parts for pressure vessels, the scope of this part of ISO 16528 includes the following: • a) welding end connection for the first circumferential joint for welded connections; • b) first threaded joint for screwed connections; • c) face of the first flange for bolted, flanged connections; • d) first sealing surface for proprietary connections or fittings; • e) safety accessories, where necessary. In relation to the geometry of pressure-containing parts for boilers, the scope of this part of ISO 16528 covers the following: • f) feedwater inlet (including the inlet valve) to steam outlet (including the outlet valve), including all inter-connecting tubing that can be exposed to a risk of overheating and cannot be isolated from the main system; • g) associated safety accessories; • h) connections to the boilers involved in services, such as draining, venting, desuperheating, etc.	
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's	N/A

	4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	This part of ISO 16528 does not apply for nuclear components, railway and marine boilers, gas cylinders or piping systems or mechanical equipment, e.g. turbine and machinery casings.	N/A
Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	ISO 16528 Part 2: Procedures for fulfilling the requirements of ISO 16528-1	N/A
Application	Offshore Process Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Pressure Vessels.	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.

Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Pressure Vessels.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

23　随伴水処理パッケージ

随伴水とは石油・ガスと共に産出される埋蔵水を表す用語である。石油・ガス埋蔵地は通常大量の水・石油・固形物・凝縮物、ガスを含んでいる。石油・ガスの処理時に分離された水は坑井中に適切な圧力を維持するために埋蔵地にポンプで戻される。あるいは、水は海か下水装置に排出される。どちらの方法にも坑井汚濁と水汚染を防止を目的とした一連の条件と厳格な規制がある。

オフショア随伴水処理パケージで採用されている技術は:

- サイクロン脱油・脱砂粒
- 小型浮遊装置(CFU)
- 砂粒洗浄

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Produced Water Treatment Package developments for offshore applications with safety as critical factor while still being economical.	This specification of Firewater Pump Skids defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use

		on an offshore facility.
Baseline Standard	To be determined during gap analysis.	The baseline spec was identified by the workgroup after a gap analysis between various operator specifications.
Scope	To be determined during gap analysis.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	To be determined during gap analysis.	N/A

Gap Analysis	Gap analysis is to be performed between various Operator & Owner Specs to identify the common requirements.	N/A
Risk Assessment	Risk assessment is to be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	A Datasheet format is developed and attached as an Appendix to the specification.
Normative References	To be determined during gap analysis.	N/A
Application	Offshore Process Non-Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirement for the designing and manufacturing of the Produced Water Treatment Package.	The baseline requirements are verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for the Produced Water Treatment Package.	The vendors are contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser.	N/A

	Identification of Key Class and Regulatory requirements in the appendix.	

24　低圧プロセス炭化水素圧力容器

この規格化の意図は将来の開発に向けて個別の石油会社の仕様書に代わって、焼棄ドラム、脱ガス装置、ＭＥＯＨ 貯蔵タンクなどの低圧プロセス炭化水素適用のための圧力容器の設計・工学技術・材料選択・製造・テストに関連する建造スケジュールやコストに影響するであろう不確実性を削減する共通の判定基準を採用することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pressure Vessels developments for Low Pressure Process Hydrocarbon applications with safety as a critical factor while still being economic.	This specification for Pressure Vessels defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on ASME Boiler and Pressure Vessel Code Section VIII/ISO16528-1.	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	The scope of this specification includes the following: a) welding end connection for the first circumferential joint for welded connections; b) first threaded joint for screwed connections; c) face of the first flange for bolted, flanged connections; d) first sealing surface for proprietary connections or fittings; e) safety accessories, where necessary.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations	N/A

	3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	This specification does not apply for nuclear components, railway and marine boilers, gas cylinders or piping systems or mechanical equipment, e.g. turbine and machinery casings	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	API Std. 527 - Seat Tightness of Pressure Relief Valves ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form) ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (Inch) ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250 ASME B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 Through NPS 24 Metric/Inch Standard	N/A

	ASME B16.9 - Factory-Made Wrought Buttwelding Fittings ASME B16.11 - Forged Fittings, Socket-Welding and Threaded ASME B16.15 - Cast Copper Alloy Threaded Fittings, Classes 125 and 250 ASME B16.20 - Metallic Gaskets for Pipe Flanges — Ring-Joint, Spiral– Wound, and Jacketed ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500, and 2500 ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300 ASME B16.47 - Large Diameter Steel Flanges, NPS 26 Through NPS 60 Metric/Inch Standard ASME B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) ASME B36.10M - Welded and Seamless Wrought Steel Pipe ASME PCC-1 - Guidelines for Pressure Boundary Bolted Flange Joint Assembly ASME PCC-2 - Repair of Pressure Equipment and Piping ASME PTC 25 - Pressure Relief Devices ASME QAI-1 - Qualifications for Authorized Inspection ACCP - ASNT Central Certification Program ANSI/ASNT CP-189 - ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel ASNT SNT-TC-1A - Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing ASTM D56 - Standard Test Method for Flash Point by Tag Closed Tester ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester	

	ASTM E3 - Standard Guide for Preparation of Metallographic Specimens ANSI/API Std. 521 - Pressure Relieving and Depressuring Systems ASTM E125 - Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings ASTM E140 - Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness ASTM E186 - Standard Reference Radiographs for Heavy-Walled [2 to 41/2-in. (51 to 114-mm)] Steel Castings ASTM E208 - Standard Test Method for Conducting Drop-Weight Test to Determine Nil– Ductility Transition Temperature of Ferritic Steels ASTM E280 - Standard Reference Radiographs for Heavy-Walled [41/2 to 12-in. (114 to 305-mm)] Steel Castings ASTM E446 - Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness ANSI/UL-969 - Marking and Labeling Systems ISO 148-1 - Metallic Materials — Charpy Pendulum Impact Test Part 1: Test Method ISO 148-2 - Metallic Materials — Charpy Pendulum Impact Test Part 2: Verification of Testing Machines ISO 148-3 - Metallic Materials — Charpy Pendulum Impact Test Part 3: Preparation and Characterization of Charpy V-Notch Test Pieces for Indirect Verification of Pendulum Impact Machines ASME B1.13M - Metric Screw Thread — M Profile ASME B1.21M - Metric Screw Thread — MJ Profile ASME B18.2.3.3M - Metric Heavy Hex Screws	

	ASME B18.2.3.5M - Metric Hex Bolts ASME B18.2.3.6M - Metric Heavy Hex Bolts ASME B18.2.6M - Metric Fasteners for Use in Structural Applications ASTM C695 - Standard Test Method for Compressive Strength of Carbon and Graphite ASTM C709 - Standard Terminology Relating to Manufactured Carbon and Graphite ASTM E4 - Standard Practices for Force Verification of Testing Machines ASTM E177 - Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods ASTM E691 - Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method ANSI/AWS A4.2M - Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal	
Application	Low Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of Pressure Vessels for Low Pressure Process Hydrocarbon applications	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Pressure Vessels for Low Pressure Process Hydrocarbon applications	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages	N/A

	at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	

25　PIG ランチャー・レシーバーパッケージ

PIG ランチャー装置と PIG レシーバー装置は、PIG のパイプラインへの入出を可能とするパイプラインの部分である。PIG ランチャー装置と PIG レシーバー装置はパイプラインのピッギングシステムに不可欠である。これらの安全弁、防犯錠、加圧・減圧能力は PIG の搭載や除去にとり安全な手段である。現行の規格は PIG ランチャー装置・レシーバー装置に対し統一要求事項を規定している。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pig Launcher and Receiver Package developments for offshore applications with safety as critical factor while still being economic.	This specification for Pig Launchers and Receivers defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on ASME B31.X. We recommend using B31.3 as the baseline standard.	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment has been performed
Scope	This specification will cover Pig Launchers and Receivers that are to be used on piping used in processing applications.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry	N/A

	Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	This specification excludes low pressure systems of the following conditions: 1. Pressure less than 15psi 2. Pressure greater than 0psi 3. The fluid is nonflammable, nontoxic and not damaging to human tissue. 4. The temperature is between -20F and 366F.	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	The Normative references will be determined after the gap analysis.	N/A
Application	Low Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of Pig Launchers and Receivers.	The baseline requirements will be verified with the vendors for existing practices and cost benefit

		analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Pig Launchers and Receivers.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

26　燃料ガス処理パッケージ　–　低圧炭化水素

燃料ガス架台は天然ガス流から汚染物質と液体を除去し、圧力を調整し燃料としての使用や他の機器用の計器用ガスの供給に備える。高圧ガス流は二重高圧調整器を通って架台に入る。次にガスは第二の下部並列圧力調整器を通る。下流の分離器が液体を落下するよう遊離させガス流から除去する。規格化範囲は低圧炭化水素適用のみに限られている。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Fuel Gas Treatment Package developments for offshore applications with safety as critical factor while still being economic.	This specification for Fuel Gas Treatment Packages defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	The baseline standard that this specification will be based off of will be determined after the gap analysis and risk assessment between the various operator	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment

	specifications. ASME Section VIII - Pressure Vessel ANSI B31.3/ANSI B31.3 - Piping ASME Section IX - Pipe Fab AWS D1.1 - Structural Steel Assembly API RP 14C - for testing?	has been performed
Scope	The scope of this specification will be determined after the gap analysis and risk assessment between the various operator specifications.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	The limitations of this specification will be determined after the gap analysis and risk assessment between the various operator specifications.	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment	N/A

	package to identify if the standardized specification provide an acceptable level of safety.	
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	Normative References to be determined after baseline standard is determined.	N/A
Application	Low Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of Fuel Gas Treatment Packages.	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Fuel Gas Treatment Packages.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

27　低圧プロセス炭化水素ポンプ

規格化の意図は将来の開発に向けて個別の石油会社の仕様書明に代わって、石油輸出、凝縮ガソリン、熱媒体などの LP プロセス炭化水素ポンプ用のポンプの設計・工

学技術・材料選択・製造・テストに関連する建設スケジュールやコストに影響するであろう不確実性を削減する共通の判定基準を採用することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future pump developments for offshore applications with safety as critical factor while still being economic.	This specification for Pumps defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on API STD 610.	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment has been performed
Scope	The scope of this specification includes the following: 1. Centrifugal pumps 2.Overhung pumps 3. Between-bearing pumps 4. Vertically suspended pumps.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	Seamless pumps are not included in the scope, along with heavy duty	N/A

	pump for applications in industries other than petroleum, petrochemical and gas processing.	
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	ISO 7-1, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation ISO 228-1, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation ISO 261, ISO general purpose metric screw threads — General plan ISO 262, ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts ISO 281:2007, Rolling bearings — Dynamic load ratings and rating life ISO 286 (all parts), ISO system of limits and fits ISO 724, ISO general-purpose metric screw threads — Basic dimensions ISO 965 (all parts), ISO general-purpose metric screw threads — Tolerances ISO 1940-1, Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of	N/A

	balance tolerances ISO 3117, Tangential keys and keyways ISO 4200, Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length ISO 5753, Rolling bearings — Radial internal clearance ISO 7005-1, Metallic flanges — Part 1: Steel flanges for industrial and general service piping systems ISO 7005-2, Metallic flanges — Part 2: Cast iron flanges ISO 8501 (all parts), Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness ISO 9606 (all parts), Approval testing of welders — Fusion welding1) ISO 9906, Rotodynamic pumps — Hydraulic performance acceptance tests2) ISO 10438:2007 (all parts), Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries ISO 10441, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications ISO 10721-2, Steel structures — Part 2: Fabrication and erection ISO 11342, Mechanical vibration — Methods and criteria for the mechanical balancing of flexible rotors ISO 14120, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards ISO 14691, Petroleum, petrochemical and natural gas industries — Flexible couplings for	

	mechanical power transmission — General-purpose applications ISO 15156-1, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials ISO 15609 (all parts), Specification and qualification of welding procedures for metallic materials — Welding procedure specification ISO 15649, Petroleum and natural gas industries — Piping ISO/TR 17766, Centrifugal pumps handling viscous liquids — Performance corrections ISO 21049:2004, Pumps — Shaft sealing systems for centrifugal and rotary pumps IEC 60034-1, Rotating electrical machines — Part 1: Rating and performance IEC 60034-2-1, Rotating electrical machines — Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles) IEC 60079 (all parts), Electrical apparatus for explosive gas atmospheres3) EN 953, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards EN 13445 (all parts), Unfired pressure vessels EN 13463-1, Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements ANSI/ABMA 7, Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered	

	Roller Bearings) Conforming to Basic Boundary Plan 4) ANSI/AGMA 9000, Flexible Couplings — Potential Unbalance Classification5) ANSI/AGMA 9002, Bores and Keyways for Flexible Couplings (Inch Series) ANSI/AMT B15.1, Safety Standard for Mechanical Power Transmission Apparatus6) ANSI/API Std 541, Form-Wound Squirrel-Cage Induction Motors — 500 Horsepower and Larger ANSI/API Std 611, General-Purpose Steam Turbines for Petroleum, Chemical, and Gas Industry Services ANSI/API Std 670, Machinery Protection Systems ANSI/API Std 671/ISO 10441, Special Purpose Couplings for Petroleum, Chemical and Gas Industry Services ANSI/ASME B1.1, Unified Inch Screw Threads, UN and UNR Thread Form7) ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard ANSI/ASME B16.11, Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME B16.42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300 ANSI/ASME B16.47, Larger Diameter Steel Flanges: NPS 26 Through NPS 60 ANSI/ASME B18.18.2M, Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners ANSI/ASME B31.3, Process Piping ANSI/HI 1.6, Centrifugal Tests8) ANSI/HI 2.6, American National	

	Standard for Vertical Pump Tests API Std 547, General-Purpose Form-Wound Squirrel Cage Induction Motors — 250 Horsepower and Larger API Std 677, General-Purpose Gear Units for Petroleum, Chemical and Gas Industry Services ASME, Boiler and pressure vessel code BPVC, Section V, Nondestructive Examination ASME, Boiler and pressure vessel code BPVC, Section VIII, Rules for Construction of Pressure Vessels ASME, Boiler and pressure vessel code BPVC, Section IX, Welding and Brazing Qualifications DIN 910, Heavy-duty hexagon head screw plugs9) IEEE 841, IEEE Standard for Petroleum and Chemical Industry — Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors — Up to and Including 500 hp10) MSS SP-55, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities11) NACE MR0103, Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments12) NFPA 70:2008, National Electrical Code13) SSPC SP 6, Commercial Blast Cleaning14)	
Application	Low Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of pumps for low pressure applications	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for	The vendors will be contacted for feedback on

	pumps for low pressure applications.	existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

28　高圧炭化水素圧力容器

規格化の意図は将来の開発に向けて個別の石油会社の仕様書に代わって、分離装置、吸引洗浄装置、静電気コアレッサー/処理器、ガスコンタクターなどの高圧炭化水素適用のための圧力容器の設計・工学技術・材料選択・製造・テストに関連する建造スケジュールやコストに影響するであろう不確実性を削減する共通の判定基準を採用することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Pressure Vessels developments for High Pressure Process Hydrocarbon application developments with safety as a critical factor while still being economic.	This specification for Pressure Vessels defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on ASME Boiler and Pressure Vessel Code Section VIII/ISO16528-1.	The baseline spec will be identified by the workgroup after a gap analysis between various operator specifications.
Scope	The scope of this specification includes the following: a) welding end connection for the	The intent of selection of scope is to include all aspect of the equipment

	first circumferential joint for welded connections; b) first threaded joint for screwed connections; c) face of the first flange for bolted, flanged connections; d) first sealing surface for proprietary connections or fittings; e) safety accessories, where necessary.	such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	This specification does not apply for nuclear components, railway and marine boilers, gas cylinders or piping systems or mechanical equipment, e.g. turbine and machinery casings	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the	N/A

	Purchaser in the datasheet.	
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	API Std. 527 - Seat Tightness of Pressure Relief Valves ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form) ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (Inch) ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250 ASME B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 Through NPS 24 Metric/Inch Standard ASME B16.9 - Factory-Made Wrought Buttwelding Fittings ASME B16.11 - Forged Fittings, Socket-Welding and Threaded ASME B16.15 - Cast Copper Alloy Threaded Fittings, Classes 125 and 250 ASME B16.20 - Metallic Gaskets for Pipe Flanges — Ring-Joint, Spiral– Wound, and Jacketed ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500, and 2500 ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300 ASME B16.47 - Large Diameter Steel Flanges, NPS 26 Through NPS 60 Metric/Inch Standard ASME B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) ASME B36.10M - Welded and Seamless Wrought Steel Pipe ASME PCC-1 - Guidelines for Pressure Boundary Bolted Flange Joint Assembly ASME PCC-2 - Repair of Pressure Equipment and Piping ASME PTC 25 - Pressure Relief	N/A

	Devices ASME QAI-1 - Qualifications for Authorized Inspection ACCP - ASNT Central Certification Program ANSI/ASNT CP-189 - ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel ASNT SNT-TC-1A - Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing ASTM D56 - Standard Test Method for Flash Point by Tag Closed Tester ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester ASTM E3 - Standard Guide for Preparation of Metallographic Specimens ANSI/API Std. 521 - Pressure Relieving and Depressuring Systems ASTM E125 - Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings ASTM E140 - Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness ASTM E186 - Standard Reference Radiographs for Heavy-Walled [2 to 41/2-in. (51 to 114-mm)] Steel Castings ASTM E208 - Standard Test Method for Conducting Drop-Weight Test to Determine Nil– Ductility Transition Temperature of Ferritic Steels ASTM E280 - Standard Reference Radiographs for Heavy-Walled [41/2 to 12-in. (114 to 305-mm)] Steel Castings ASTM E446 - Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness ANSI/UL-969 - Marking and Labeling Systems	

	ISO 148-1 - Metallic Materials — Charpy Pendulum Impact Test Part 1: Test Method ISO 148-2 - Metallic Materials — Charpy Pendulum Impact Test Part 2: Verification of Testing Machines ISO 148-3 - Metallic Materials — Charpy Pendulum Impact Test Part 3: Preparation and Characterization of Charpy V-Notch Test Pieces for Indirect Verification of Pendulum Impact Machines ASME B1.13M - Metric Screw Thread — M Profile ASME B1.21M - Metric Screw Thread — MJ Profile ASME B18.2.3.3M - Metric Heavy Hex Screws ASME B18.2.3.5M - Metric Hex Bolts ASME B18.2.3.6M - Metric Heavy Hex Bolts ASME B18.2.6M - Metric Fasteners for Use in Structural Applications ASTM C695 - Standard Test Method for Compressive Strength of Carbon and Graphite ASTM C709 - Standard Terminology Relating to Manufactured Carbon and Graphite ASTM E4 - Standard Practices for Force Verification of Testing Machines ASTM E177 - Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods ASTM E691 - Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method ANSI/AWS A4.2M - Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal	
Application	High Pressure Process Hydrocarbon	N/A
Impact on Design	Provides baseline requirements for the designing and manufacturing of	The baseline requirements will be verified with the

and Manufacturing	Pressure Vessels for High Pressure Process Hydrocarbon applications	vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Pressure Vessels for High Pressure Process Hydrocarbon applications	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

29　計量パッケージ

計量架台はフレームあるいはモデュール上に全ての軽量関連機器を備えた流量計の一式である。最低不確実性を得て、操業・整備保守コストを最適化するように設計されている。計量架台は、流量調整・濾過・自動あるいは手動操作順序・水切り・換気・安全・整備保守・吊上げ・確認・見本抽出などのための機器を含む。オンショア地帯では問題ではないが、オフショア計量架台は往々に最低設置面積と重量が必要である。計量システムの最適性能と操作可能性にとり最も重要なものの一つはその制御システムである。計量制御システムの設計は各種の機能的適用や必要条件にかかっている。現行の規格化の意図はプロジェクト特定の要求事項を排除してオフショア適用に統一した必須条件を規定することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Metering Package developments with safety as a critical factor while still being economic.	This specification for Metering Package defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use

		on an offshore facility.
Baseline Standard	The baseline standard that this specification will be based off of will be determined after the gap analysis and risk assessment between the various operator specifications. B31.3 - Process piping ISO 17089 - ultrasonic gas meters?	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment has been performed
Scope	The scope of this specification will be determined after the gap analysis and risk assessment between the various operator specifications.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	The limitations of this specification will be determined after the gap analysis and risk assessment between the various operator specifications.	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A

Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	Normative References to be determined after baseline standard is determined.	N/A
Application	High Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of Fuel Gas Treatment Packages.	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Fuel Gas Treatment Packages.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

30　燃料ガス処理パッケージ　-　高圧炭化水素

燃料ガス架台は天然ガス流から汚染物質と液体を除去し、圧力を調整し燃料としての使用や他の機器用の計器用ガスの供給に備える。高圧ガス流は二重高圧調整器を通って架台に入る。次にガスは第二の下部並列圧力調整器を通る。下流の分離器が液体を落下するよう遊離させガス流から除去する。またガス調節架台も含まれる。規格化の範囲は高圧炭化水素適用に適用できる。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Fuel Gas Treatment Package developments for offshore applications with safety as critical factor while still being economic.	This specification for Fuel Gas Treatment Packages defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	The baseline standard that this specification will be based off of will be determined after the gap analysis and risk assessment between the various operator specifications. ASME Section VIII - Pressure Vessel ANSI B31.3/ANSI B31.3 - Piping ASME Section IX - Pipe Fab AWS D1.1 - Structural Steel Assembly API RP 14C - for testing?	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment has been performed
Scope	The scope of this specification will be determined after the gap analysis and risk assessment between the various operator specifications.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations	N/A

	3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	The limitations of this specification will be determined after the gap analysis and risk assessment between the various operator specifications.	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	Normative References to be determined after baseline standard is determined.	N/A
Application	High Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of Fuel Gas Treatment Packages.	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for Fuel Gas Treatment Packages.	The vendors will be contacted for feedback on existing practices and practicality of the specified

		requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

31　高圧プロセス炭化水素ポンプ

規格化の意図は将来の開発に向けて個別の石油会社の仕様書に代わって、石油輸出、凝縮ガソリン、熱媒体などの HP プロセス炭化水素適用のポンプの設計・工学技術・材料選択・製造・テストに関連する建造スケジュールやコストに影響するであろう不確実性を削減する共通の判定基準を採用することである。

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future pump developments for offshore applications with safety as critical factor while still being economic.	This specification for Pumps defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on API STD 610.	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment has been performed
Scope	The scope of this specification includes the following: 1. Centrifugal pumps 2.Overhung pumps 3. Between-bearing pumps	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing,

	4. Vertically suspended pumps.	installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	Seamless pumps are not included in the scope, along with heavy duty pump for applications in industries other than petroleum, petrochemical and gas processing.	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	ISO 7-1, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation	N/A

	ISO 228-1, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation ISO 261, ISO general purpose metric screw threads — General plan ISO 262, ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts ISO 281:2007, Rolling bearings — Dynamic load ratings and rating life ISO 286 (all parts), ISO system of limits and fits ISO 724, ISO general-purpose metric screw threads — Basic dimensions ISO 965 (all parts), ISO general-purpose metric screw threads — Tolerances ISO 1940-1, Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances ISO 3117, Tangential keys and keyways ISO 4200, Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length ISO 5753, Rolling bearings — Radial internal clearance ISO 7005-1, Metallic flanges — Part 1: Steel flanges for industrial and general service piping systems ISO 7005-2, Metallic flanges — Part 2: Cast iron flanges ISO 8501 (all parts), Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness ISO 9606 (all parts), Approval testing of welders — Fusion welding1) ISO 9906, Roto-dynamic pumps — Hydraulic performance acceptance tests2) ISO 10438:2007 (all parts),	

	Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries ISO 10441, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications ISO 10721-2, Steel structures — Part 2: Fabrication and erection ISO 11342, Mechanical vibration — Methods and criteria for the mechanical balancing of flexible rotors ISO 14120, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards ISO 14691, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications ISO 15156-1, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials ISO 15609 (all parts), Specification and qualification of welding procedures for metallic materials — Welding procedure specification ISO 15649, Petroleum and natural gas industries — Piping ISO/TR 17766, Centrifugal pumps handling viscous liquids — Performance corrections ISO 21049:2004, Pumps — Shaft sealing systems for centrifugal and rotary pumps IEC 60034-1, Rotating electrical machines — Part 1: Rating and performance	

	IEC 60034-2-1, Rotating electrical machines — Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles) IEC 60079 (all parts), Electrical apparatus for explosive gas atmospheres3) EN 953, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards EN 13445 (all parts), Unfired pressure vessels EN 13463-1, Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements ANSI/ABMA 7, Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plan 4) ANSI/AGMA 9000, Flexible Couplings — Potential Unbalance Classification5) ANSI/AGMA 9002, Bores and Keyways for Flexible Couplings (Inch Series) ANSI/AMT B15.1, Safety Standard for Mechanical Power Transmission Apparatus6) ANSI/API Std 541, Form-Wound Squirrel-Cage Induction Motors — 500 Horsepower and Larger ANSI/API Std 611, General-Purpose Steam Turbines for Petroleum, Chemical, and Gas Industry Services ANSI/API Std 670, Machinery Protection Systems ANSI/API Std 671/ISO 10441, Special Purpose Couplings for Petroleum, Chemical and Gas Industry Services ANSI/ASME B1.1, Unified Inch Screw Threads, UN and UNR	

	Thread Form7) ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard ANSI/ASME B16.11, Forged Steel Fittings, Socket-Welding and Threaded ANSI/ASME B16.42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300 ANSI/ASME B16.47, Larger Diameter Steel Flanges: NPS 26 Through NPS 60 ANSI/ASME B18.18.2M, Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners ANSI/ASME B31.3, Process Piping ANSI/HI 1.6, Centrifugal Tests8) ANSI/HI 2.6, American National Standard for Vertical Pump Tests API Std 547, General-Purpose Form-Wound Squirrel Cage Induction Motors — 250 Horsepower and Larger API Std 677, General-Purpose Gear Units for Petroleum, Chemical and Gas Industry Services ASME, Boiler and pressure vessel code BPVC, Section V, Nondestructive Examination ASME, Boiler and pressure vessel code BPVC, Section VIII, Rules for Construction of Pressure Vessels ASME, Boiler and pressure vessel code BPVC, Section IX, Welding and Brazing Qualifications DIN 910, Heavy-duty hexagon head screw plugs9) IEEE 841, IEEE Standard for Petroleum and Chemical Industry — Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors — Up to and Including 500 hp10)	

	MSS SP-55, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities11) NACE MR0103, Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments12) NFPA 70:2008, National Electrical Code13) SSPC SP 6, Commercial Blast Cleaning14)	
Application	High Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of pumps for high pressure applications	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for pumps for high pressure applications.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

32　ガス圧縮機器パッケージ

典型的なガス圧縮機器パッケージはあらゆる配列の適用のための特注仕様書では250 から 9,000 馬力(HP)に渡る。現行の規格はガス圧縮機器パッケージに共通する必須条件を規定している。

範囲に含まれるガス圧縮機器は:

- ガスのリフト・再注入
- 収集ガス処理
- ガスタービン燃料増加
- トランスミッション・貯蔵
- 浮動生産・貯蔵・荷下ろし(FPSO)

Procedure	**Criteria**	**Process**
Equipment Selection	The purpose of this specification is to harmonize the requirements of individual company specifications for future Gas Compressor Package developments for offshore applications with safety as critical factor while still being economic.	This specification for Gas Compressor Packages defines the minimum requirements for the design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation for use on an offshore facility.
Baseline Standard	This specification will be based on ISO 13707.	The baseline spec will be determined by the workgroup after a gap analysis and risk assessment has been performed
Scope	The scope of this specification includes reciprocating compressors and their drivers used in the petroleum and natural gas industries with either lubricated or non-lubricated cylinders. Also included are aftercoolers, controls, instrumentation, intercoolers, lubricating systems, pulsation suppression devices and other auxiliary equipment.	The intent of selection of scope is to include all aspect of the equipment such as: design, fabrication, assembly, inspection, testing, packing, installation, commissioning and documentation.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations	N/A

	3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	The following are not included within the scope of this specification: 1. integral gas-engine driven compressors 2. Packaged high-speed separable engine-driven reciprocating gas compressors 3. Compressors with single-acting trunk-type piston that also serve as crossheads 4. Plant or instrument air compressors that discharge at gauge pressure of 131 bar or below. 5. Gas engine 6. steam engine drivers	N/A
Gap Analysis	A Gap analysis will be performed between various Operator & Owner Spec to identify the common requirements.	N/A
Risk Assessment	A Risk assessment will be performed on the selected equipment package to identify if the standardized specification provide an acceptable level of safety.	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	ISO 7-1, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions,	N/A

	Tolerances and Designation. ISO 261, ISO general-purpose metric screw threads — General plan. ISO 262, ISO general-purpose metric screw threads — Selected sizes for screws, bolts and nuts. ISO 281-1, Rolling bearings — Dynamic load ratings and rating life — Part 1: Calculation methods. ISO 1217, Displacement compressors — Acceptance tests. ISO 7005-1, Metallic flanges — Part 1: Steel flanges. ISO 7005-2, Metallic flanges — Part 2: Cast iron flanges. ISO 8501-1, Preparation of steel substrates before application of paints and related products — Visual assessment of surfaces cleanliness. Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings. ISO 10436, Petroleum and natural gas industries — General-purpose steam turbines for refinery service. ISO 10437, Petroleum and natural gas industries — Special-purpose steam turbines for refinery service. ISO 10438-2, Petroleum and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries — Part 2: Special-purpose oil systems. ISO 10441, Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications. ISO 13691, Gears — High-speed special-purpose gear units for the petroleum, chemical and gas industries. ISO 13706, Petroleum and natural gas industries — Air-cooled heat exchangers. ISO 14691, Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — General purpose applications.	

	ISO 16812, Petroleum and natural gas industries — Shell and tube heat exchangers. IEC 60034-1, Rotating electrical machines — Part 1: Rating and performance. IEC 60079-0, Electrical apparatus for explosive gas atmospheres — Part 0: General requirements. IEC 60529, Degrees of protection provided by enclosures (IP codes). IEC 60848, Preparation of function charts for control systems. ANSI1) B 1.20.1, Pipe Threads, General Purpose (Inch). ANSI B 16.5, Pipe Flanges and Flanged Fittings. ANSI B 31.3, Process Piping. API2) RP 520/1, Sizing, Selection and Installation of Pressure Relieving Devices in Refineries — Part 1: Sizing and selection. API RP 520/2, Sizing, Selection and Installation of Pressure Relieving Devices in Refineries — Part 2: Installation. API Std 526, Flanged Steel Pressure Relief Valves. API Std 614, Lubrication, Shaft Sealing and Control Oil Systems And Auxiliaries For Petroleum, Chemical and Gas Industry Service. API Std 670, Vibration, Axial-Position, and Bearing-Temperature Monitoring Systems. ASME3), Boiler and Pressure Vessel Code 1998. ASTM4) A 106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service. ASTM A 193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service. ASTM A 194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both.	

	ASTM A 216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service. ASTM A 247, Standard Test Method for Evaluating the Microstructure of Graphite in Iron Castings. ASTM A 269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service. ASTM A 278M, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F. ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength. ASTM A 312M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes. ASTM A 320M, Standard Specification for Alloy Steel Bolting Materials for Low-Temperature Service. ASTM A 388M, Standard Practice for Ultrasonic Examination of Heavy Steel Forgings. ASTM A 395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures. ASTM A 503, Standard Specification for Ultrasonic Examination of Large Forged Crankshafts. ASTM A 536, Standard Specification for Ductile Iron Castings. ASTM A 668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use. ASTM E 94, Standard Guide for Radiographic Testing. ASTM E 125, Standard Reference Photographs for Magnetic Particle	

	Indications on Ferrous Castings. ASTM E 142, Standard Method for Controlling Quality of Radiographic Testing. ASTM E 709, Standard Guide for Magnetic Particle Examination.	
Application	High Pressure Process Hydrocarbon	N/A
Impact on Design and Manufacturing	Provides baseline requirements for the designing and manufacturing of gas compressor packages.	The baseline requirements will be verified with the vendors for existing practices and cost benefit analysis.
Inspection and testing	Provides baseline requirement for inspection, testing and packaging for gas compressor packages.	The vendors will be contacted for feedback on existing practices and practicality of the specified requirements.
Installation and commissioning	The procedures of installation and commissioning onboard shall be developed and mutually agreed upon by the purchaser and the Vendor.	N/A
Impact of standardization on stakeholders	Global reach and standard harmonized spec for worldwide use. Reduction of custom made orders, vendors can offer standard packages at cost benefit. Reduction of documentation requirement for vendors. Cost benefit for purchaser. Identification of Key Class and Regulatory requirements in the appendix.	N/A

VIII. 監視・制御システムの規格化

1　序文

制御はデータの収集・分析や検索・処理の中で操業するオフショア業界において不可欠要素である。石油・ガス業界での機器に極度な要求が課され、耐久性・信頼性の必要性が増大化して、これらの工業用プロセスシステムの補助機器がプロセスのスムーズな作動を確実化するために一層重要となっている。

下記の図1は基礎的制御フローの過程を示す。データ収集(DAQ)はコンピューターで電圧、電流、温度、圧力又は音などの電気的あるいは物理的現象を計測する。DAQ システムはセンサー、DAQ 測定ハードウェアそしてプログラム化可能ソフトウェアを持つコンピュータから構成されている。プロセスはデータ記憶と分析が続く。最終時点で、データの視覚化と解釈が示される。

図 1：基礎的制御システム処理

1.1　掘削制御システムの型式

- 分散型制御システム(DCS)
- 監視制御・データ収集(SCADA)
- 安全計器装備システム(SIS)
- パイプ連結管理システム,
- 衝突防止システム
- 泥土制御システム
- スマート掘削計器装備
- ドロー・ワーク主及び補助システム

2　分散型制御システム

Procedure	**Criteria**	**Process**
Equipment Selection	A distributed control system (DCS) is a digital automated industrial control system (ICS) that uses geographically distributed control loops throughout a factory, machine or control area. Unlike a centralized control system that operates all machines, a DCS allows each section of a machine to have its own dedicated controller that runs the operation. A DCS has several local controllers located throughout the area that are connected by a high-speed communication network. While each controller works autonomously, there is central supervisory control run by an operator.	Process oriented control system
Baseline Standard	IEC 61131 and IEC 61499, IEC/TS 62443-1-1	N/A
Scope	To give the standard guidelines for PIMS system Especially for: a) Safety b) Risk model c) Design and software d) Inspection and testing DCS includes both software and hardware elements. Installation costs are minimized by the simplicity of local installation with most controllers. Reliability is improved by onsite, low-latency automated control;	**Decision criteria for selection** 1. Standardize the substantial system 2. Standardize stronger analytical capability 3. Standardizing good conceptual model of failures 4. Standardizing robust system 5. Standardizing the rules and guidance on risk factors and risk modeling—to fix known problems that are undermining effective safety decisions by

	human oversight is enabled for central control functions and remote control options. Individual processes have their own controllers with separate CPUs, so other processes can continue in an individual failure situation, unlike a central controller system. **Subcomponents** A DCS combines the following into a single automated system: human machine interface (HMI), logic solvers, historian, common database, alarm management, and a common engineering suite.	operators. 6. Re-shaping the inspection program to adapt to the special challenges in performance-based regulation. 7. Expanding the accident investigations program 8. Developing a system for managing change—grounded in credible analysis, testable assumptions, and broad input; and with evaluation built into program design.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	Increased software development cost, more complex failure diagnosis and dependence on	N/A

	communication technology.	
Gap Analysis	Gap analysis needs to be developed	N/A
Risk Assessment	• Risk assessment failure, and incident data in evaluating their risk models • FMEA/FMECA	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	IEC 1131-3 API RP 16E : Recommended Practice for Design of Control Systems API16D IEEE SA - 1865 - Specifications for Maintenance and Testing of ...	N/A
Application	offshore	N/A
Impact on Design and Manufacturing	Robust and sustainable design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	Inspection and test plan to be submitted	N/A
Impact of standardization on stakeholders	• Cost efficient • Better operation efficiency • Better Maintenance procedure	N/A

3　監視制御・データ収集　（SCADA）

Procedure	Criteria	Process
Equipment Selection	SCADA systems are used to control dispersed assets where centralized data acquisition is as important as control. SCADA systems integrate data acquisition systems with data transmission systems and HMI software to provide a centralized monitoring and control system for numerous process inputs and outputs. SCADA systems are designed to collect field information, transfer it to a central computer facility, and display the information to the operator graphically or textually, thereby allowing the operator to monitor or control an entire system from a central location in near real time. It uses the Remote Terminal Units (RTUs) and/or PLCs.	DCS and SCADA are monitoring and control mechanisms in industrial installations, they have different goals. • DCS is process oriented, whereas SCADA is data-gathering oriented. DCS emphasizes more on control of the process and it also consists of supervisory control level. SCADA concentrates more on acquisition process data • DCS employs a closed loop control at process control station and at remote terminal units. But in case of • SCADA there is no such closed loop control. • SCADA maintains a database to log the parameter values which can be further retrieved for operator display and this makes the SCADA to present the last recorded values
Baseline Standard	IEC 61131 and IEC 61499, IEC/TS 62443-1-1	N/A
Scope	To give the standard guidelines for PIMS system Especially for:	**Decision criteria for selection** 1. Standardize the

	a) Safety b) Risk model c) Design and software d) Inspection and testing DCS includes both software and hardware elements. Installation costs are minimized by the simplicity of local installation with most controllers. Reliability is improved by onsite, low-latency automated control; human oversight is enabled for central control functions and remote control options. Individual processes have their own controllers with separate CPUs, so other processes can continue in an individual failure situation, unlike a central controller system.	substantial system 2. Standardize stronger analytical capability 3. Standardizing good conceptual model of failures 4. Standardizing robust system 5. Standardizing the rules and guidance on risk factors and risk modeling—to fix known problems that are undermining effective safety decisions by operators. 6. Re-shaping the inspection program to adapt to the special challenges in performance-based regulation. 7. Expanding the accident investigations program 8. Developing a system for managing change—grounded in credible analysis, testable assumptions, and broad input; and with evaluation built into program design.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should	N/A

	be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	
Limitation	Point-to-point is functionally the simplest type; however, it is expensive because of the individual channels needed for each connection. In a series configuration, the number of channels used is reduced; however, channel sharing has an impact on the efficiency and complexity of SCADA operations. Second issue is on cybersecurity of SCADA data networks. SCADA and industrial protocols, such as Modbus/TCP, EtherNet/IP, IEC 61850, ICCP and DNP315, are critical for communications to most control devices. Unfortunately, many of these protocols were designed without security built	N/A
Gap Analysis	Gap analysis needs to be developed	N/A
Risk Assessment	• Risk assessment failure, and incident data in evaluating their risk models • FMEA/FMECA	N/A
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A

Normative References	• NIST National Institute of Standards and Technology • NSTB National SCADA Testbed • ISO 16484-2:2004(en), Building automation and control systems • IEC 1131-3 • API RP 16E : Recommended Practice for Design of Control Systems • API16D • IEEE SA - 1865 - Specifications for Maintenance and Testing of ... • ISO 16484-2:2004(en), Building automation and control systems • ISO 11064-1:2000(en), Ergonomic design of control centers • NEMA ICS 1-Industrial Control and Systems: General Requirements	N/A
Application	offshore	N/A
Impact on Design and Manufacturing	Robust and sustainable design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	Inspection and test plan to be submitted	N/A
Impact of standardization on stakeholders	• Cost efficient • Better operation efficiency • Better Maintenance procedure	N/A

4　安全計器装備システム

Procedure	**Criteria**	**Process**
Equipment Selection	Safety instrumentation systems helps in risk reduction and incident prevention. A safety instrumented system (SIS) takes automated action to keep a plant in a safe state, or to put it into a safe state, when abnormal conditions are present. The SIS may implement a single function or multiple functions to protect against various process hazards in your plant.	Layer of Protection Analysis of high hazard scenarios, we often rely on a diversity of protections including instrumented and non-instrumented safeguards
Baseline Standard	API 14C standard ISA84/IEC1508 IEC 61508	N/A
Scope	To give the standard guidelines for PIMS system Especially for: a) Safety b) Risk model c) Design and software d) Inspection and testing Safety instrumented system. A safety instrumented system (SIS) consists of an engineered set of hardware and software controls which are especially used on critical process systems.	**Decision criteria for selection** 1. Standardize the substantial system 2. Standardize stronger analytical capability 3. Standardizing good conceptual model of failures 4. Standardizing robust system 5. Standardizing the rules and guidance on risk factors and risk modeling—to fix known problems that are undermining effective safety decisions by operators. 6. Re-shaping the inspection program to adapt to the special challenges in performance-based regulation. 7. Expanding the accident

		investigations program 8. Developing a system for managing change—grounded in credible analysis, testable assumptions, and broad input; and with evaluation built into program design.
Standardization Methodology	The methodology for standardization Process followed is: 1. Request for design specs (owner/operator, shipyard, engineering company and class) 2. Identify Industry Standard/Regulations 3. Perform gap analysis & Identify the gap in spec's 4. Justify whether Risk analysis required 5. Perform risk analysis and justify the specified Equipment Package should be included in the harmonized standard 6. Identify common ground for accepting the spec. 7. Develop a harmonized standard for the selected equipment	N/A
Limitation	Logic solver issues, Limited trip action and reduced vulnerability to a single failure compared to a 1oo1 architecture.	N/A
Gap Analysis	Gap analysis needs to be developed	N/A
Risk Assessment	• Risk assessment failure, and incident data in evaluating their risk models • FMEA/FMECA • Hazards and	N/A

	Operability Studies (HAZOP) and Layer of Protection Analysis (LOPA)	
Class Requirement	Applicable Class Requirement for the Project are to be specified by the Purchaser in the datasheet.	N/A
Regulatory Impact	Applicable Regulatory Requirement are to be specified by the Purchaser in the datasheet.	N/A
Normative References	IEC 1131-3 API RP 16E : Recommended Practice for Design of Control Systems API16D IEEE SA - 1865 - Specifications for Maintenance and Testing of ...	N/A
Application	offshore	N/A
Impact on Design and Manufacturing	Robust and sustainable design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	Inspection and test plan to be submitted	N/A
Impact of standardization on stakeholders	• Cost efficient • Better operation efficiency • Better Maintenance procedure Perpetual benefits that last for the life of the system include less maintenance, faster testing, easier documentation of the safety management reports and modular replacement strategies	N/A

5　パイプライン健全性管理システム

Procedure	**Criteria**	**Process**
Equipment Selection	The goal of Pipeline Integrity Management (PIM) for gas transport pipelines is to ensure operations with as little damage and environmental impact as possible while still being economic.	The installation of high-pressure gas pipelines follows applicable construction norms and relevant DVGW worksheets in order to ensure the integrity of the line during installation. During pipeline operation, maintenance is of essential importance for the sustaining technical integrity
Baseline Standard	ASME B318S, ANSI/API RP 1173	N/A
Scope	To give the standard guidelines for PIMS system Especially for: a) Safety b) Risk model c) Design and software d) Inspection and testing	**Decision criteria for selection** 1. Standardize the substantial system rules and the inspection and enforcement processes in a way that more clearly considers how the program influences behavior. 2. Standardize stronger analytical capability 3. Standardizing good conceptual model of failures—to underpin data collection, inspection, investigations, 4. Standardizing robust system 5. Standardizing the rules and guidance on risk factors and risk modeling—to fix known problems that are undermining effective safety decisions by operators. 6. Re-shaping the inspection program to adapt to the special challenges in

		performance-based regulation. 7. Expanding the accident investigations program 8. Developing a system for managing change— grounded in credible analysis, testable assumptions, and broad input; and with evaluation built into program design.
Standardization Methodology	• The scope of work included the implementation of an integrated software solution including: 1. Pipeline Integrity Management System (including Asset Management, Risk Assessment, Inspection Planning, Defect Assessment, Data Alignment, etc.) 2. Integration with external software currently present at client site. 3. Software and Manuals 4. 4. Data Integration and Analysis (including GAP analysis)	N/A
Limitation	Time-dependent anomalies such as internal corrosion, external corrosion, or stress corrosion cracking.	Piping cracking is evaluated, an analysis utilizing appropriate assumptions about rates shall be used to assure that the defect will not attain critical dimensions prior to the scheduled repair or next inspection. It all depend on pressure and loading of pipes.

Gap Analysis	Gap analysis needs to be developed	N/A
Risk Assessment	• Risk assessment for leak, failure, and incident data in evaluating their risk models • Pipe stress analysis • Corrosion evaluation • Hazardous liquid and gas transmission pipelines identify the target problem	N/A
Class Requirement	ABS group Guidelines for Implementing Process Safety Management, 2nd edition	N/A
Regulatory Impact	Regulations of DVGW1, European regulations2, PHMSA, Planning and Informed Pipeline Alliance, BSEE, USCG	N/A
Normative References	• 49 CFR Part 195 Pipeline Safety: Pipeline Integrity Management in High Consequence Areas (Hazardous Liquid Operators with 500 or More Miles of Pipeline), Final Rule • API Standard 1160 – Managing System Integrity for Hazardous Liquid Pipelines • ASME B31.8S Managing System Integrity of Gas Pipelines – American Society of Mechanical Engineers • ISO/IEC 31010: Risk Management – Risk Assessment Techniques,	N/A

	International Organization for Standardization	
Application	Onshore and offshore	N/A
Impact on Design and Manufacturing	Robust and sustainable design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	Inspection and test plan to be submitted	N/A
Impact of standardization on stakeholders	• Global reach and strong product focus • Early Diagnosis of the pipelines • Better alarm system and immediate repair plan	N/A

6 CMC 制御：クラウン据付補正装置

Procedure	**Criteria**	**Process**
Equipment Selection	The CMC offers passive heave compensation for the drill string. Aiming to keep a constant load on the bit while drilling. The CMC is mounted on top of the derrick crown beams. CMCs are used on conventional derrick/draw work vessels.	To apply a constant tension to the drill string and compensate for any rig movement. Correct weight on bit (tension in drill string) is extremely important to maintain efficient drilling and long drill bit life. The CMC is installed on top of the derrick. They all comprises of a pair of vertically mounted hydraulic cylinders whose function is to convert load to hydraulic pressure. The piston rods are attached directly to the crown block. Since the crown block will move in relation to the derrick, some form of length compensation is required for the drill line. This is obtained by guide sheave and pivoted arms, or through our new Eccenter Hub.

Baseline Standard	API 8C, PSL1 and supplementary requirements of SR-3 and SR-5 for the sheaves and bearings, and API 4F for the structure and crown block assembly.	N/A
Scope	To give the standard guidelines for CMC control system Especially for: a) Safety b) Risk model c) Design and software d) Inspection and testing Focusing on Dynamic capacity, static capacity, cylinder stroke, working pressure, Drill line diameter, AHC capacity.	**Decision criteria for selection** Improved WOB performance ■ Light-weight design with low center of gravity (COG) ■ Modular design simplifies component handling ■ Fully-assembled and tested for easy installation and commissioning ■ Optimal geometry of the compensator minimizes wire wear and tear ■ Easy and safe access for optimized maintenance with increased uptime
Standardization Methodology	•Following the general overview guidelines for Standardization	Importance of Standardization This simplifies installation considerably, as it eliminates the need to assemble various components on the rig. The modular design also simplifies component handling and keeps your operational costs at a minimum.
Limitation	Installation difficulties encountered which needs to be standardized	N/A
Gap Analysis	Gap analysis needs to be developed	N/A
Risk Assessment	-Shock absorption	Floating rigs / MODUs

	-Overload protection -Quick-lift protection -Sub-sea retrieval	(mobile offshore drilling units) utilise a drill string compensation system to provide rig heave compensation. These systems can lock-up or fail, and when this occurs during locked-to-bottom operations the consequences can be severe due to the potential to catastrophically damage the workstring in either compression or tension as the rig heaves without compensation. The consequence is further elevated by the fact that hydrocarbons will often be flowing through the work string during these operations. These potential consequences result in the classification of this hazard as a major accident event if it was to occur.
Class Requirement	ABS group to be checked	N/A
Regulatory Impact	SHMS, OSHA	N/A
Normative References	API, IEC	N/A
Application	offshore	N/A
Impact on Design and Manufacturing	Robust and sustainable design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	Inspection and test plan to be submitted	N/A
Impact of standardization on stakeholders	• Cost and operational efficiency	N/A

7　衝突防止制御システム

Procedure	**Criteria**	**Process**
Equipment Selection	Anti-collision system: The machines have position measurement capabilities in all moving axis via sensors that pass to the ACS to dynamically monitor the coordinates and calculate machine exclusion zones. The ACS can then stop the machines automatically before a potential collision occurs if it senses a zone clash. This system will prevent downtime and safety hazards by deflecting all the possible near accidents that could occur on the drillfloor.	**Available for machinery in the following zones:** Main well Aux well Offline stand building area Off drillfloor setback area
Baseline Standard	API	N/A
Scope	To give the standard guidelines for Anti-collision control system Especially for: a) Safety b) Risk model c) Design and software d) Inspection and testing Focus on •Networking and communication to the crane controllers •Collision avoidance software •Override functionality	N/A
Standardization Methodology	•Following the general overview guidelines for Standardization Focus of standardization is to check the functionality of the system and verify.	N/A

Limitation		N/A
Gap Analysis	Gap analysis needs to be developed	N/A
Risk Assessment	-	N/A
Class Requirement	ABS rule requirements	N/A
Regulatory Impact	UK HSE, PFEER, SOLAS, OSHA	N/A
Normative References	API, IEC	N/A
Application	offshore	N/A
Impact on Design and Manufacturing	Robust and sustainable design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	Inspection and test plan to be submitted	N/A
Impact of standardization on stakeholders	• Cost and operational efficiency	N/A

8　スマート掘削計器装備

Procedure	**Criteria**	**Process**
Equipment Selection	Real-time data acquisition, historical trending, flexible alarm capabilities and mechanisms for storing **drilling** parameters for post-project analysis. This **system** sets the industry standard for high-technology interface between downhole sensors, high capacity processing	N/A
Baseline Standard	API and IEC	N/A
Scope	Hardware included: • Sdi PLC and Remote Input/Output cabinets • Sensor package may include sensors to measure • Standpipe pressure sensor • Trip Tank Level/volume sensor, • Stripping tank level sensor, • Mud Pit Level/Volume sensor, • Mud Return Flow sensor, Flow paddle • Mud Temperature in/out sensor, Clamp-on • Mud density in sensor, Radioactive Clamp-on • Mud Pit Density sensor, 2 x PT • Tong torque sensor • Cement pressure monitoring in Sdi • Choke&kill pressure monitoring in Sdi • Alarm Horn	N/A

	• Alarm Horn/Light in Mud Pit Area Software included: • HMI displays for Drilling, Tripping, Volume control and Setup functionality • Sdi Alarm system • Trending functionality for drilling data	
Standardization Methodology	API, IEC, ABS ISQM	N/A
Limitation	control system for managing, controlling and monitoring **rig** floor equipment in a safe and efficient manner hence a back up power is most appropriate.	N/A
Gap Analysis	To be developed	N/A
Risk Assessment	more expensive, and with the risk of cuttings is not properly handled, oil based mud can be a possible hazard	N/A
Class Requirement	To be checked	N/A
Regulatory Impact	To be checked	N/A
Normative References	API, IEC,	N/A
Application	Drilling control system	N/A
Impact on Design and Manufacturing		N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	To be checked	N/A
Impact of standardization on stakeholders	Cost and operational efficiency	N/A

9　泥土制御システム

Procedure	**Criteria**	**Process**
Equipment Selection	Drilling fluid is used to aid the drilling of boreholes into the earth. Often used while drilling oil and natural gas wells and on exploration drilling rigs, drilling fluids are also used for much simpler boreholes, such as water wells. Liquid drilling fluid is often called drilling mud. The three main categories of drilling fluids are water-based muds (which can be dispersed and non-dispersed), non-aqueous muds, usually called oil-based mud, and gaseous drilling fluid, in which a wide range of gases can be used.	The mud control system includes • Bulk storage and transfer system • Mud additive system • Mud circulation and storage • Solid control equipment • Mud real time monitoring system
Baseline Standard	API, IEC 60079-10-1, ATEX, IECEx.	N/A
Scope	The scope of mud control system requirements -hardware -network -voltage and power -design temperature -controller -Control panel -Ex equipment classifications	Mud control system for control and monitoring of mud mixing, mud transfer and bulk transfer. • User friendly HMI system to ensure fast and safe operations. • Remote control of equipment and systems. • Fully automated mode • Control and monitoring of mud storage systems • Interface to rig systems. • PLC panels, Remote IO panels (safe or hazardous area), LCP panels and VFD panels. • Reporting, trending and logging of data

		• MCC
Standardization Methodology	Overview of standard methodology will be followed	N/A
Limitation	-drilling fluids can be recycled so as to be reused - efficient separation of drilled rock particles from fluids and a reduction in the volumes of **mud** lost - the possibility of well-bore instability	N/A
Gap Analysis	Gap analysis to be developed	N/A
Risk Assessment		N/A
Class Requirement	To be checked	N/A
Regulatory Impact	Code of federal regulations, Natural gas regulatory system	N/A
Normative References	IEC 60079-10-1	N/A
Application	Offshore	N/A
Impact on Design and Manufacturing	Uniform design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	To be checked	N/A
Impact of standardization on stakeholders	Improve cost, and operation efficiency	N/A

10　ドロー･ワーク制御システム

Procedure	**Criteria**	**Process**
Equipment Selection	A draw-works is the primary hoisting machinery that is a component of a rotary drilling rig. Its main function is to provide a means of raising and lowering the traveling blocks. The wire-rope drilling line winds on the drawworks drum and extends to the crown block and traveling blocks, allowing the drill string to be moved up and down as the drum turns	Modern draw-works consists of five main parts: the drum, the motor(s), the reduction gear, the brake, and the auxiliary brake. The motors can be AC or DC-motors, or the draw-works may be connected directly to diesel engines using metal chain-like belts. The number of gears could be one, two or three speed combinations.
Baseline Standard	API standards; ACGIH TLVs; ANSI standards; NEC, IEC, IEEE-45, API 500, and NEMA standards	N/A
Scope	Draw-work control system scope -Rating input power -Maximum fastline pull -Drill line dia -Drum size -Gear speed -Main & Auxiliary brake -Outline size -weight	N/A
Standardization Methodology	Overview guidelines as given	N/A
Limitation	Drill Floor Protection Protecting the floor has always been difficult because block speed must be continually monitored and controlled to prevent the **drawworks** brakes.	N/A
Gap Analysis	Gap analysis to be	N/A

	developed	
Risk Assessment	Risk analysis to be developed	N/A
Class Requirement	To be checked	N/A
Regulatory Impact	Code of federal regulations, Natural gas regulatory system	N/A
Normative References	To be checked	N/A
Application	Offshore	N/A
Impact on Design and Manufacturing	Uniform design	N/A
Inspection and testing	To be checked	N/A
Installation and commissioning	To be checked	N/A
Impact of standardization on stakeholders	Improve cost, and operation efficiency	N/A

IX. 掘削およびサブシー機器システムの規格化

1 序文

この規格化の意図は各種規制機関と共通する業界規格を統一し規定することである。現在の作業は5ステージで提案されている。

1. ステージ１ 坑井制御機器
2. ステージ２ 吊上げシステム機器
3. ステージ３ パイプ取扱い機器
4. ステージ４ 高圧・低圧泥土システム
5. ステージ５ サブシー生産機器

2　掘削・サブシー機器

Category	Equipment	Baseline Standard
Well Control System	Blowout Preventer System and Equipment, Lower Marine Riser Package, Choke & Kill System and Equipment, Diverter System and Equipment, Marine Drilling Riser System, and Auxiliary Well Control Equipment.	**API 16A** **API 16A** **API 16C** **API 64** **API 16F**
Derrick Systems	Conductor Tensioning System Drill String Compensation System Derricks/Mast Hoisting Equipment Riser Running Equipment	**API 4F** **API 8C** **API 16F**
Drilling Fluid Conditioning Systems	Bulk Storage and Transfer System Mud Return (Conditioning) System Well Circulation System (HP & LP)	
Pipe/Tubular Handling Systems	Lifting Equipment Handling Equipment Rotary Equipment Miscellaneous Equipment (e.g., power slips, tongs, catwalk, mechanical mousehole and any other handling devices used to aid in the transfer of drilling tubulars and marine drilling riser between the rotary table and storage areas).	**API 2C** **API 7K**

Subsea Production System/ Equipment	Wellhead, Tree and Tubing Hanger Flowline, Jumper and Riser HIPPS Manifold/PLET/PLEM and Template Injection and Service Systems Umbilical/Flying Lead Electrical System Control and Monitoring System Capping Stack Flow Meter Remotely Operated Vehicle (ROV)/Remotely Operated Tool (ROT) Interfaces Foundation Subsea Protection Structure	**API 17 Series as applicable)**

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ASME Boiler and pressure vessel code, Section V, "Non destructive examination"

ASME Boiler and pressure vessel code, Section VIII, "Pressure vessels"

ASME Boiler and pressure vessel code, Section IX, "Welding and brazing qualifications".

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API 670 Machinery Protection Systems API 6AF2 Technical Report on Capabilities of

API 6L1 TR - Elastomer Life Estimation Testing Procedures

API 15 HR - Specification for High Pressure Fiberglass Line Pipe

API 15LR SPEC Pipes Fiber Glass

API 15TL4 Care of FG Tubulars

API 520 Part I Pressure relief devices

API 520 Part II Pressure relief device Installation

API 521 - Guide for pressure relief systems

API 526 Pressure relief valves flanged

API 540 electrical installations

API 541 electric motors squirrel cage large

API 551 Process instrumentation

API 578 Alloy piping Matl. Verif. Program

API 580 Risk-based Inspection

API 610 Centrifugal pumps

API 682 Pumps Shaft Sealing

API 684 Rotors balancing

API 685 Pumps Seal Less centrifugal

API 686 Machinery installation RP

18 Pump Skid Package:

ASME B31.1 Power Piping

ISO 7 Pipe threads where pressure-tight joints are made on the threads.

ISO 7 Pipe threads where pressure-tight joints are made on the threads.

ISO 7005-1 Metallic flanges — Part 1: Steel flanges European Standards

ISO 9329-4 Seamless steel tubes for pressure purposes

ISO/R 228, Pipe threads where pressure-tight joints are not made on the threads (1/8 inch to 6 inches).

ISO 496, Driving and driven machines — Shaft heights.

ISO/R 775, Cylindrical and 1/10 conical shaft ends.

ISO 3069, End-suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing.

ISO 76 Rolling bearings — Static load ratings.

ISO 2372 Mechanical vibration of machines with operating speeds from 10 to 200 rev/s — Basis for specifying evaluation standards.

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ISO 3069 End suction centrifugal pumps — Dimensions of cavities for mechanical seals and for soft packing.

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ISO 21049 Pumps - Shaft sealing systems for centrifugal and rotary pumps.

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ISO 261 ISO general-purpose metric screw threads - General plan.

ISO 262 ISO general-purpose metric screw threads - Selected sizes for screws, bolts, and nuts.

ISO 1940-1, Mechanical vibration - Balance quality requirements of rigid rotors - Part 1:

ISO 5753 Roller bearings- Radial internal clearance.

ASME B31.1 Power Piping

ASME B16.5 Pipe Flanges and Flanged Fittings

ANSI B73.1 or B73.2

ASME B1.1 Unified inch screw threads, UN and UNR thread form.

ASME B15.1 Mechanical power transmission apparatus.

ASME B 16.1 Cast iron pipe flanges and flanged fittings.

ASME B16.5, Pipe flanges and flanged fittings.

ASME B16.11 Forged steel fittings, socket-welding and threaded.

ASME B16.42 Ductile iron pipe flanges & flanged fittings.

ASME B16.47 Large diameter steel flanges.

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API 670 Machinery Protection Systems

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API 6L1 TR - Elastomer Life Estimation Testing Procedures

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API 580 Risk-based Inspection

API 610 Centrifugal pumps

API 682 Pumps Shaft Sealing

API 684 Rotors balancing

API 685 Pumps Seal Less centrifugal

API 686 Machinery installation RP

19 Chemical Injection Package:

ASME B31.1 Power Piping

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ASME B 16.1 Cast iron pipe flanges and flanged fittings.

ASME B16.5, Pipe flanges and flanged fittings.

ASME B16.11 Forged steel fittings, socket-welding and threaded.

ASME B16.42 Ductile iron pipe flanges & flanged fittings.

ASME B16.47 Large diameter steel flanges.

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IEC 60034 Rotating Electrical Machines

API 670 Machinery Protection Systems API 6AF2 Technical Report on Capabilities of

API 6L1 TR - Elastomer Life Estimation Testing Procedures

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API 580 Risk-based Inspection

API 610 Centrifugal pumps

API 682 Pumps Shaft Sealing

API 684 Rotors balancing

API 685 Pumps Seal Less centrifugal

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20 Firewater Pump Skid:

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RP 14C Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms

RP 14E Design and Installation of Offshore Production Platform Piping Systems

RP 14F Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1, and Division 2 Locations

RP 14FZ Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1 and Zone 2 Locations

RP 14J Design and Hazards Analysis for Offshore Production Facilities

RP 75 Development of a Safety and Environmental Management Program for Offshore Operations and Facilities

RP 500 Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2

RP 505 Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2

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RP 521 Guide for Pressure-relieving and Depressurizing Systems

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B 163 Standard Methods of Fire Tests of Window Assemblies

D 2996 Standard Specifications for Filament Wound Reinforced Thermosetting Resin Pipe

D 4024 Standard Specification for Reinforced Thermosetting Resin (RTR) Flanges

E 84 Standard Methods of Test for Surface Burning Characteristics of Building Materials

E 119 Standard Test Methods for Fire Tests of Building Construction and Materials

E 152 Standard Methods of Fire Tests of Door Assemblies

E 814 Standard Methods of Through Penetration Fire Stops

UL 711 Classification, Rating, and Fire Testing of Class A B, and C Fire Extinguishers and for Class D Extinguishers

or Agents for Use on Combustible Metals

UL 1709 Rapid Rise Fire Tests of Protection Materials for Structural Steel

21 Diesel Centrifugal Package:

API STD 610 Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries

22 Emergency/Essential Generation:

IS/ISO 8528-1:2005 Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets

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ISO 8528-4, Reciprocating internal combustion engine driven alternating current generating sets — Part 4: Controlgear and switchgear

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23 Gas Turbine Generation:

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ISO 3016, Petroleum products — Determination of pour point

ISO 3104, Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity

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24 Aviation Re-fueling Package:

CAP 437

2010 MODU Code

2014 SOLAS

25 Utility Hydrocarbon Pumps:

API STD 610 Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries

ISO 7-1, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation

ISO 228-1, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation

ISO 261, ISO general purpose metric screw threads — General plan

ISO 262, ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts

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ISO 3117, Tangential keys and keyways

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ISO 7005-1, Metallic flanges — Part 1: Steel flanges for industrial and general service piping systems

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ANSI/API Std 611, General-Purpose Steam Turbines for Petroleum, Chemical, and Gas Industry Services

ANSI/API Std 670, Machinery Protection Systems

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ANSI/ASME B16.42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

ANSI/ASME B16.47, Larger Diameter Steel Flanges: NPS 26 Through NPS 60

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27 Process Non-hydrocarbon Pressure Vessels:

ISO 16528-1:2007 Boilers and pressure vessels — Part 1: Performance requirements

ISO 16528 Part 2: Procedures for fulfilling the requirements of ISO 16528-1

28 Produced Water Treatment Package:

29 Low Pressure Process Hydrocarbon Pressure Vessels:

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ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300

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ASME PCC-2 - Repair of Pressure Equipment and Piping

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ASME B18.2.3.5M - Metric Hex Bolts

ASME B18.2.3.6M - Metric Heavy Hex Bolts

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30 PIG Launcher and receiver package:

ASME B31.X

B31.3

31 Fuel Gas Treatment Package:

ASME Section VIII - Pressure Vessel

ANSI B31.3/ANSI B31.3 – Piping

ASME Section IX - Pipe Fab

AWS D1.1 - Structural Steel Assembly

API RP 14C

32 Low Pressure Process Hydrocarbon Pumps:

API STD 610

ISO 7-1, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation

ISO 228-1, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation

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ANSI/AGMA 9002, Bores and Keyways for Flexible Couplings (Inch Series)

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API Std 547, General-Purpose Form-Wound Squirrel Cage Induction Motors — 250 Horsepower and Larger

API Std 677, General-Purpose Gear Units for Petroleum, Chemical and Gas Industry Services

ASME, Boiler and pressure vessel code BPVC, Section V, Nondestructive Examination

ASME, Boiler and pressure vessel code BPVC, Section VIII, Rules for Construction of Pressure Vessels

ASME, Boiler and pressure vessel code BPVC, Section IX, Welding and Brazing Qualifications
DIN 910, Heavy-duty hexagon head screw plugs9)

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MSS SP-55, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities11)

NACE MR0103, Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments

NFPA 70:2008, National Electrical Code13)

SSPC SP 6, Commercial Blast Cleaning14)

33 High Pressure Hydrocarbon Pressure Vessels:

ASME Boiler and Pressure Vessel Code Section VIII/ISO16528-1.

API Std. 527 - Seat Tightness of Pressure Relief Valves

ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form)

ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (Inch)

ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250

ASME B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 - Factory-Made Wrought Buttwelding Fittings

ASME B16.11 - Forged Fittings, Socket-Welding and Threaded

ASME B16.15 - Cast Copper Alloy Threaded Fittings, Classes 125 and 250

ASME B16.20 - Metallic Gaskets for Pipe Flanges — Ring-Joint, Spiral– Wound, and Jacketed

ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 600, 900, 1500, and 2500

ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Class 150 and 300

ASME B16.47 - Large Diameter Steel Flanges, NPS 26 Through NPS 60 Metric/Inch Standard

ASME B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B36.10M - Welded and Seamless Wrought Steel Pipe

ASME PCC-1 - Guidelines for Pressure Boundary Bolted Flange Joint Assembly

ASME PCC-2 - Repair of Pressure Equipment and Piping

ASME PTC 25 - Pressure Relief Devices

ASME QAI-1 - Qualifications for Authorized Inspection

ACCP - ASNT Central Certification Program

ANSI/ASNT CP-189 - ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

ASNT SNT-TC-1A - Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

ASTM D56 - Standard Test Method for Flash Point by Tag Closed Tester

ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

ASTM E3 - Standard Guide for Preparation of Metallographic Specimens

ANSI/API Std. 521 - Pressure Relieving and Depressuring Systems

ASTM E125 - Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings

ASTM E140 - Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness

ASTM E186 - Standard Reference Radiographs for Heavy-Walled [2 to 41/2-in. (51 to 114-mm)] Steel Castings

ASTM E208 - Standard Test Method for Conducting Drop-Weight Test to Determine Nil–Ductility Transition Temperature of Ferritic Steels

ASTM E280 - Standard Reference Radiographs for Heavy-Walled [41/2 to 12-in. (114 to 305-mm)] Steel Castings

ASTM E446 - Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness

ANSI/UL-969 - Marking and Labeling Systems

ISO 148-1 - Metallic Materials — Charpy Pendulum Impact Test Part 1: Test Method

ISO 148-2 - Metallic Materials — Charpy Pendulum Impact Test Part 2: Verification of Testing Machines

ISO 148-3 - Metallic Materials — Charpy Pendulum Impact Test Part 3: Preparation and Characterization of Charpy V-Notch Test Pieces for Indirect Verification of Pendulum Impact Machines

ASME B1.13M - Metric Screw Thread — M Profile

ASME B1.21M - Metric Screw Thread — MJ Profile

ASME B18.2.3.3M - Metric Heavy Hex Screws

ASME B18.2.3.5M - Metric Hex Bolts

ASME B18.2.3.6M - Metric Heavy Hex Bolts

ASME B18.2.6M - Metric Fasteners for Use in Structural Applications

ASTM C695 - Standard Test Method for Compressive Strength of Carbon and Graphite

ASTM C709 - Standard Terminology Relating to Manufactured Carbon and Graphite

ASTM E4 - Standard Practices for Force Verification of Testing Machines

ASTM E177 - Standard Practice for Use of the Terms Precision and Bias in ASTM Test Methods

ASTM E691 - Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

ANSI/AWS A4.2M - Standard Procedures for Calibrating Magnetic Instruments to Measure the Delta Ferrite Content of Austenitic and Duplex Ferritic-Austenitic Stainless Steel Weld Metal

34 Metering Package:

B31.3 - Process piping

ISO 17089 - ultrasonic gas meters

35 Fuel Gas Treatment Package – High Pressure Hydrocarbon:

ASME Section VIII - Pressure Vessel

ANSI B31.3/ANSI B31.3 – Piping

ASME Section IX - Pipe Fab

AWS D1.1 - Structural Steel Assembly

API RP 14C - for testing

36 High Pressure Process Hydrocarbon Pumps:

API STD 610

ISO 7-1, Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation ISO 228-1, Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation

ISO 261, ISO general purpose metric screw threads — General plan

ISO 262, ISO general purpose metric screw threads — Selected sizes for screws, bolts and nuts

ISO 281:2007, Rolling bearings — Dynamic load ratings and rating life

ISO 286 (all parts), ISO system of limits and fits

ISO 724, ISO general-purpose metric screw threads — Basic dimensions

ISO 965 (all parts), ISO general-purpose metric screw threads — Tolerances

ISO 1940-1, Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances

ISO 3117, Tangential keys and keyways

ISO 4200, Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length

ISO 5753, Rolling bearings — Radial internal clearance

ISO 7005-1, Metallic flanges — Part 1: Steel flanges for industrial and general service piping systems

ISO 7005-2, Metallic flanges — Part 2: Cast iron flanges

ISO 8501 (all parts), Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness

ISO 9606 (all parts), Approval testing of welders — Fusion welding1)

ISO 9906, Roto-dynamic pumps — Hydraulic performance acceptance tests2)

ISO 10438:2007 (all parts), Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries

ISO 10441, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications

ISO 10721-2, Steel structures — Part 2: Fabrication and erection

ISO 11342, Mechanical vibration — Methods and criteria for the mechanical balancing of flexible rotors

ISO 14120, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards

ISO 14691, Petroleum, petrochemical and natural gas industries — Flexible couplings for mechanical power transmission — General-purpose applications

ISO 15156-1, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials

ISO 15609 (all parts), Specification and qualification of welding procedures for metallic materials — Welding procedure specification

ISO 15649, Petroleum and natural gas industries — Piping

ISO/TR 17766, Centrifugal pumps handling viscous liquids — Performance corrections

ISO 21049:2004, Pumps — Shaft sealing systems for centrifugal and rotary pumps

IEC 60034-1, Rotating electrical machines — Part 1: Rating and performance

IEC 60034-2-1, Rotating electrical machines — Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)

IEC 60079 (all parts), Electrical apparatus for explosive gas atmospheres

EN 953, Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards

EN 13445 (all parts), Unfired pressure vessels

EN 13463-1, Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements

ANSI/ABMA 7, Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plan 4)

ANSI/AGMA 9000, Flexible Couplings — Potential Unbalance Classification5)

ANSI/AGMA 9002, Bores and Keyways for Flexible Couplings (Inch Series)

ANSI/AMT B15.1, Safety Standard for Mechanical Power Transmission Apparatus6)

ANSI/API Std 541, Form-Wound Squirrel-Cage Induction Motors — 500 Horsepower and Larger

ANSI/API Std 611, General-Purpose Steam Turbines for Petroleum, Chemical, and Gas Industry Services

ANSI/API Std 670, Machinery Protection Systems

ANSI/API Std 671/ISO 10441, Special Purpose Couplings for Petroleum, Chemical and Gas Industry Services

ANSI/ASME B1.1, Unified Inch Screw Threads, UN and UNR Thread Form7)

ANSI/ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125 and 250

ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

ANSI/ASME B16.11, Forged Steel Fittings, Socket-Welding and Threaded

ANSI/ASME B16.42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

ANSI/ASME B16.47, Larger Diameter Steel Flanges: NPS 26 Through NPS 60

ANSI/ASME B18.18.2M, Inspection and Quality Assurance for High-Volume Machine Assembly Fasteners

ANSI/ASME B31.3, Process Piping

ANSI/HI 1.6, Centrifugal Tests8)

ANSI/HI 2.6, American National Standard for Vertical Pump Tests

API Std 547, General-Purpose Form-Wound Squirrel Cage Induction Motors — 250 Horsepower and Larger

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37 Gas Compressor Package:

ISO 13707

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ISO 281-1, Rolling bearings — Dynamic load ratings and rating life — Part 1: Calculation methods.

ISO 1217, Displacement compressors — Acceptance tests.

ISO 7005-1, Metallic flanges — Part 1: Steel flanges.

ISO 7005-2, Metallic flanges — Part 2: Cast iron flanges.

ISO 8501-1, Preparation of steel substrates before application of paints and related products — Visual assessment of surfaces cleanliness. Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.

ISO 10436, Petroleum and natural gas industries — General-purpose steam turbines for refinery service.

ISO 10437, Petroleum and natural gas industries — Special-purpose steam turbines for refinery service.

ISO 10438-2, Petroleum and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries — Part 2: Special-purpose oil systems.

ISO 10441, Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — Special-purpose applications.

ISO 13691, Gears — High-speed special-purpose gear units for the petroleum, chemical and gas industries.

ISO 13706, Petroleum and natural gas industries — Air-cooled heat exchangers.

ISO 14691, Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — General purpose applications.

ISO 16812, Petroleum and natural gas industries — Shell and tube heat exchangers.

IEC 60034-1, Rotating electrical machines — Part 1: Rating and performance.

IEC 60079-0, Electrical apparatus for explosive gas atmospheres — Part 0: General requirements.

IEC 60529, Degrees of protection provided by enclosures (IP codes).

IEC 60848, Preparation of function charts for control systems.

ANSI B 1.20.1, Pipe Threads, General Purpose (Inch).

ANSI B 16.5, Pipe Flanges and Flanged Fittings.

ANSI B 31.3, Process Piping.

API RP 520/1, Sizing, Selection and Installation of Pressure Relieving Devices in Refineries — Part 1: Sizing and selection.

API RP 520/2, Sizing, Selection and Installation of Pressure Relieving Devices in Refineries — Part 2: Installation.

API Std 526, Flanged Steel Pressure Relief Valves.

API Std 614, Lubrication, Shaft Sealing and Control Oil Systems And Auxiliaries For Petroleum, Chemical and Gas Industry Service.

API Std 670, Vibration, Axial-Position, and Bearing-Temperature Monitoring Systems. ASME3), Boiler and Pressure Vessel Code 1998.

ASTM A 106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.

ASTM A 193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

ASTM A 194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both.

ASTM A 216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.

ASTM A 247, Standard Test Method for Evaluating the Microstructure of Graphite in Iron Castings.

ASTM A 269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

ASTM A 278M, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F.

ASTM A 307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

ASTM A 312M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.

ASTM A 320M, Standard Specification for Alloy Steel Bolting Materials for Low-Temperature Service.

ASTM A 388M, Standard Practice for Ultrasonic Examination of Heavy Steel Forgings.

ASTM A 395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

ASTM A 503, Standard Specification for Ultrasonic Examination of Large Forged Crankshafts.

ASTM A 536, Standard Specification for Ductile Iron Castings.

ASTM A 668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.

ASTM E 94, Standard Guide for Radiographic Testing.

ASTM E 125, Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings.

ASTM E 142, Standard Method for Controlling Quality of Radiographic Testing.

ASTM E 709, Standard Guide for Magnetic Particle Examination.

38 Drilling and Subsea equipment:

(1) Well Control System:

API 6A

API 16A

API 16C

API 64

API 16F

(2) Derrick Systems:

API 4F

API 8C

API 16F

(3) Drilling Fluid Conditioning Systems:

(4) Pipe/Tubular Handling Systems:

API 2C

API 7K

(5) Subsea Production System/ Equipment:

API 17 A, 17O, 17Q, 17V, 17TR5, 17TR6, 17D, 17P, 17TR3, 17TR4, 17B, 17L2, 17J, 17K, 17L1, 17R, 17U, 17E, 17F, 17S, 17C, 17G, 17H, 17W

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〒100-0013　東京都千代田区霞が関 3-8-1　虎ノ門三井ビルディング
TEL 03-3502-2063　FAX 03-3503-1479

一般財団法人 日本船舶技術研究協会

〒107-0052　東京都港区赤坂 2-10-9 ラウンドクロス赤坂
TEL 03-5575-6426　FAX 03-5114-8941