Crane Safety Assessment Findings, Results, and Recommendations Final Report

Submitted to

The Bureau of Safety and Environmental Enforcement (BSEE)

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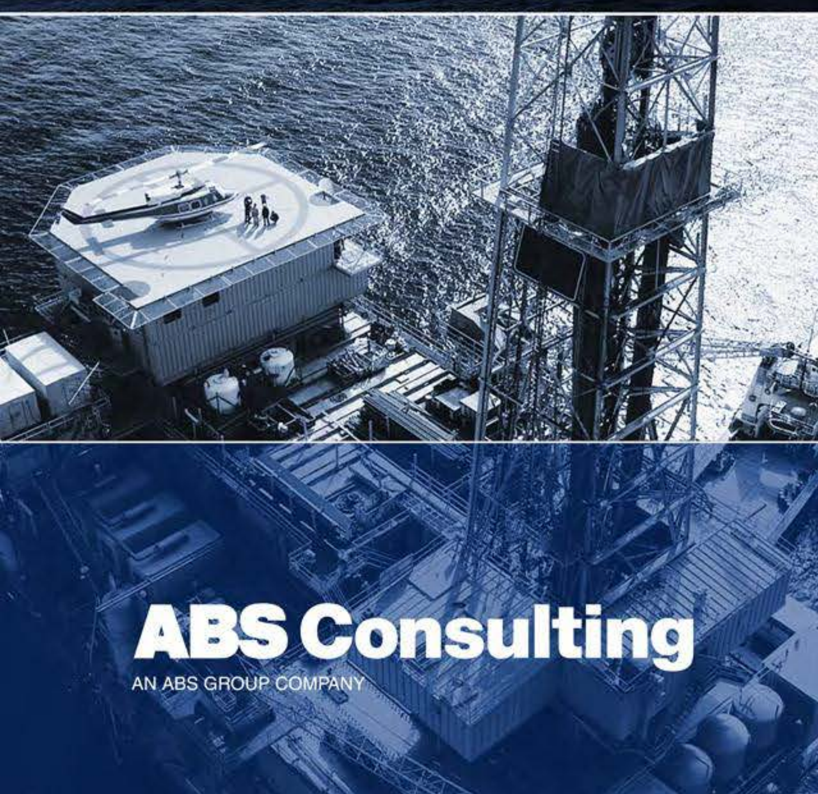

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Executive Summary

The Bureau of Safety and Environmental Enforcement (BSEE) works to promote safety, protect the environment, and conserve natural resources on the Outer Continental Shelf (OCS) through vigorous regulatory oversight and enforcement. BSEE is responsible for enforcing the regulations found at 30 CFR 250.108 for cranes and material handling equipment installed on fixed platforms on the OCS. In addition to the 30 CFR 250 crane regulations, BSEE requires lessees and operators to comply with various industry standards incorporated by reference into regulation. Conversely, the United States Coast Guard (USCG) is responsible for safety of life on floating facilities operating on the OCS. The USCG crane and material handling certification and inspection strategy is promulgated in 46 C.F.R. §107.258 and 259. Crane inspections may be conducted by a USCG marine inspector or by one of two authorized third-party inspectors.

On April 25, 2014, BSEE initiated the Crane Safety Assessment. The study involved analysis of cranes and material handling equipment operating on the OCS, analysis of BSEE lifting Potential Incidents of Noncompliance (PINCs) and incidents, review of industry standards and practices, and recommendations for changes to lifting regulation. The goal of this study was to develop an inspection methodology that may be used by BSEE and USCG personnel in performing an assessment in regards to the safety of cranes and material handling equipment.

The team began by researching the population and attributes of cranes and material handling equipment operating on the OCS. Crane operators and service providers were consulted to provide information on the age, type, and population of cranes operating on the OCS. BSEE and USCG provided Government Furnished Information (GFI) such as lifting PINCS, records of OCS lifting incidents, and records of crane populations on the OCS to inform the study. Following the collection of information, the study team performed a statistical analysis on the population of cranes and material handling equipment operating on the OCS. The incident data supplied by BSEE through GFI was analyzed to identify failure event data, trends and key issues that could be addressed in the development of an improved offshore crane and material handling equipment inspection program. The study team reviewed the lifting PINCs and provided recommendations for improvement and consideration. Lifting standards, inspection methodologies and strategies were analyzed to identify best practices and provide recommendations for BSEE’s consideration in the incorporation of these practices into an inspection strategy. BSEE stakeholders were consulted and engaged throughout the analysis phase of the study and provided interim feedback on the analysis results. The study team evaluated the findings of the incident analysis and applied their understanding of lifting standards and methodologies to develop interim recommendations. The USCG BSEE Memorandum of Understanding/Memorandum of Agreement (MOU MOA) was reviewed to inform the study of the responsibility each agency shared in the oversight of lifting equipment on the OCS. BSEE stakeholders were consulted to provide feedback on the interim recommendations drafted by the study team.

Based on the information gathered and analysis conducted it is recommended that the future inspection strategy move away from a prescriptive methodology, BSEE’s philosophy of strict regulatory compliance, and toward ensuring that operators create and comply with a robust Safety and Environmental Management System (SEMS) tailored for their facility.

The following recommendations are outlined in the report to produce a robust crane and material handling inspection program for offshore facilities which harmonizes with 30 C.F.R §250.108 and 30 C.F.R. §250.1913, et seq. and with the intentions of 46 C.F.R. §107.258 and 259:

- Create database of offshore facilities having cranes subject to API Spec 2D, API RP 2D, and material handling equipment with capacities greater than 5 short tons subject to ASME B30.2.
- Amend regulation 30 C.F.R. §250.108 for pedestal, overhead bridge, and gantry cranes.
- Amend regulation 30 C.F.R. §250.108 for material handling.
- Amend regulation 30 C.F.R. §250.198 to incorporate applicable ASME B30 series standards.
- Amend PINCs to harmonize with the requirements of 30 C.F.R. §250.1900.
- Train BSEE inspectors to become qualified crane and rigging inspectors as promulgated by API RP 2D and ASME B30 series standards, or audit crane inspection records performed by third-party qualified inspectors similar to the strategy adopted by the USCG in 46 C.F.R. §107.259.
- Require drilling systems used on mobile offshore drilling units (MODUs) to be certified drilling systems (CDS) and inspected by the marine classification society that issued the CDS certificate.
- Develop a formal training qualification program for BSEE inspectors in mechanical and electro-hydraulic equipment fundamentals, hazard identification for machine safety.
- Inspect or audit third-party inspections to ensure that the cranes and material handling equipment are designed, maintained, and operated in accordance with the standards promulgated by marine classification societies, API, or ASME as regulations promulgated by 30 C.F.R. 250.108 and 30 C.F.R. 250.1913 (d);

The following recommendations for changes to 30 CFR 250.108 (a-e) are shown in red and proposed to improve worker safety while operating *cranes* installed on fixed OCS facilities.

§250.108 What requirements must I follow for cranes and other material-handling equipment?

(a) All pedestal cranes installed on fixed platforms must be operated in accordance with American Petroleum Institute's Recommended Practice for Operation and Maintenance of Offshore Cranes, API RP 2D (as incorporated by reference in § 250.198).

(b) All cranes installed on fixed platforms must be equipped with a functional anti-two block device.

(c) If a fixed platform is installed after March 17, 2003, all pedestal cranes on the platform must meet the requirements of American Petroleum Institute Specification for Offshore Pedestal Mounted Cranes, API Spec 2C (as incorporated by reference in §250.198).

(d) All pedestal cranes manufactured after March 17, 2003, and installed on a fixed platform, must meet the requirements of API Spec 2C.

(e) All overhead bridge cranes manufactured after 1 January 2016 and installed on a fixed platform must meet the requirements of CMMA Specification No. 70 – Specifications for Electric Overhead Travelling Cranes (as incorporated by reference in §250.198).

(f) All overhead bridge cranes installed on fixed platforms must be operated in accordance with the American Society of Mechanical Engineers (ASME) B30.2, Safety Standard for Overhead Bridge and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist) or ASME B30.17 Safety Standard for Overhead Bridge and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist), as applicable to the type of crane, (as incorporated by reference in §250.198). Required frequent and periodic inspections (other than daily or operational inspections) of overhead bridge cranes shall be performed by a qualified crane inspector designated by the crane manufacturer or certified in accordance with the requirements of the National Commission for the Certification of Crane Operators (NCCCO).

(g) All operators of overhead bridge cranes greater than 5 tons must be certified in accordance with the requirements of the National Commission for the Certification of Crane Operators (NCCCO). Rigging of loads greater than 5 tons shall be conducted by personnel certified in accordance with API RP 2D or certified in accordance with the NCCCO requirements for Rigger I for loads up to 15 tons and Rigger II for loads over 15 tons.

(h) All crane owners or operators on fixed platforms must have a crane operations safety policy that differentiates between routine, critical and engineered lifts. Routine lifts are those not designated as critical or engineered lifts. Critical lifts are those where the failure or loss of load control could result in loss of life, major structural damage to facilities or equipment, or large environmental release. Some factors, but not all factors, that may be used to determine a critical lift are:

- When a load is lifted over or near operating equipment or safety areas designated by a dropped object study;
- When two or more pieces of lifting equipment are required to work in unison, including trolleys installed on the same bridge;
- When special lifting equipment such as non-standard crane configurations or purpose built, one-off lifting appurtenances will be used;
- The weight of the load exceeds set limits such as 20 tons;
- The weight of the load exceeds 75 percent of the crane's rated capacity; or
- When making personnel transfers.

Engineered lifts are those that exceed the rated capacity of the crane at the required lifting angle (not to include load testing requirements in API Spec 2C). Engineered lifts are so exceptional that there shall be increased inspection requirements to be met prior to operation. For engineered lifts, the crane shall be inspected by the crane manufacturer or a qualified third-party inspector in accordance with API Spec 2D annual inspection requirements not more than two days prior to the lift. Any deterioration or defects found by that shall be considered in design calculations to support the lift. The crane shall also be inspected by the crane manufacturer or a qualified third-party in accordance with annual inspection requirements, including and non-destructive testing required by the manufacturer, after the engineered lift is completed and prior to release for use in normal operations. A record of the engineered lift, including supporting calculations, inspections, weights, and all distances moved, shall maintained in accordance with (i) (2) below.

(i) You must maintain records specific to a crane or the operation of a crane installed on an OCS fixed platform, as follows:

(1) Retain all design and construction records, including installation records for any anti-two block safety devices, for the life of the crane. The records must be kept at the OCS fixed platform.

(2) Retain all inspection, testing, and maintenance records of cranes for at least 4 years. The records must be kept at the OCS fixed platform.

(3) Retain the qualification records of the crane operator and all rigger personnel for at least 4 years. The records must be kept at the OCS fixed platform.

The following recommendations for changes to 30 CFR 250.108 (f) are shown in red and proposed to improve worker safety while operating *material handling equipment* installed on fixed OCS facilities.

§250.108 What requirements must I follow for cranes and other material-handling equipment?

(j) You must operate and maintain all other material-handling equipment in a manner that ensures safe operations and prevents pollution.

(1) All winches, including, but not limited to, wireline winches, pneumatic and hydraulic line tuggers, electric, pneumatic and hydraulic planetary gear hoists and winches, electromechanical and umbilical winches, man-riding winches, or any other power-driven drum devices shall be designed, operated and maintained in accordance with ASME B30.7, Winches (as incorporated by reference in §250.198).

(2) All slings shall be operated and maintained in accordance with ASME B30.9, Slings, which is incorporated by reference in API RP 2D Section 5.2.1 (as incorporated by reference in §250.198).

(3) All hooks shall be operated and maintained in accordance with ASME B30.10, Hooks (as incorporated by reference in §250.198).

(4) All monorails and underhung cranes shall be operated and maintained in accordance with ASME B30.11, Monorails and Underhung Cranes (as incorporated by reference in §250.198).

(5) All overhead hoists shall be operated and maintained in accordance with ASME B30.16, Overhead Hoists (as incorporated by reference in §250.198).

(6) All below-the-hook lifting devices, including, but not limited to, structural, mechanical, vacuum, close-proximity lifting magnets, plate clamps, or any other device or appurtenance used for attaching a load to a hoist, shall be operated and maintained in accordance with ASME B30.20, Below-the-Hook Lifting Devices (as incorporated by reference in §250.198). Moreover, all below–the-hook lifting devices, including, but not limited to, spreader bars and frames, pad eyes, attachment points, and all other lifting appurtenances shall be designed in accordance with ASME BHT-1, Below-the-Hook Lifting Devices (as incorporated by reference in §250.198).

(7) All ratchet and pawl and friction brake type lever chain, rope, and web strap hoists (come-a-long) used for lifting, pulling, and tensioning applications shall be operated and maintained in accordance with ASME B30.21, Lever Hoists (as incorporated by reference in §250.198).

(8) All detachable rigging hardware used for load-handling activities, including but not limited to, shackles, links, rings, swivels, turnbuckles, eyebolts, hoist rings, wire rope clips, wedge sockets, rigging blocks, and load-indicating devices, shall be operated and maintained in accordance with ASME B30.26, Rigging Hardware (as incorporated by reference in §250.198).

(9) All loads suspended from rotorcraft-helicopters shall be conducted in accordance with Federal Air Regulation 14 C.F.R. Part 133 and ASME B30.12, Handling Loads Suspended from Rotorcraft (as incorporated by reference in §250.198). Personnel rigging external loads must have specialized training in helicopter external load operations.

(10) Rigging of loads greater than 5 tons shall be conducted by personnel certified in accordance with API RP 2D or certified in accordance with the NCCCO requirements for Rigger I for loads up to 15 tons and Rigger II for loads over 15 tons.

(11) All specialty material handling equipment, including, but not limited to, bails, BOP/LMRP service cranes and transporters, crown and traveling blocks, deadline anchors, drilling derricks or masts, draw works, drill floor manipulator arms, drilling elevators, riser handling systems and carts, iron roughnecks, kelly drives, top drives, riser spiders, rotary tables, and drill

swivels, shall be operated and maintained in accordance with the manufacturer's recommendation and instructions. Such recommendations and instructions shall be supported by a Failure Modes, Effects and Criticality Analysis (FMECA) in accordance with generally accepted engineering practices to verify the required inspection and maintenance schedules for the service intended.

Design and installation of specialty material handling equipment should consider ASTM F1166, Human Engineering Design for Marine Systems, Equipment and Facilities. All specialty material handling equipment shall also be subjected to a task analysis and job safety analysis by a qualified human factors or safety professional to ensure safe operation. Moreover, all specialty material handling equipment shall be installed, operated, and maintained to ensure that inadvertent leaks or spills of operating fluids do not result in an environmental release.

(k) All owners or operators on fixed platforms shall have a safety policy and procedures that cover all material handling equipment.

(l) All required maintenance on material handling equipment shall be performed by a qualified maintenance or service personnel. All required inspections shall be performed by a qualified inspector or third-party inspection service. A qualified person is one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated their ability to inspect, diagnose and troubleshoot faults, and service or repair the specific equipment.

(m) You must maintain records specific to the material handling equipment installed on an OCS fixed platform, as follows:

(1) Retain all design and construction records, including installation records for any specialty material handling equipment for the life of the equipment. The records must be kept at the OCS fixed platform.

(2) Retain any required operator or daily inspection records for a period of not less than 90 days. The records must be kept at the OCS fixed platforms.

(3) Retain all frequent and periodic inspection and testing records for all material handling equipment for at least 4 years. The records must be kept at the OCS fixed platform.

(4) Retain the qualification records of all material handling maintenance, inspection, and all rigger personnel for at least 4 years. The records must be kept at the OCS fixed platform.

Table of Contents

List of Tables

List of Figures

1 Introduction

The Bureau of Safety and Environmental Enforcement (BSEE) is responsible for the oversight of exploration, development, and production operations for oil and natural gas on the Outer Continental Shelf (OCS). BSEE's regulation and oversight of Federal offshore resources ensures that energy development on the OCS is done in a safe and environmentally responsible manner. The functions of BSEE include oil and gas permitting, facility inspections, regulations and standards development, safety research, data collection technology assessments, field operations, incident investigation, environmental compliance and enforcement, oil spill prevention and readiness, review of operator oil spill response plans, oversight of production and development plans, and resource conservation efforts.[1]

BSEE works to promote safety, protect the environment, and conserve natural resources on the OCS through vigorous regulatory oversight and enforcement. BSEE is responsible for enforcing the regulations found at 30 CFR 250.108 for cranes installed on fixed platforms on the OCS. In addition to the 30 CFR 250 crane regulations, BSEE requires lessees and operators to comply with various industry standards incorporated by reference into regulation. BSEE is also responsible for the oversight of material handling equipment located on fixed platforms. Conversely, the United States Coast Guard (USCG) is responsible for safety of life on floating facilities operating on the OCS. The USCG crane and material handling certification and inspection strategy is promulgated in 46 C.F.R. §107.258 and 259. Crane inspections may be conducted by a USCG marine inspector or by one of two authorized third-party inspectors. The USCG ensures compliance by auditing the results of third-party inspections or by relying on BSEE's support in conducting USCG mandated inspections in accordance with Z-PINC.

On April 25, 2014, BSEE initiated the Crane Safety Assessment. The study involved analysis of cranes and material handling equipment operating on the OCS, analysis of BSEE lifting Potential Incidents of Noncompliance (PINCs) and incidents, review of industry standards and practices, and recommendations for changes to regulation. The goal of this study was to develop an inspection methodology that may be used by BSEE and USCG personnel in performing an assessment in regards to the safety of cranes and material handling equipment.

This report contains the results of the assessment. The following sections describe the assessment methodology, findings, analysis, and recommendations for BSEE's consideration in the development of a lifting inspection strategy.

2 Methodology

To provide a recommendation for a lifting inspection strategy, the ABS Group Team, herein referred to as the study team, met with BSEE stakeholders to review the plan of action for accomplishing the tasks outlined in the Crane Safety Assessment. Figure 1 illustrates the assessment methodology for collecting

[1] The United States Department of the Interior, 'Budget Justifications and Performance Information Fiscal Year 2015 for the Bureau of Safety and Environmental Enforcement.' Retrieved from BSEE.gov: https://www.bsee.gov/uploadedFiles/BSEE/About_BSEE/Budget/00000%20BSEE%20FY%202015%20Final%20Greenbook%20File.pdf. (April 14, 2015).

information, conducting analysis, and evaluating the findings in order to provide recommendations for the development of an improved offshore crane and material handling equipment inspection program.

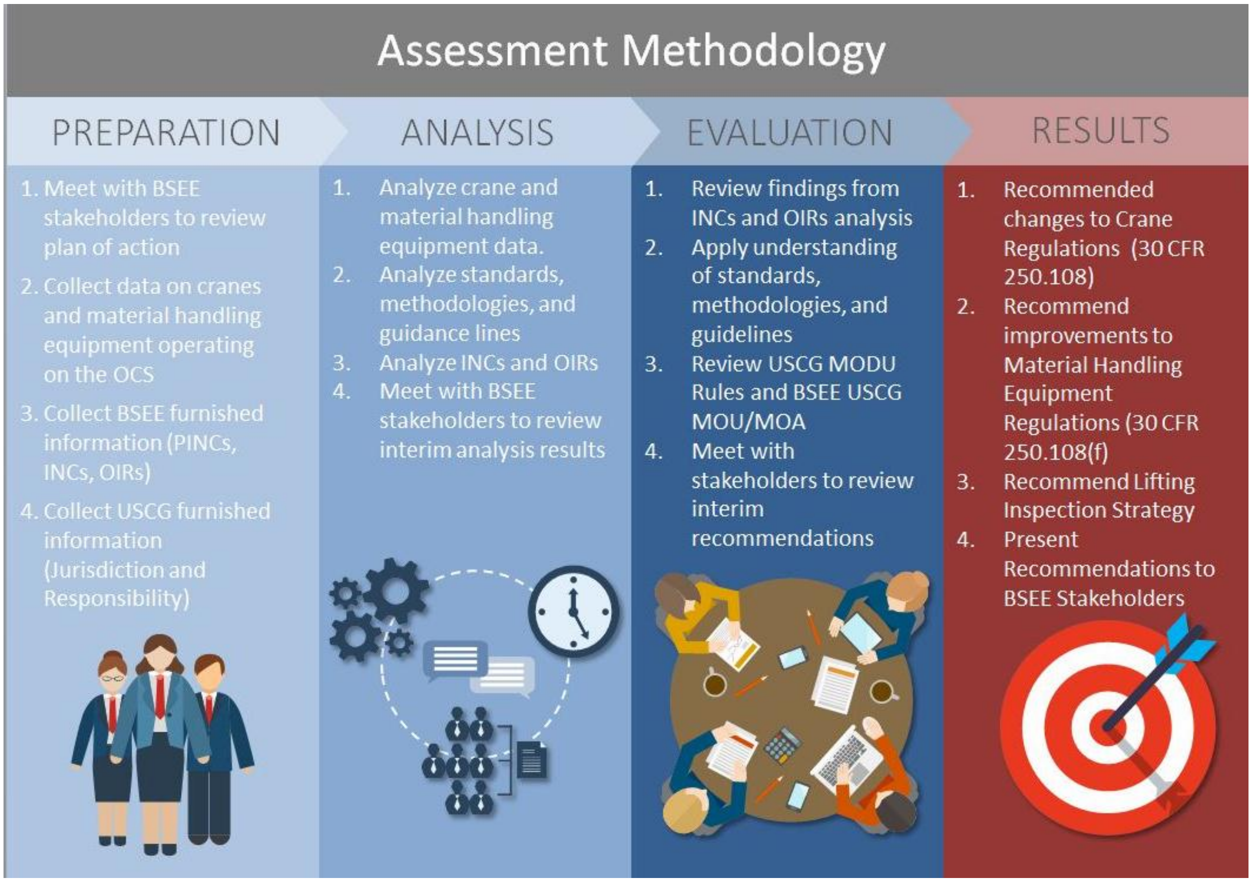


Figure 1: Assessment Methodology

The team began the study by researching the population and attributes of cranes and material handling equipment operating on the OCS. The study team collected open source information, which included publicly available information, such as original equipment manufacturers (OEM) drilling contractor's websites and ABS vessel information. BSEE's website was queried however no information specific to cranes or material handling located on a facility or vessel under its jurisdiction was identified. Next, crane operators and service providers were consulted to provide information on the age, type, and population of cranes operating on the OCS.

The study team requested Government Furnished Information (GFI) such as lifting PINCS, records of OCS lifting incidents, and records of crane populations on the OCS to inform the study. BSEE provided limited data related to cranes by facility and material handling equipment operating on the OCS contained in the Technical Information Management System (TIMS) database.

Following the collection of information, the study team performed a statistical analysis of the population of cranes and examined material handling equipment installed on existing OCS facilities and vessels under BSEE and USCG jurisdiction. The data was examined to: (1) identify equipment included in the scope of this study; (2) ensure relevancy to the scope; and (3) resolve issues of data quality and duplication. The incident data supplied by BSEE through GFI was analyzed to identify failure event data, trends and key issues that could be addressed in the development of an improved offshore crane and material handling equipment inspection program. The study team reviewed the lifting PINCs and provided recommendations for improvement and consideration. Lifting standards, inspection methodologies and strategies were analyzed to identify best practices and provide recommendations for BSEE's consideration in the incorporation of these practices into an inspection strategy. BSEE stakeholders were consulted and engaged throughout the analysis phase of the study and provided interim feedback on the analysis results.

The study team evaluated the findings of the incident analysis and applied their understanding of lifting standards and methodologies to develop interim recommendations. The USCG BSEE Memorandum of Understanding/Memorandum of Agreement (MOU MOA) was reviewed to inform the study of the responsibility each agency shared in the oversight of lifting equipment on the OCS. BSEE stakeholders were consulted to provide feedback on the interim recommendations drafted by the study team.

Based upon the results of the study and the feedback received from BSEE stakeholders, the study team developed a lifting inspection strategy that recommended changes to crane regulations and improvements to material handling oversight.

3 Crane Assessment

The study team analyzed cranes found on fixed and floating offshore facilities, floating production storage and offloading vessels (FPSOs), and mobile offshore drilling units (MODUs). Two offshore operators and one crane equipment contractor voluntarily provided crane information for assets they operated, owned or serviced. The majority of the data points collected from operators were for cranes located on fixed platforms while most of the data points extracted from publicly available sources were located on cranes on MODUs.

The objectives of this effort were to (1) analyze the current population of cranes operating on the OCS, (2) perform statistical analyses to identify trends, and (3) identify the breadth and depth of crane types which will form part of the inspection program. The effort sought to identify potential safety issues that should be added to the crane inspection program.

The following section summarizes the data gathered from publicly available information from original equipment manufacturers (OEMs), drilling contractors and OCS field operators. The availability of the data, limited the analysis to the current population of offshore facilities without regard for current operating location. The analysis focused on sorting and trending the data from 921 cranes to identify:

- Generic crane types used on the OCS; and
- Descriptive statistics concerning crane load ratings and ages.

3.1 Assumptions and Limitations

The results are based on the following assumptions and limitations:

- The raw data obtained from publicly available sources was assumed to be accurate and complete. When possible, the study team, attempted to correct identified data anomalies; and

- Duplicate data points were purged when verified as duplicates.

Population sampling techniques were applied for the analyses because the actual crane population size was unknown. There was no publicly available data on the actual population size of cranes operating on the Gulf of Mexico (GOM) Region OCS. Based on guidance from BSEE stakeholders, the study team assumed a sample size of 5000 cranes operating in OCS. The number was based upon the data available on BSEE's website stating that there are approximately 2,500 active platforms in the GOM Region. The study team conservatively estimated that each platform had two cranes. Considering a crane population of 5000 cranes and a desired confidence level of 95%, the minimum desired crane sample size, 146, was determined with the following formula:

$$N = \frac{n}{1+\frac{n}{\text{population}}}, \text{ where } n = \frac{Z^2 \times P(1-P)}{D^2}$$

A sampling distribution size based on a 95% confidence interval repeatedly used to draw from the population tends to yield distribution means that fall within approximately two standard deviations of the sample mean. This prediction assumes that the sampling distribution is also normal.

N = Sample size
Z = Area of normal distribution corresponding to confidence level
P = Expected value
D = Confidence interval

Population = 5000	Confidence Level/Value of Z
Z = 1.96	90%/1.645
P = 0.5	95%/1.960
D = 0.08	99%/2.575
n = 150.06	99.9%/3.29
N = 146	

Figure 2: Formula for Minimum Sample Size

3.2 Crane Analysis

The study team collected data points on 921 cranes for the analysis. Table 1 provides the classification of the cranes organized by mount type. Out of the 921 crane units, 471 units did not provide information regarding mount type and, as a result, could not be classified.

Table 1: OCS Cranes by Mount Type and Capacity

Mount Type	Data Source			
	Operator 1 and Service Provider	Operator 2	Public Source	Total
King Post	32	44	24	100
Swing Bearing Mount	247	103	-	350
No Data Provided	120	141	210	471

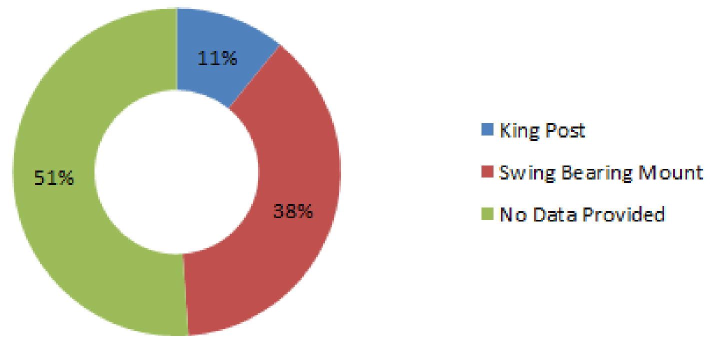


Figure 3 shows the frequency distribution of crane capacities across 188 data points. The distribution bimodal has two commonly-occurring values and is slightly positively skewed by a small number of outliers. Based upon the statistical analysis, the most appropriate representative measure of the distribution is the arithmetic mean (70.3 mT). Approximately 75% of the cranes fall within one standard deviation of the arithmetic mean of crane capacities (i.e. 70.3 ± 31.9). Due to five outlier data points, which were more than two and a half standard deviations above the mean, the distribution was positively skewed.

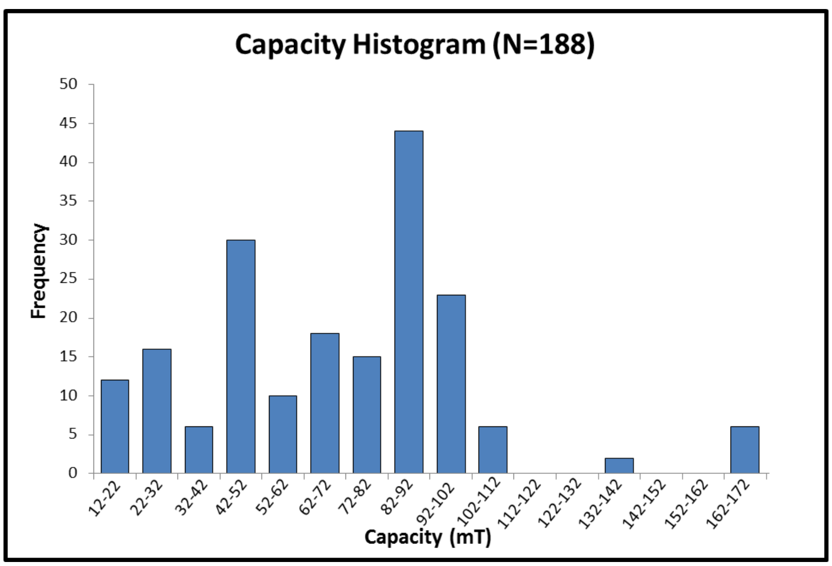


Figure 3: Frequency Distribution of Capacities

Table 2 below provides the descriptive statistics of the frequency distribution of capacity data for the cranes shown in

Figure 3. This information was collected from publicly available sources.

Table 2: Descriptive Statistics of the Frequency Distribution

Statistical Term	Capacity (mT)
Mean	70.3
Mode	74.0
Median	85.0
Minimum	12.0
Maximum	165
Range	153
Standard Deviation	31.9
Count	188

Figure 4 below shows the frequency distribution of capacities, in metric tons (mT), across 182 cranes. Note that the data is a subset of the data shown in

Figure 3. Figure 4 shows the data from

Figure 3 without the outliers mentioned above.

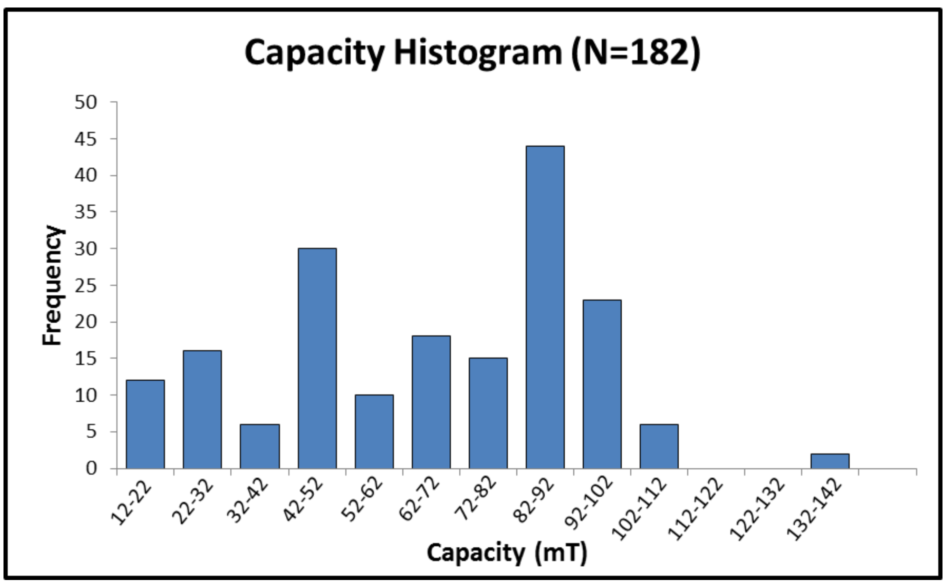


Figure 4: Frequency of Distribution Capacities

Descriptive statistics of the trimmed distribution from Figure 4 are listed in Table 3 below.

Table 3: Descriptive Statistics of the Trimmed Frequency Distribution

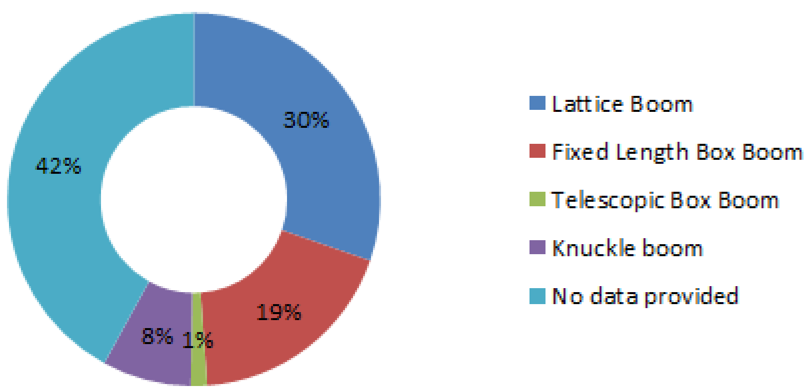
Statistical Term	Capacity (mT)
Mean	67.2
Mode	85.0
Median	71.0
Minimum	12.0
Maximum	136

Range	124
Standard Deviation	27.3
Count	182

Table 4 provides crane classification organized by boom type. Lattice booms represent 30% of the sample size and approximately 60% of the cranes operating on the OCS.[2] This is an important observation to note, as lattice boom type cranes are maintenance intensive due to bolted construction, particularly in a corrosive environment.

Table 4: OCS Cranes by Boom Type

Boom Type	**Data Source**			
	Operator 1 and Service Provider	Operator 2	Public Source	Total
Lattice Boom	187	92	-	279
Fixed Length Box Boom	88	83	-	171
Telescopic Box Boom	4	9	-	13
Knuckle Boom	-	-	71	71
No data provided	120	104	163	387



[2] Cranes data points that did not provide boom type data were excluded from this analysis in Table 4.

Table 5 provides the cranes by mount and boom type and is organized by manufacturer/ crane service provider.

Table 5: OCS Cranes by Manufacturer/Service Provider

Manufacturer/Crane Service Provider	Mount Type			Boom Type			
	Swing Bearing Mount	King Post Mount	Unknown	Fixed Length Box Boom	Lattice Boom	Telescopic Box Boom	Unknown
Gulf Crane Service	247	21	120	88	176	4	120
EBI	15	0	1	15	-	-	1
NAUTILUS	71	10	21	62	15	9	16
UNIT-MARINER	6	7	35	6	39	-	3
AMERICAN-AERO	11	1	40	-	24	-	28
SEATRAX	-	26	-	-	14	-	12
COASTAL	-	-	2	-	-	-	2
EMC	-	-	1	-	-	-	1
HOUSTON-SYSTEMS	-	-	5	-	-	-	5
HYDRA CRANE	-	-	1	-	-	-	1
JOE STINE	-	-	3	-	-	-	3
LINKBELT	-	-	2	-	-	-	2
M&M	-	-	1	-	-	-	1
MANITEX	-	-	2	-	-	-	2
PEDESTAL	-	-	2	-	-	-	2
PMC	-	-	2	-	-	-	2
RH-ENTERPRISE	-	-	1	-	-	-	1
SMATCO	-	-	3	-	-	-	3
TITAN	-	-	17	-	-	-	17
WEATHERFORD	-	-	1	-	-	-	1
ENERGY CRANES	-	-	1	-	-	-	1

Two operators provided data points that identified crane age. Table 6 provides average crane organized by mount and boom type. Crane age data was collected for total of 238 cranes.[3]

Table 6: Average Crane Age by Mount and Boom Type

	Crane Type			Boom Type			
	Swing Bearing Mount	King Post Mount	Unknown	Fixed Length Box Boom	Lattice Boom	Telescopic Box Boom	Unknown
Average Age (Years)	22.6	24.3	27.7	23.6	28.2	20.4	24.7
Maximum Age (Years)	39.07	40.07	30.07	44.07	40.07	30.66	44.07
Minimum Age (Years)	4.07	8.49	19.07	4.07	4.07	8.82	4.07

Figure 5 shows the frequency distribution of the OCS crane ages sample across 238 cranes from the two operators who provided crane data.

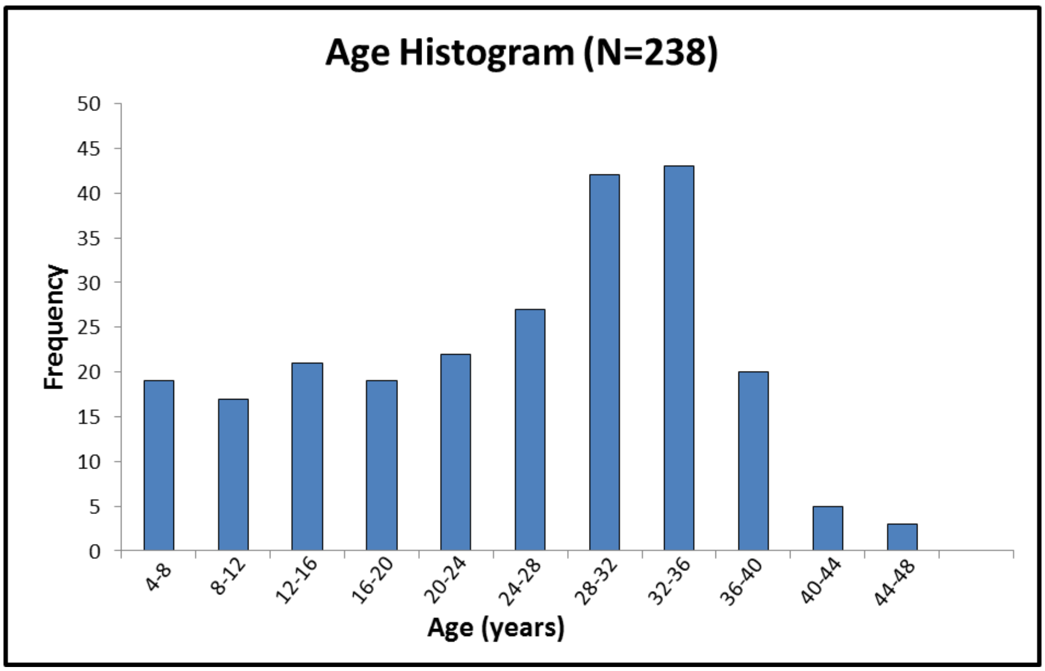


Figure 5: Frequency Distribution of Crane Ages (Years)

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[3] According to supporting information provided by GOM Region personnel, the average crane age is driven by the current regulation and API standard. Operators do not want to upgrade their cranes because of cost, and the current standards. The current standards require an operator to meet the requirements of API Spec 2C if a crane is manufactured after March 17, 2003, and installed on a fixed platform. Thus, the operator would prefer to keep and maintain their older crane because a crane manufactured before March 17, 2003, doesn't have to meet API Spec 2C requirements.

The distribution shows that ages are fairly consistent with the exception of noticeable upward trends in the age range of 28 to 36. Consistent with this observation, approximately 55% of the cranes fall within the age group of 24 to 40 years; this is an important observation because old cranes require more careful and detailed inspection. Moreover, these cranes are more maintenance intensive due their oft-fatigued critical components and due to extended exposure to particularly corrosive environments.

Table 7 provides the descriptive statistics of the age distribution shown in Figure 5.

Table 7: Descriptive Statistics of the Age Frequency Distribution

Statistical Term	Capacity (mT)
Mean	24.7
Mode	35.1
Median	26.5
Minimum	4.0
Maximum	44.1
Range	40.1
Standard Deviation	10.1
Count	238.0

Table 8 identifies average off-board lift capacities by mount and boom type. The off-board lift data was supplied by two operators. The majority of the cranes fall within the range of 1700 to 32000 LBS lift capacity.

Table 8: OCS Cranes Average Off-Board Lift Capacities by Mount and Boom Type

Off board Lift	Crane Type			Boom type			
	Swing Bearing Mount	King Post Mount	unknown	Fixed Length Box Boom	Lattice Boom	Telescopic Box Boom	Unknown
Average Off board Lift - All Weights at 25 ft Radius (Lbs)	15167	17131	14462	13517	17174	13991	14663
Maximum – Off board Lift	103546	48000	42200	103546	61210	33759	70000
Minimum – Off board Lift	1727	1980	41593	1727	2732	2360	1980

Figure 6 provides frequency distribution of off-board lift capacities in mT across 238 cranes from the sample containing offshore operator data.

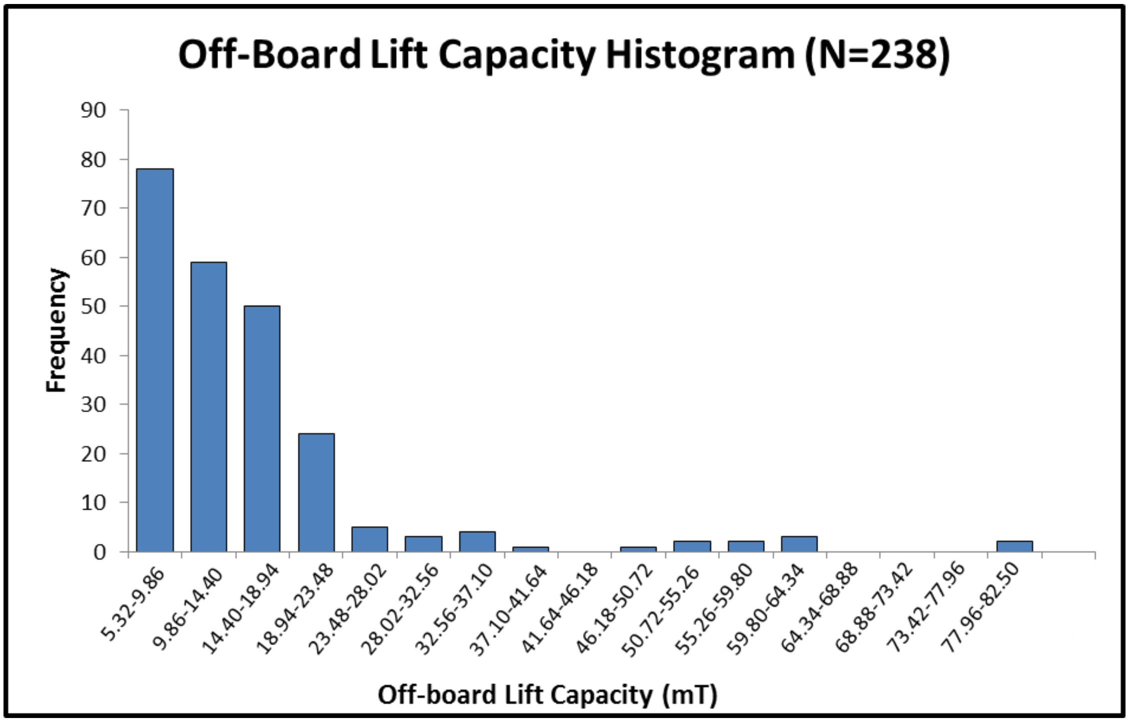


Figure 6: Frequency of Off-board Lift Capacities (mT) at 25 ft Radius

Table 9 below provides descriptive statistics of the frequency distribution shown in Figure 6.

Table 9: Descriptive Statistics of the Age Frequency Distribution

Statistical Term	Capacity (mT)
Mean	10.86
Mode	5.22
Median	8.61
Minimum	0.78
Maximum	73.65
Range	72.86
Standard Deviation	11.69
Count	238

3.3 Observations

The following observations should be considered:

- The data obtained for the analysis were assumed to be accurate and complete within common industry practices. However, it is likely that some details included in the data set may contain inaccuracies.
- The type and quality of the available data was inconsistent from operator to operator and from OEM to OEM.
- Despite these limitations, the study team was still able to achieve a scientifically reasonable sample size that could be used with some confidence to characterize the offshore crane population. It should be noted here that inferences about the general population of cranes in the GOM Region offshore community are qualified by the lack of statistical normality in the distributions shown above. Inferences should be drawn with requisite caution.
- Unfortunately, there is no universal repository of offshore crane location or capacity data. Data supplied by the crane inspection vendor, owner or operator included only limited capacity data which could be rationally analyzed. Therefore, the data only allowed for gross characterization by pedestal mount and boom type.
- The most likely explanation for the bimodal nature of the capacity distribution is that the sample includes two distinct subpopulations of fixed platforms and MODUs. The former tend to have lower capacity cranes than the latter due to the weights of the routine lifts performed during their operations.
- The upward trends in the crane age is coincides with the offshore oil boom between 1978 and 1986, which can clearly account for the increased number of cranes in this range.
- The taper in the number of cranes at the higher end of the age distribution is likely due to both fatigue-life limits and lifecycles of fixed platform and MODU facilities.

4 Material Handling Equipment Assessment

An assessment and analysis was performed of material handling equipment used on fixed and floating offshore facilities, FPSO and mobile offshore drilling units (MODU). This equipment includes, but is not limited to, the following types of lifting devices:

- gin pole cranes
- man-riding hoists
- equipment-based hoists
- winches
- come-alongs
- BOP hoists
- riser carts
- drill floor/derrick lifting equipment (Kelly drives, elevators, top drive systems)
- below-the-hook (BTH) lifting devices
- manual lifting device

The lifting equipment described in the call order varies in nomenclature and function. The purpose of reviewing material handling equipment for this study was to explore application of crane-like inspection methods and procedures to the subject equipment. Accordingly, the scope of the analysis was limited to material handling equipment with crane-like, or at least crane related, properties. Equipment determined to be "in-scope" for this project are covered in the following standards shown in Table 10.[4]

- All equipment covered by ASME BTH-1-2011 and the ASME B30 series commonly used in the offshore industry (excluding vacuum, magnetic and grapple lifting devices);
- All equipment listed as "material handling equipment" in BSEE PINC I-190; and
- Lifting equipment in ABS Guide for the Classification of Drilling Equipment 2012 (2012 CDS).

Table 10: Scope of Material Handling Equipment Analysis

In Scope*				Out of Scope
ASME BTH-1-2011 & B30 SERIES	BSEE PINC I-190	ABS 2012 CDS	Other	
Below the hook rigging and rigging hardware	Air hoists	Riser running tool	Man Basket / "Billy Pugh"	Jacks
Below the hook rigging and rigging hardware	Hoists	Riser spider (when used for lifting)		Industrial rollers
Hooks	Tugger	Crown block		Air casters and pallets
Slings	Air tugger	Traveling block		Balance lifting units
Winches (lifting only)	Winch (lifting only)	Deadline anchor		Pad eyes
Supporting lifters	Man-riding winch	Top drive		Scissor lift
Pressure gripping lifters		Drawworks Drilling elevators		Aerial manlift
Friction type lifters		Bails/links		Elevators (non-drilling)
Floating cranes		Horizontal to Vertical (HTV) machine		Vacuum lifting device
Overhead bridge cranes and hoists		BOP crane		Magnetic lifting device
Stacker cranes				Grapple
Monorails				Mobile cranes
Gantry crane				Tower cranes

[4] Only lifting equipment is considered (e.g. equipment that applies a vertical force to the top of an object) in this review. Material handling equipment which supports the object from underneath (scissor lift) or provides for horizontal translation (riser catwalk) was not considered during this review.

In Scope*				Out of Scope
ASME BTH-1-2011 & B30 SERIES	**BSEE PINC I-190**	**ABS 2012 CDS**	**Other**	
Jib crane				Container cranes
Articulating boom crane				Loads suspended from rotorcraft
Personnel lifting systems				Riser tensioning system
Material placement systems				
Come-alongs				

* All of the equipment covered by ASME BTH-1 and B30 series is covered in the ASME B30 review section.

4.1 Analysis

The following sections outline the analysis conducted on material handling equipment.

4.1.1 Certified Drilling System (CDS) Equipment

Certified Drilling System (CDS) equipment refers to equipment specifically designed for use in marine drilling systems and which is generally covered by a standard of design promulgated by a marine classification society. To obtain a CDS mark or notation on the facility or MODU's classification certificate, the equipment must be designed to a standard, such as the ABS Guide for the Classification of Drilling Systems or one published by other marine classification societies such as Lloyd's Register (LR), Det Norske Veritas (DNV), Bureau Veritas (BV), or Germanischer-Lloyd (GL), among others.

CDS equipment includes material handling devices such as riser running tools, top drive systems, draw works, and BOP cranes, which are unique to mobile offshore drilling units (MODU). Typical components of the hoisting system include the crown block with its support beams, traveling block with its guide track and dolly, sheaves for the crown block and traveling block, deadline anchors, draw works, drilling hook, top drive, drilling line, drilling elevators and links, hydraulic cylinders for overhead hoisting power swivel, bells, and rotary swivel, wire rope and hoisting equipment gears.

There is no universal database that reports what specific equipment is installed on an individual facility. Research indicates that much of this information is proprietary. In fact, a number of devices are unique, having been specifically designed or retrofitted to an individual MODU or facility, and therefore are not representative of the fleet operating on the OCS.

Typical nomenclature and functions of material handling equipment are presented below.

4.1.2 Hoisting, Lifting, Rotating and Handling Systems

Bail: The bail is a large, cylindrical steel bar that supports the swivel and connects it to the drill hook on the travelling block.

BOP/LMRP Service Crane: provide the lifting capacity when handling the BOP Stack and a complete assembly or the LMRP and BOP individually between the transporter and storage positions.

BOP/LMRP Transporter: transports a BOP from its crane loading position to well center. The BOP Transporter travels on rails under the moon pool via hydraulic cylinders.

Crown Block: The crown block is the stationary section of the derrick drill string lifting apparatus that contains a set of sheaves through which the drill line wire rope is reeved and is opposite and above the travelling block.

Deadline Anchor: The deadline anchor or deadline tie-down anchor is a mechanical device used to secure the deadline section of the drill line to the mast or derrick substructure.

Derricks/Masts: Derricks and masts provide the structural stability for load handling and positioning the drilling string above the downhole or well bore and contains the machinery for turning the drilling bit and controlling the weight on the drill string.

Draw Works: The draw works is the primary hoisting machinery of the rotary drilling system. Its main function is to provide motive power to raise and lower the travelling block. The wire rope drilling line winds on the draw works drum and extends to the crown and travelling blocks, allowing the drill string to be moved up and down and to vary the weight on the drill bit. The draw works typically consists of the wire rope drum, motor, reduction gear, main brake and auxiliary brake. Motive power is usually through an AC motor using a variable frequency control but may be by DC traction motors using a thyristor control, closed-loop hydraulic system, or by direct drive from a diesel engine, depending upon the age and configuration of the system. Some draw works may also provide motive power to the rotary table.

Drill Floor Manipulator Arm (DFMA): A drill floor manipulator arm (DFMA) is a single working guide arm that guides tubulars to and from the wellbore to a laydown area or pipe rack. It is fixed mounted with a heavy duty slewing bearing for rotation and a telescoping box arm for reach. It is designed to handle a large variety of tubular diameters and to tail in marine risers and slip joints as well as stab in drill string components. The DFMA is generally controlled from a free-standing control unit on the drill floor or by radio remote control from the driller's cabin.

Drill Hook: A large hook mounted on the bottom of the travelling block which holds the swivel and drill string.

Drill Line: The drill line is a multi-thread, twisted wire rope reeved through the crown and travelling blocks to lower and lift the drill string in and out of the wellbore. The section of drill line from the draw works drum to the crown block is the "fastline". The drilling line then reeves though the sheaves of the crown block and makes several passes through the travelling block to create the mechanical advantage for hoisting the drill string. The line then exits the last sheave on the crown block and is fastened to the derrick and is called the "deadline".

Drilling Elevators: Drill elevators are a set of large clamps that grip the drill string or casing to facilitate the lifting or lowering of tubular as a whole, or is used to resist cross-axial loads of the weight of the pipe joints. Drilling elevators are highly stressed components that require regular, careful inspection.

Hoisting Equipment: Typical components of the hoisting system would include the crown block with its support beams, traveling block with its guide track and dolly, sheaves for the crown block and traveling block, deadline anchors, drawworks, drilling hook, top drive, drill line and sand line, drilling elevators and links, hydraulic cylinders for overhead hoisting power swivel, bells, and rotary swivel, wire rope and hoisting equipment gears.

Horizontal Riser Handling System: A riser handling cart or skate is a mechanical device which horizontally transports a riser assembly to the derrick for positioning in the wellbore and is a type of horizontal-to-vertical material handling device. The riser must be transported to the riser lift tool at the wellbore. This is achieved with a riser skate or multi-function catwalk machine. The riser is landed on the skate by a riser handling crane and driven to the wellbore for attachment to the lift tool. Once the riser is lifted clear by the traveling block, the rear support of the cart freewheels along the skate or catwalk with the riser bucket pivoting to follow the changing angle of the riser as it transitions from horizontal to vertical. When the riser is centered in the wellbore, the lower riser end may be tailed out of the cart using a dedicated tailing arm or drill floor manipulator arm fitted with a riser tailing head.

Iron Roughneck: The iron roughneck is so named because it replaces the personnel (roughnecks) and automates the installation and removal of drill pipe from the drill floor. The iron roughneck is fed tubulars mechanically and personnel are removed from the dangerous conditions during drill string insertion or removal from the wellbore, drilling operations being remotely controlled from the safety of the driller's cabin. The iron roughneck clamps the bottom pipe, providing torque, while a spinning or rotary wrench turns the top pipe, joining the two sections together. When a drill bit must be replaced or the well is completed, the pipe is simply turned in the opposite direction to disconnect and remove it.

Kelly Bushing: The Kelly bushing is an adapter that connects the rotary table to the Kelly drive. The Kelly bushing has an inside profile, square or hexagonal, which matches the Kelly drive on the drill string and is connected to the rotary table by four large steel pins that fit into mating holes on the rotary table. The rotary motion from the rotary table is transmitted to the bushing through the pins and then to the Kelly drive through the square or hexagonal surfaces between the Kelly drive and the Kelly bushing. The Kelly drive then rotates the entire drill string. Depth measurements for the wellbore are commonly referred to as KP or depth below the Kelly bushing.

Kelly Drive: The Kelly drive is a long, square or hexagonal steel bar, rifle drilled for a fluid path, and is used to transmit rotary motion and torque from a rotary table system (in lieu of a top drive system) or Kelly bushing to the drill string. This allows the drill string to be raised or lowered while turning the drill bit. The Kelly is inserted into the Kelly bushing which is in turn attached to the rotary table which provides motive power to the drill string.

Riser Spider: The riser spider is used to run riser sections through any the rotary table. Retractable dogs or pawls are hydraulically activated to support the riser string. The riser spider is remotely operated through a panel in the driller's cabin, eliminating the need to manually retract and extend the dogs as each section of the riser is positioned in the wellbore.

Rotary Table: The rotary table is the revolving section of the drill floor that provides motive power and torque to the drill string. The rotary motion and power are transmitted through the Kelly bushing and Kelly drive. Almost all drilling systems have a rotary table as a primary or backup system for rotating the drill string, although many modern drilling systems have dispensed with the rotary table and use a top drive system exclusively.

Swivel: The swivel is a mechanical device that suspends the weight of the drill string from the drill hook and traveling block. It is designed to allow rotation of the drill string while conveying high volumes of pressure control "mud" drilling fluid between the mud circulation system and the drill string.

Top Drive: The top drive is a mechanical device which provides torque to the drill string to rotate the drill bit. A top drive system is used in lieu of a rotary table such as a Kelly drive because it lessens the manual labor and risks on the drill floor and allows the longer sections of the drill string to be used in a single operation (typically three tubulars). The top drive is suspended from the hook of the travelling block and is thus free to travel up and down with the drill string. Motive power for the top drive is usually through an AC motor using variable frequency control but may also be through a closed-loop hydrostatic transmission system using a hydraulic motor.

Travelling Block: The travelling block is the freely moving section of the derrick drill string lifting apparatus that contains a set of sheaves through which the drill line wire rope is reeved and is opposite and under the crown block. Depending upon the size of the drill system, travelling blocks can be quite massive (>80-100 tons) with loads of over one million pounds and represent a serious dropped-object hazard.

Vertical Riser Handling System: A vertical riser handling system is a mechanical device for moving slip joints and marine risers from a vertical storage position to the wellbore, together with a top drive and traveling block. The system typically consists of a riser handling gantry crane and hoist, fingerboard or racking board locks, riser chute, tail-in arm, and control cabin mounted on the riser crane. The riser handling crane lifts the riser from vertical storage to the riser chute. The riser tail-in arm guides the tail end of the riser from the chute to the wellbore.

4.1.3 Auxiliary Hoisting and Material Handling Equipment

Auxiliary hoisting and manual material handling equipment is that which may or may not be associated exclusively with the drilling process but may be used for material handling. These items include, but are not limited to:

Man-Riding Winch: A man-riding winch is used for lifting personnel in a harness or boatswain's chair to upper levels of the derrick such as fingerboards or monkey boards. These winches require a minimum of an 8:1 design factor to safe working load limit, overload devices, slack wire detectors, limit switches, emergency stops, and emergency lowering and spooling devices. They are often built to marine classification society standards.

Tongs: Tongs are large clamps used to manually manipulate tubulars in the wellbore by the drill crew. Tongs may be designated as lead, makeup, or breakout depending upon their function. These have been replaced by the iron roughneck and drill floor manipulator arm (DFMA) on modern drilling systems.

Tugger: A tugger is an electrically, pneumatically, or hydraulically-operated drum and wire or synthetic rope winch system often mounted on the drill floor and used to hoist or tag-line control heavy drilling components.

Winch: A winch is an electrically, pneumatically, or hydraulically-operated horizontal (windlass) or vertical (capstan) hoisting or pulling system used to provide motive power to raise or lower material or to tension a line or rope.

4.1.4 BSEE I-190 PINC for Material Handling Equipment

The BSEE I-190 PINC is grounded in 30 C.F.R. Part 250.108 (f) which states that the operator must operate and maintain all other material handling equipment in a manner that ensures safe operations and prevents pollution. Material handling equipment is not defined in 30 C.F.R. Part 250.105. BSEE could define material handling equipment as devices, appliances, components, attachments, etc. the purpose of which is to facilitate or stabilize the movement (horizontal and vertical) of machinery, tools, contained liquids and solids or any material or equipment which cannot be moved safely and within the physical capabilities of the human being.

The BSEE I-190 compliance guidance requires inspectors to determine if all material handling equipment is operated and maintained in a manner that ensures safe operation and prevents pollution. The current inspection procedure also requires an inspection of records to ensure material handling equipment is operated "per manufacturers and/or operators specifications." The inspector must also issue a component shut-in (C) incident of noncompliance citation when these conditions are not met. Although material handling equipment is not defined in the statute, the I-190 PINC notes that material handling equipment includes, but is not limited to: air hoists, hoists, tugger, air tugger, man-riding winch, come-a-long, monorail, gantry crane, jib crane, etc.

Since the statute does not define material handling equipment, any equipment which moves or manipulates components or material would rightly be subject to this regulation; this includes CDS and auxiliary material handling equipment referred to above. The I-190 PINC guidance to BSEE inspectors subjects the regulated entity to variations in the training, experience, and capriciousness of the inspector; making compliance and inspection difficult. Moreover, the large variation in the motive power and functionality of the equipment makes it highly unlikely that any one inspector would be a subject matter expert (SME) or competent inspector of all of the systems covered by the regulation.

Most standards, such as those promulgated by API or marine classification societies, consider the design and not the inspection or maintenance of the equipment at the user's level. Companies operating material handling equipment on the OCS must develop operations, maintenance safety and environmental pollution control procedures. This is normally accomplished through a Failure Modes, Effects and Criticality Analysis (FMECA) which qualitatively identifies the failure modes and effects of the equipment's major components and line replaceable units and qualitatively evaluates the frequency of failure based on cycle or fatigue limits. Instructions on how to perform the FMECA may be found in MIL-STD-1629A, Procedures for Performing a Failure Modes, Effects and Criticality Analysis, as well as other treatises on FMECA. From the FMECA, a robust, predictive and preventative inspection and maintenance schedule may be produced. The FMECA is sometimes produced by the manufacturer to form the basis of an inspection and maintenance schedule and this information is incorporated into the equipment's operations and maintenance instructions. Therefore, the equipment owner or operator may develop an inspection and maintenance schedule based on the manufacturer's instructions. This may be valid, however, only if the schedule and manufacturer's instructions are based on a FMECA.

Once the inspection and preventive maintenance schedule is produced from an FMECA or from the manufacturer's instructions based on an FMECA, a job safety analysis (JSA) and task analysis (TA) should be performed to produce the inspection procedure. The JSA and TA take into account the inspection and maintenance tasks, the frequency and sequence in which they are to be performed, and the pass or fail criteria for the components to be inspected. From the JSA and TA, an inspection and maintenance checklist or other job aid may be produced and entered into a computerized maintenance management system. This system would schedule and track inspection and maintenance to ensure the equipment is maintained in a safe and efficient manner.

Generally, inspections are scheduled on a frequent or periodic basis. Frequent inspections are those operational and preventive maintenance checks and services performed by a competent equipment operator on a daily, pre-operational, or shift-change basis. Periodic inspections are those performed by qualified maintenance or service personnel on a calendar basis, as recommended by the inspection and maintenance schedule discussed above. Sometimes, equipment owners and operators will have the equipment manufacturer or other independent third party perform the annual inspection of the equipment as an audit check of the inspection and maintenance quality of its own maintenance personnel.

Although Office of Safety and Health Administration (OSHA) does not have jurisdictional responsibility on the OCS, definitions of competent and qualified personnel are shown below:

> A competent person is one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt, corrective measures to eliminate them. Thus, a competent operator would be one who is trained in accordance with a written qualification or structured on-the-job (OJT) training program, depending upon the complexity of the equipment; and who is trained to recognize the safety and environmental hazards of the equipment and is able to take corrective actions to eliminate those hazards.

Conversely, a qualified person is one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated their ability to solve or resolve problems relating to the subject matter, the work, or the project. This generally refers to inspection and maintenance personnel who are either mechanical engineers or who by a manufacturer's or nationally-recognized certification training program, or who through a combination of education, training AND experience, is a subject matter expert on the operation, inspection and maintenance of the equipment, and can render an educated, informed opinion on the safety and efficacy of the equipment's operation and maintenance. Therefore, maintenance personnel should be qualified to perform the periodic inspections as required by the inspection and maintenance schedule by formal training or certification procedure.

Thus, inspectors of CDS and material handling equipment must be qualified by some formal training program. The marine classification societies offer courses in CDS equipment inspection for their surveyors which may be attended by BSEE inspectors. Moreover, inspectors should have formal training in mechanical and electro-hydraulic equipment fundamentals, hazard identification such as machine safety and machine guarding and other OSHA-type hazard identification procedures, and general inspection and maintenance auditing procedures.

Lastly, it is well recognized the 60 to 80 percent of mishaps involve human error. Many times, these errors are due to a lack of training and qualification of personnel as discussed above. The mishaps are just as likely to be the result of an error provocative design or improper installation of the equipment. The frequency and magnitude of near misses and mishaps could be significantly reduced by subjecting the equipment to a human factors analysis (HFA) which specifically addresses the human-machine interface (HMI). This analysis may be based on ASTM F1166, Standard Practice for Human Engineering Design for Marine Systems, Equipment and Facilities. By subjecting the equipment to a HFA by trained human factors engineering personnel, many of the human error producing conditions may be eliminated.

5 Analysis of Lifting PINCs, INCs, and OIRs

The study team analyzed the PINC list associated with the operations of offshore cranes and material handling equipment on the OCS. The objective of this task was to analyze PINCs and identify key issues that could be addressed in the development of an improved offshore crane and material handling equipment inspection program.

The study team conducted analysis on the PINCs in determining the objectivity and ambiguity of PINC questions. The PINCs were reviewed to determine the inspector's ability to confirm an operator's compliance or non-compliance and the consistency of the recommended enforcement action (sanctions with potential consequences). In addition to the recommendations shown in Table 11, changes to PINCs were drafted to serve as the interim lifting PINCs during a transition from the "As-Is" to the "To-Be" structure. The updated PINCs are shown in Appendix A.

The analysis shown below focused on the following:

- Standards incorporated by reference in 30 CFR 250 associated with lifting PINCs
- Objectivity and ambiguity of PINC questions
- Ability for the inspector to confirm an operators compliance or non-compliance with the PINC
- Consistency of the inspectors enforcement action (sanctions with potential consequences)

5.1 PINC Analysis

The following recommendations for changes to PINCs were based upon the study team's analysis and are provided for BSEE's consideration in the development of a future lifting inspection strategy. In addition to the recommendations provided below, modifications to existing BSEE

Table 11: Recommendations for Changes to PINCs

#	PINC Original Text	Comments for Consideration
I-101	WHENEVER THERE IS ANY DOUBT AS TO SAFETY, DOES THE CRANE OPERATOR STOP AND REFUSE TO HANDLE LOADS OR CONTINUE OPERATIONS AS SAFETY DICTATES IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5a? **Note:** PINC list can only be used if crane operations continued under adverse conditions and caused an accident or near miss, which resulted in injury, death, pollution, or property damage. INSPECTION PROCEDURE: Verify that crane operations were restricted during periods of bad weather, such as lightning, high winds or high seas, or when the Crane Operator's ability to see the signal person is impaired by darkness, fog, rain, etc. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC if inspection reveals that crane was operated under adverse conditions and caused an accident which resulted in injury, death, pollution, or property damage. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	This is a leading question; it telegraphs the desired answer. The requirement needs to be elicited using an action verb. An example is as follows: "Did the crane operator demonstrate sufficient or adequate knowledge of the operator's crane safety procedures." How would the inspector verify the answer to this question? Are crane operation logs required? Do the logs capture real-time climatological data? How would impaired visibility be verified? The restrictive language of the note perpetuates the "compliance mentality" discussed later in this analysis.
I-102	ARE PROPER CRANE OPERATING PRACTICES FOR ATTACHING AND MOVING THE LOAD BEING UTILIZED IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 3.2.1, 3.2.2 AND 3.2.3 AND API RP 2C, PARAGRAPH 7.5.4.3 ? INSPECTION PROCEDURE: 1. Verify that the load is attached to the hook by means of slings or other suitable devices. Sling use shall be in accordance with the guidelines of API RP 2D, Appendix	"Guidelines" are not necessarily mandatory and therefore may not be enforceable; by contrast, the procedures must comply with a regulation or standard adopted by reference.

#	PINC Original Text	Comments for Consideration
	B, paragraph B.3.2.2.c, and Appendix G, paragraph G.5.2.1. 2. Verify that Hooks are equipped with a latch to retain loose lifting gear under non-lifting conditions and that the latch is lockable if the hook is used for transporting personnel. 3. Procedures for moving the load are in accordance with the guidelines of API RP 2D, Appendix B, paragraph B.3.2.3. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC if procedures for attaching and/or moving the load are not within specified guidelines. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I-103	ARE PROCEDURES FOR PERSONNEL TRANSFER PERFORMED IN ACCORDANCE WITH RECOMMENDED PRACTICES SPECIFIED IN API RP 2D, PARAGRAPH 3.4 AND APPENDIX B, PARAGRAPH B.3.4? INSPECTION PROCEDURE: If at the time of inspection, personnel are being transferred via personnel carrier from vessel to vessel, vessel to platform, or from platform to vessel, verify that: 1. Personnel carrier is of an approved type and is maintained in a safe conditions 2. All hooks used for support of personnel carrier are equipped with a safety latch. 3. Personnel are riding the carrier in a safe manner and are wearing an approved PFD. 4. Personnel are not raised or lowered directly over a vessel. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC for a violation of 1 through 4 above.	The operator's manual needs to be evaluated for procedures that meet API RP 2D; then the demonstration needs to be conducted in accordance with the manual. What criteria define "safe manner?" How does the inspector address a safety violation observed during an actual lift? Is it correct to shut-in the component for a personnel violation?

#	PINC Original Text	Comments for Consideration
	INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I-104	ARE CRANES WHICH ARE POSITIONED IN THE PROXIMITY OF HELIDECKS OR APPROACH/TAKE-OFF ZONES NOT OPERATED DURING HELICOPTER OPERATIONS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5M? INSPECTION PROCEDURE: If the crane and helicopter operations are in progress at the time of the inspection, verify that the crane boom is positioned and secured as required and the Crane Operator is out of the cab unless he is in direct voice communications with the pilot. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC if the crane boom is not positioned and secured as required or if the Crane Operator remains in the cab without direct voice communications with the pilot during landings/take-offs. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane observed.	Non-compliance with this requirement is, by definition, a safety of flight issue. A warning should not be an appropriate sanction.
I-105	IF DEFICIENCIES THAT IMPAIR SAFE OPERATION ARE KNOWN, IS THE CRANE TAKEN OUT OF SERVICE OR ITS OPERATION RESTRICTED TO ELIMINATE THE UNSAFE CONDITION IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5c? **Note:** Limited (restricted) service may, in some cases, be continued after the identification and before correction of a deficiency. In such cases, the deficiency must be documented and cautionary notices posted in accordance with API RP 2D, paragraph 1, item c. INSPECTION PROCEDURE: 1. Check facility crane inspection records to determine if any deficiencies have been identified. 2. If deficiencies have been identified, verify that cautionary notices have been	What records are available/ required to determine when the crane was operated? How would the inspector verify that the crane was operated with a deficiency?

#	PINC Original Text	Comments for Consideration
	posted. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (**C**) INC if deficiencies have been identified and cautionary notices have not been posted. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I-111	IS AN OPERABLE SWING BRAKE MECHANISM INSTALLED THAT IS CAPABLE OF SMOOTH STARTS AND STOPS WITH CONTROLLABLE RATES OF ACCELERATION AND DECELERATION AS SPECIFIED IN API SPEC 2C PARAGRAPH 9.1 ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003? INSPECTION PROCEDURE: Verify that the swing brake mechanisms listed below operate according to the requirements in API SPEC 2C Paragraphs 9.1.3, 9.1.3, and 9.1.4: 1. Parking Brake. 2. Automatic Parking Brake. 3. Dynamic Friction Brake. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC for each crane audit that does not confirm that the operator has records of inspecting each crane swing brake mechanism that does not comply with the requirement in API SPEC 2C, Paragraph 9.1. Issue a component shut-in (C) INC for each crane swing brake mechanism inspected that does not comply with the requirements in API SPEC 2C, Paragraph 9.1. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	The inspector should verify that the operator's manual contains procedures for the swing-brake check and that the procedures conform to the API 2C, 7.4. The question should be two parts: First, verify the procedure is written and compliant; second, observe the conduct of the check by the crane operator. Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 7.4.

#	PINC Original Text	Comments for Consideration
I-112	IS AN OPERABLE BOOM HOIST HIGH LIMITER OR SHUTOFF PROVIDED TO AUTOMATICALLY STOP THE BOOM HOIST WHEN THE BOOM REACHES A PREDETERMINED HIGH ANGLE, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.1.1, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003? **Note:** Low angle limiter or shut off shall not be inspected by BOEMRE. INSPECTION PROCEDURE: Verify that the crane boom hoist high limiter or shutoff will automatically stop the boom hoist when the boom reaches a pre-determined high angle. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC for each crane audit that does not confirm that the operator has records of inspecting the boom hoist limiter or shutoff as specified in API RP 2D, Paragraph 4.2.2. Issue a component shut-in (C) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.1.1. INSPECTION COUNT/ INC Enter one item checked/issue one INC for each crane inspected.	Does the operator's manual contain procedures for inspecting the boom hoist limiter or shutoff that comply with API RP 2D? Does the operator maintain records of boom hoist limiter/shutoff inspections? Did the crane operator's boom hoist limiter inspection conform to the manual? Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 10.3.2.1.
I113	ARE BOOM STOPS PROVIDED TO RESIST THE BOOM FALLING BACKWARDS IN A HIGH WIND OR SUDDEN RELEASE OF THE LOAD, AS SPECIFICED IN API SPEC 2C, PARAGRAPH 13.1.2, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003? INSPECTION PROCEDURE: Verify that the crane boom stops provided are designed to resist the boom falling backwards. Note: Designs for boom stops include one of the following: 1. A fixed or telescoping bumper. 2. A shock absorbing bumper	Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 10.3.2.2.

#	PINC Original Text	Comments for Consideration
	3. Hydraulic boom elevation cylinder(s). IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.1.2. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected,	
I114	IS A BOOM ANGLE OR LOAD RADIUS INDICATOR READABLE FROM THE OPERATOR'S STATION PROVIDED, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.1.4.1, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003? INSPECTION PROCEDURE: Verify that the crane boom angle or load radius indicator is provided and readable from the operator's stations. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC for each crane audit that does not confirm that the operator has records of inspecting the boom angle/radius indicators over full range for accuracy as specified in API RP 2D, Paragraph 4.2.2. Issue a component shut in (C) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.1.4.1. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 10.3.2.4 If the boom angle or load radius indicator is a safety device, then inspection and verification of proper operation serves as safety-critical functions. How can lack of inspection records for a safety device be worthy of only a warning?
I115	HAVE SECURELY FASTENED GUARDS BEEN INSTALLED ON EXPOSED MOVING PARTS WHICH MAY CONSTITUTE A HAZARD, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.2, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?	Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 10.3.3.

#	PINC Original Text	Comments for Consideration
	INSPECTION PROCEDURE: 1. Verify that exposed moving parts such as gears, set screw, projecting keys, chains chain sprockets, and reciprocating or rotating parts which may constitute a hazard under normal operating conditions are guarded. 2. Verify that an appropriate sign is posted if a guard is impractical to install on the above crane components. IF NONCOMPLIANCE EXISTS: Issue a component shut in (C) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.2. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I116	HAS AN ANTI-TWO BLOCK DEVICE BEEN PROVIDED TO PROTECT HOIST ROPES, STRUCTURAL COMPONENTS AND MACHINERY FROM DAMAGE WHICH MAY OCCUR WHEN TWO SHEAVE GROUPS (e.g., LOAD BLOCK AND BOOM HEAD) COME INTO CONTACT AS THE HOIST CABLE IS DRAWN IN, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.7, ON EACH CRANE ON A FIXED PLATFORM INSTALLED BY MARCH 16, 2005? Note: 1. BSEE Inspectors do not test stalling mechanisms for hoist drum. 2. A control override device or proximity warning device may be used. Stalling of the hoist drum is acceptable where damage or loss on control would not result. INSPECTION PROCEDURE: 1. Verify that a means to protect hoist ropes, structural components and machinery from damage is provided on all cranes. 2. Verify that the operator is documenting the proper inspection of the controls override or proximity warning device as specified in API RP 2D,	Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 10.3.6. If the anti-two block device is a safety device, then inspection and verification of proper operation serve safety-critical functions. How can lack of inspection records for a safety device be worthy of only a warning?

#	PINC Original Text	Comments for Consideration
	Paragraph 4.2.2. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC for each crane audit that does not confirm that the operator has records of inspecting the control override or proximity warning devices as specified in API RP 2D, Paragraph 4.2.2. Issue a component shut in (C) INC for each crane inspected that does not have an operational control override or proximity warning device installed. INSPECTION COUNT/INC Enter one item checked/ issue one INC for each crane inspected.	
I117	IS THERE A FIRE EXTINGUISHER OF APPROPRIATE SIZE AND TYPE KEPT IN THE CAB OR VICINITY OF THE CRANE IN ACCORDANCE WITH AP1 RP 2D, PARAGRAPH 3.5.2? **Note:** ASME B30.4c recommends a portable fire extinguisher with a basic minimum extinguisher rating of 10 BC. (10 = 10 lbs., B = Flammable Fluids, C = Energized Electrical). INSPECTION PROCEDURE: Verify that a fire extinguisher is located in the crane cab or near the crane. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC if fire extinguisher: 1. Is not located where required. 2. Is not of the appropriate size or type. 3. Does not exist or is inoperable. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I131	IS THE CORRECT LOAD RATING CHART FOR THE CRANE CONFIGURATION IN USE AT THE PRIMARY CONTROL STATION IN ACCORDANCE WITH API RP 2D, PARAGRAPH	

#	PINC Original Text	Comments for Consideration
	3.2.1? INSPECTION PROCEDURE: Verify that the load chart is legible, posted and visible in the primary control station for the crane configuration in use. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC for the crane if the correct load rating chart is not posted and visible at the primary control station for the crane. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I132	ARE WRITTEN REPORTS ON LOAD TESTS PREPARED BY A QUALIFIED CRANE INSPECTOR SHOWING LOAD TEST PROCEDURES AND RESULTS WHEN LOAD TESTS ARE REQUIRED IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.2.3? **Note:** Load tests are required under the following conditions: 1. New cranes being placed in service. 2. Cranes that are being permanently relocated. 3. Temporary/rental cranes after each rig-up or relocation. 4. When repairs or replacement do not meet the requirements of API RP 2D, paragraph 4.3.3. INSPECTION PROCEDURE: Verify from facility crane records that load tests were conducted when required by a qualified crane inspector using API RP 2D, Appendix E, as a reference guide. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (**C**) INC if load tests are not conducted when necessary by a qualified crane inspector using API RP 2D, Appendix E, as a referenced guide. INSPECTION COUNT/INC	

#	PINC Original Text	Comments for Consideration
	Enter one item checked/ issue one INC for each crane inspected.	
I133	HAVE STATIC AND DYNAMIC LOAD RATING CHARTS BEEN ESTABLISHED FOR ALL CRANES IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5h? Note: 1. Static Load Ratings must be established for lifting from or setting on the crane-supporting structure (platform). 2. Dynamic Load Ratings must be established for lifting from or setting on vessels. INSPECTION PROCEDURE: Verify from facility crane records that static and dynamic load ratings charts have been established for all cranes. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC if records indicate that: 1. Static and dynamic load ratings have not been established for all cranes. 2. Crane has operated without appropriate load rating charts established and posted. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I134	IS THE LOAD BLOCK RATING LABEL(S) PERMANENTLY AFFIXED TO THE HOOK BLOCK, AS SPECIFIED IN AP SPEC 2C, PARAGRAPH 7.5.3.2, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, OR EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003? INSPECTION PROCEDURE: 1. Verify that the load block rating label(s) is permanently affixed to the hook block. 2. Verify that the label includes the following load block requirements.	Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, 7.2.5.3.

#	PINC Original Text	Comments for Consideration
	a. The maximum static and personnel rated loads. b. The service temperature and assembly weight. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (C) INC for any crane load block that does comply with the requirements in API SPEC 2C, Paragraph 7.5.3.2. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I141	HAVE MANUFACTURER'S RECOMMENDATIONS BEEN INCLUDED IN ESTABLISHING ALL INSPECTION REQUIREMENTS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2 AND APPENDIX C? INSPECTION PROCEDURE: Verify that the manufacturer's recommendations have been included in establishing all inspection requirements. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC if records indicate that manufacturer's recommendations have been excluded from establishing inspection requirements. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	Is a warning an appropriate sanction for an improperly and/or incompletely inspected crane? If the crane has not been inspected in accordance with all standards and manufacturer's requirements, how does the operator know that it is safe to operate?
I142	HAVE NEW OR RELOCATED CRANES RECEIVED AN INITIAL INSPECTION BY A QUALIFIED INSPECTOR WITH RECORDS MAINTAINED AT AN APPROPRIATE LOCATION FOR FOUR YEARS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.1 AND 4.2.2? **Note:** Cranes in this category are required to be load tested in accordance with API RP 2D, Appendix E. INSPECTION PROCEDURE:	Is a warning if most current inspection is up to date and accurate. A (C) should be issued if no records are available.

#	PINC Original Text	Comments for Consideration
	Verify that: 1. Records of initial inspection are readily available and are maintained for a period of 4 years. 2. Inspection and load test was performed. 3. Records include date and time of inspection and name/initial of person performing the inspection. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC if records of initial inspection are not available and/or not maintained for 4 years. Issue a component shut-in (**C**) INC if: 1. The crane was not inspected prior to use when new or prior to use after being permanently relocated. 2. The crane was not load tested. INSPECTION COUNT/ INC Enter one item checked/issue one INC for each crane inspected.	
I143	HAVE PRE-USE INSPECTIONS BEEN PERFORMED PRIOR TO USE (TYPICALLY DAILY) BY A QUALIFIED CRANE OPERATOR/INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 4.1.1.1 AND 4.1.2.2, MAINTAINED AT AN APPROPRIATE LOCATION FOR FOUR YEARS? **Note:** Applies to all cranes, regardless of usage category. The pre-use inspection must be conducted prior to using the crane. Pre-use inspection record can be a record, a record book, a logbook, a computerized data collector, or an electronic data collector. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2a. INSPECTION PROCEDURE: Verify that:	What criteria determines an "appropriate location?"

#	PINC Original Text	Comments for Consideration
	1. Pre-use inspections are performed. 2. Records are kept at an appropriate location and are maintained for a period of 4 years. 3. Records include date and time of inspection and name/initial of person performing the inspection. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC if: 1. Records indicate that a pre-use inspection was missed or did not occur on schedule, but the most recent pre-use inspection has been performed. 2. Records are not maintained for a period of 4 years. Issue a component shut-in (C) INC if: 1. Records of pre-use inspections are not available or are not kept at an appropriate location. 2. Records do not indicate that a pre-use inspection has been performed. 3. The pre-use inspection currently due has not been performed. INSPECTION COUNT/INC Enter one item checked/issue one INC for each crane inspected.	
I144	HAVE MONTHLY INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE OPERATOR/INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.3 AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS? Note: 1. Applies to Heavy Usage Category cranes. An Operator's failure to document usage category will cause the crane to default to the Heavy Usage category. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2b. 2. Reference Appendix 24 for definition of "Monthly" and description of "Usage	

#	PINC Original Text	Comments for Consideration
	Category." INSPECTION PROCEDURES: Verify that: 1. Monthly inspections are performed by qualified personnel. 2. Verify that records are readily available and are maintained for a period of 4 years. 3. Verify that records include date and time of inspection and name/initial of person performing the inspection. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if records indicate that monthly inspection was missed or did not occur on schedule, but the most recent monthly inspection was completed. Issue a component shut-in (**C**) INC if: 1. Records of monthly inspections are not available or are not maintained for a period of 4 years. 2. Records do not indicate that a monthly inspection has been performed. 3. The monthly inspection currently due has not been performed. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I145	HAVE QUARTERLY INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.4 AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS? Note: 1. Applies to Moderate Usage Category cranes and Heavy Usage Category cranes. An Operator's failure to document usage category will cause the crane to default to the Heavy Usage category. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2c.	

#	PINC Original Text	Comments for Consideration
	2. Reference Appendix 24 for definition of "Quarterly" and descriptions of "Usage Category." INSPECTION PROCEDURE: Verify that: 1. Quarterly inspections are performed by a qualified crane inspector. 2. Records are readily available and are maintained for a period of 4 years. 3. Records include date and time of inspection and name/initial of person performing the inspection. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if records indicate that quarterly inspection was missed or did not occur on schedule, but the most recent quarterly inspection was completed. Issue a component shut-in (**C**) INC if: 1. Records of quarterly inspections are not available or are not maintained for a period of 4 years. 2. Records do not indicate that a quarterly inspection has been performed. 3. The quarterly inspection currently due has not been performed. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I146	HAVE ANNUAL INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 4.1.1.1, 4.1.2.5, AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS? Note: 1. Applies to all cranes, regardless of usage category. Cranes that have been out of service for 12 months or more must have an annual inspection before being used. Additionally, annual inspections must include inspection of crane critical components in accordance with API RP 2D, Appendix C,	

#	PINC Original Text	Comments for Consideration
	paragraph C.4.1.2d, items 22, 23, and 24. 2. Reference Appendix 24 for definition of "Annual" and descriptions of "Usage Category." INSPECTION PROCEDURE: Verify that: 1. Annual inspections are performed by a qualified crane inspector. 2. Records are readily available and are maintained for a period of 4 years. 3. Records include date and time of inspection and name/initial of person performing the inspection. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if records indicate that annual inspection did not occur on schedule, but the most recent annual inspection was completed. Issue a component shut-in (**C**) INC if: 1. Records of annual inspections are not available or are not maintained for a period of 4 years. 2. Records do not indicate that an annual inspection has been performed. 3. The annual inspection currently due has not been performed. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I147	HAS A WIRE ROPE INSPECTION PROGRAM BEEN ESTABLISHED IN ACCORDANCE WITH API RP 2D, PARAGRAPH 5.1.2 AND ARE INSPECTION RECORDS MAINTAINED FOR A PERIOD OF FOUR YEARS? DEFINITION: **Wire Rope Inspection Program -** A wire rope inspection program is an inspection program which takes into consideration crane type, frequency of usage, history of maintenance, wire rope manufacturer's recommendations, and crane	Is a warning appropriate for improperly maintained records? An improperly maintained record is the same as no record. Is a wire rope program that is not being followed any different than no program at all?

#	PINC Original Text	Comments for Consideration
	manufacturer's recommendations. Note: 1. Inspection records must be maintained per API RP 2D, paragraph 4.2 to determine the time interval for retirement of the wire rope. Records must be readily available until the specific wire rope is retired. All observed wire rope deterioration as listed in API RP 2D, Appendix G, paragraph G.5.2.1b must be recorded on these inspection records. 2. Reference Appendix 24 for descriptions of "Frequency of Usage." INSPECTION PROCEDURE: Verify that: 1. A wire rope inspection program has been established. 2. Wire rope inspection records are available and are maintained for a period of 4 years. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if: 1. Records are not readily available or are not maintained for a period of 4 years. 2. Records are incomplete or inaccurate, but are sufficient to indicate that a wire rope inspection program has been established. 3. Issue a component shut-in (C) INC if: 4. A wire rope program has not been established. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I151	HAS A PREVENTATIVE MAINTENANCE PROGRAM BEEN ESTABLISHED WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.3.1, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS?	Is a warning appropriate for improperly maintained records? An improperly maintained record is the same as no record. Is a

#	PINC Original Text	Comments for Consideration
	Note: A preventative maintenance program takes into consideration crane type, frequency of usage, history of maintenance, and manufacturer's recommendations. Reference Appendix 24 for descriptions of "Frequency of Usage." INSPECTION PROCEDURE: Verify that: A preventative maintenance program has been established. Preventative maintenance records are readily available and are maintained for a period of 4 years. IF NONCOMPLIANCE EXISTS: Issue a warning (W) INC if preventative maintenance program records are not immediately available or are not maintained for a period of 4 years. Issue a component shut-in (C) INC if records do not indicate that a preventive maintenance program has been established. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	preventative maintenance program that is not being followed any different than no program at all?
I152	ARE WRITTEN REPORTS CONFIRMING ADEQUACY OF REPAIRS OR ALTERATIONS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.3.3c, MAINTAINED FOR A PERIOD OF FOUR YEARS? **Note:** All replacement parts must be equal to or better than the original equipment. No welding repairs may be made to critical components, such as booms and swing circle assemblies, without specific repair procedures and recommendations from the original crane manufacturer or other similar qualified source. INSPECTION PROCEDURES:	Is a warning appropriate for improperly maintained records? An improperly maintained record is the same as no record.

#	PINC Original Text	Comments for Consideration
	Verify that: 1. Written reports confirming the adequacy of major repairs or alterations are available. 2. The reports are maintained for a period of 4 years. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if written reports confirming the adequacy of repairs or alterations are not immediately available or are not maintained for a period of 4 years. Issue a component shut-in (**C**) INC if written reports: 1. The operator is not prepared confirming the adequacy of repairs or alterations performed. 2. Are incomplete or inaccurate. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I153	ARE REPAIRS OR REPLACEMENTS OF CRITICAL COMPONENTS MADE PROMPTLY IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.3.3b? **Note:** All replacement parts must be equal to or exceed the original equipment. No welding repairs may be made to critical components, such as booms and swing circle assemblies, without specific repair procedures and recommendations from the original crane manufacturer, or other qualified source. Promptly means "Done Without Delay." INSPECTION PROCEDURE: 1. Check facility crane records for evidence of crane repair or replacements of critical components. 2. If repair or replacement has been made, verify work was done promptly and accomplished in accordance with API RP 2D, Appendix F, paragraph F.4.3.3,	"Promptly" and "without delay" do not appear in API RP 2D, PARAGRAPH 4.3.3b or Appendix F, paragraph F.4.3.3, item b. What criteria exist for determining "promptly" or "without delay? API RP 2D, PARAGRAPH 4.3.3b states: "Repairs or replacements of critical components should be made as soon as practical" (see F.4.3.3).

#	PINC Original Text	Comments for Consideration
	item b. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (**C**) INC if records indicate that work is not done promptly or accomplished in accordance with API RP 2D, Appendix F, paragraph F.4.3.3, item b. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	
I161	ARE SLINGS OF ALL TYPE, GRADE, AND CONSTRUCTION IDENTIFIED AS REQUIRED IN API RP 2D, PARAGRAPH 5.2.4b? **Note:** Sling identification includes sling manufacturer's name, pertinent working load limits, proof test certification number, length, diameter, and date of proof test. INSPECTION PROCEDURE: Verify that the slings have the specified ID tags attached. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (**C**) INC if sling identification tag is missing. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each facility inspected.	
I162	ARE SLINGS PROPERLY STORED WHEN NOT IN USE IN ACCORDANCE WITH API RP 2D, APPENDIX G, PARAGRAPH G.5.2.1? **Note:** Slings should be stored in an area where they will not be exposed to water, extreme heat, or corrosive fumes, liquids and sprays. Slings should not be stored on the deck. All slings, when not in use, should be kept on a rack. Use of a rack minimizes accidental damage and allows easier monitoring of condition between regular inspections. If space limitations require that slings be stored along the side of the platform, they should be secured in a manner to prevent abrasion due to	

#	PINC Original Text	Comments for Consideration
	rubbing and maintained in a manner to minimize corrosion. INSPECTION PROCEDURE: Visually inspect areas near cranes for slings which are not properly stored and maintained. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if slings are not properly stored. Issue a component shut-in (**C**) INC if slings are not maintained in a manner to prevent loss of integrity due to abrasion or corrosion. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each facility inspected.	
I171	IS THE LESSEE ENSURING THAT THE MANUFACTURER IS CERTIFYING EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, OR THAT EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003, MEETS THE DESIGN, MATERIAL AND DIMENSIONAL SPECIFICATIONS USED IN THE CALCULATIONS AND HAS BEEN AUTHENTICATED IN ACCORDANCE WITH API SPEC 2C, PARAGRAPHS 5.5 AND 6.2? INSPECTION PROCEDURE: 1. Verify that a nameplate is installed in compliance with API SPEC 2 C. 2. In the absence of the nameplate, verify that the lessee has the required manufacturer's information. IF NONCOMPLIANCE EXISTS: Issue one component shut-in (**C**) INC for each crane certification audited if the Lessee does not comply with API SPEC 2 C, Paragraph 5.5 and 6.2. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each crane inspected.	Should BSEE incorporate API Spec 2C, 7th edition, by reference the PINC should be corrected to the following citation: API SPEC 2C, Paragraph 4.1, and possibly 12.1.1. The term "authenticated" does not appear in API SPEC 2C.

#	PINC Original Text	Comments for Consideration
I181	DO ONLY QUALIFIED PERSONNEL PERFORM RIGGING OPERATIONS IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 2.44, 3.1.3, AND 3.1.4? DEFINITION: **Rigger** - Anyone who attaches or detaches lifting equipment to loads or lifting devices and who has received training in accordance with API RP 2D, paragraph 3.1.4 and Appendix A2. INSPECTION PROCEDURE: If rigging operations are in progress at the time of inspection, verify that personnel involved are qualified. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (**C**) INC if rigging operations are in progress and personnel involved are not qualified. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each facility inspected.	The reference to API RP 2D, Appendix A2 is incorrect. The reference should be to Appendix A3.
I182	ARE CRANES OPERATED ONLY BY QUALIFIED PERSONNEL IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 3.1.1? DEFINITION: Qualified Person: A person who has met and passed the requirements of API RP 2D, paragraphs 2.42 and 3.1.2; • A trainee under the direct supervision of a Qualified Crane Operator; • Appropriate maintenance and supervisory personnel, when it is necessary for them to do so in the performance of their duties. • **Note:** No one other than the personnel specified above should enter a crane	

#	PINC Original Text	Comments for Consideration
	cab. INSPECTION PROCEDURE: 1. Verify from facility records that crane operations were performed by qualified personnel. 2. If crane is in operation, verify that the person operating the crane is qualified. **Note:** 1. A crane operator is not qualified if qualifications are not maintained, at a minimum, every four years. 2. A written document from the facility operator stating that qualifications have been met is sufficient. IF NONCOMPLIANCE EXISTS: Issue a warning (**W**) INC if facility records indicate that the crane was previously operated by unqualified personnel. Issue a component shut-in (**C**) INC if the crane in operation during the inspection is operated by unqualified personnel. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each facility inspected.	
I183	ARE CRANE INSPECTORS QUALIFIED IN ACCORDANCE WITH API RP 2D, PARAGRAPH 2.43? DEFINITION: **Qualified Crane Inspector** - A person so designated by the employer who by reason of appropriate experience and training, in addition to meeting the requirements of Qualified Crane Operator, has attended formal training in and successfully completed courses on crane maintenance and troubleshooting, hoist	The actual source documents of training and qualification should be verified.

#	PINC Original Text	Comments for Consideration
	troubleshooting and overhaul, and on structural aspects of offshore cranes, which gives a knowledge of structurally critical components and critical inspection areas for non-mechanical and/or mechanical cranes, as applicable. INSPECTION PROCEDURE: Verify from facility crane records that duties requiring a qualified crane inspector have been performed by qualified personnel. Note: 1. A crane inspector is not qualified if qualifications are not maintained, at a minimum, every 4 years. 2. A written document from the Operator stating that qualifications have been met is sufficient. IF NONCOMPLIANCE EXISTS: Issue a component shut-in (**C**) INC if records indicate that duties requiring a qualified crane inspector have been performed by unqualified personnel. INSPECTION COUNT/ INC Enter one item checked/ issue one INC for each facility inspected.	
I190	IS ALL MATERIAL-HANDLING EQUIPMENT OPERATED AND MAINTAINED IN A MANNER THAT ENSURES SAFE OPERATIONS AND PREVENTS POLLUTION? INSPECTION PROCEDURE: 1. Verify that material handling equipment is operated and maintained in a safe and pollution free manner. 2. Inspect records to ensure material handling equipment is operated per manufacturers and/or operators specifications. IF NONCOMPLIANCE EXISTS:	This question is excessively subjective.

#	PINC Original Text	Comments for Consideration
	Issue a component shut-in (C) INC when; 1. Material handling equipment is not operated and maintained in a safe manner. 2. Material handling equipment is not operated and maintained in a pollution free manner. INSPECTION COUNT AND INC COUNT: Enter one item checked / issue one INC for facility inspected. **NOTE -** Material handling equipment includes, but is not limited to; air hoists, hoists, tugger, air tugger, winch, man-riding winch, come-a-long, monorail, gantry crane, jib	

5.1.1 Discussion and Analysis

The objective of BSEE inspections is to ensure operator compliance with the letter and spirit of the statutes applicable to offshore operations. The letter of the law is objectively set out in specific regulatory language. The spirit of the law is much more subjective but can be inferred from the broad mandate of 30 CFR § 250.107:

(a) You must protect health, safety, property, and the environment by: (1) Performing all operations in a safe and workmanlike manner; and (2) Maintaining all equipment and work areas in a safe condition.

BSEE currently uses an inspection rubric based upon PINC. The PINCs are restatements of proscriptive and prescriptive regulations and standards incorporated by reference in 30 CFR 250. An observation, by a BSEE inspector, of non-compliance with a PINC gives rise to an Incident of Non-Compliance (INC). The INC may be a warning, component "shut-in" or facility "shut-in." Theoretically, INCs and the corrective actions that follow should prevent the consequences associated with the hazards targeted by the PINC and identified by the INC; thereby achieving the goals described in the CFR.

A review of the BSEE statistics on Crane and Personnel/Material Handling Incidents on the OCS indicates that from CY 2007 to CY 2013, there were 1158 incidents in those two combined categories. The raw totals for each year are: 161, 201, 222, 101, 109, 179 and 185. The two-year decline, 2010 to 2011, in incidents is most likely attributable to the moratorium on drilling in the aftermath of the Deepwater Horizon accident in April 2010. The yearly average is 165 incidents in the combined categories.

In CY 2010, for example, 33 workers sustained reportable injuries during crane and material handling operations, with 24 requiring evacuation to shore-based medical facilities. The upward trend in the yearly totals since CY 2010 begs an attention-getting question. The BSEE inspection program could be one of the answers to this question.

The PINCs, in their current form, focus on individual, technical compliance issues. The reported incidents/accidents, however, were the culmination of many in-process decisions and subsequent behaviors. An example of the difference in emphasis between ensuring technical compliance and ensuring that a comprehensive decision making process is at work may be found in a crane accident that occurred in November of 2007. The nylon sling used to lower a section of flowline was exposed to turbine generator exhaust of 800 degrees F, and subsequently failed, dropping the load 20 feet and pinning a rigger. The rigger had to be medically evacuated by helicopter due to serious injuries.

The cause of the accident was listed as equipment failure, but there was no material fault found with the sling. There was no INC assessed; presumably the operator had satisfied PINC I161 and I162. A focus on the operator's hazard analysis, JSA programs, and human error issues may have indicated a weakness in those areas or a more general safety culture issue.

Of note, also, is the lack of emphasis on human factors in the PINCs. Many of the incident/accident reports list human error as the single cause or one of two causes. The field of human error has multiple facets and is heavily nuanced. Frontline personnel errors, for example, cannot be viewed out of context; they must be analyzed in relation to possible supervisory, managerial, or organization errors.

The PINCs and the associated data create "lagging" indicators of the safety status of an operator. After-the-fact inspections of historical data tell little of the daily, operational culture of the organization. There are few questions regarding operator training requirements or programs. There are no questions on Safety and Environmental Management Programs (SEMP). There are no questions on near–miss reporting. There are no questions concerning job hazard/safety analyses (JSA/JHA) or pre-lift/pre-movement surveys or plans.

For example, in 2011, a fatal accident occurred on an offshore production platform. A rigger handling a tag line was killed when the crane's main hoist wire rope failed. Some of the findings of the BSEE investigation were:

- The Crane was at approximately 118% of its capacity when the lift was undertaken;
- the operator did not have a separate written policy or manual for operation of cranes specifying procedures, use of tag lines, positioning of riggers, pre-use crane inspection;
- there was no internal methodology to insure the annual inspections by third parties comprehensively checked all components of the crane;
- the applicable JSA had been prepared two days earlier and used multiple times.

A comprehensive crane safety policy would most likely contain a robust JSA program along with appropriate initial and recurrent training requirements. These programs indicate a pro-active safety and compliance attitude. Inspection parameters that highlighted pro-active safety program elements would provide data on what the operator is doing right, overall, rather than what went wrong in a specific incident.

The sanctions contained in the PINCs indicate the agency's predisposition toward allowing operations to continue for all but the most egregious non-compliant behavior. Many of the sanctions are inconsistent with the nature of the non-compliance or fail to consider the severity of the consequences if the hazard had resulted in an accident. For example:

> "I-182- ARE CRANES OPERATED ONLY BY QUALIFIED PERSONNEL IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 3.1.1? Issue a warning (**W**) INC if facility records indicate that the crane was previously operated by unqualified personnel."

If the crane was operated by non-qualified personnel, the facility manager or operator allowed it, actually or constructively. The operating policies and procedures of the facility or vessel are suspect and need to be thoroughly reviewed for active and latent hazards. Allowing continued operations with only a warning validates the non-compliant attitudes.

Additionally, there are several PINCs which allow a warning for missing or non-existent records of inspections, i.e.

> "I-152 ARE WRITTEN REPORTS CONFIRMING ADEQUACY OF REPAIRS OR ALTERATIONS IN ACCORDANCE WITH API RP 2D. Issue a warning (W) INC if written reports confirming the

> adequacy of repairs or alterations are not immediately available or are not maintained for a period of 4 years."

BSEE should consider reviewing the enforcement action related to I-152 and evaluate if "unavailable records" should warrant a more aggressive enforcement action than a warning. If an operator is not keeping records of inspections they are more than likely not conducting inspections. If an operator is not conduction inspections then they are unsafe to operate.

The current lifting PINCs may fall into the category of "compliance mentality." This phrase was used by the Committee on Alternatives for Inspection of Outer Continental Shelf Operations (Committee), National Research Council in their 1990 report: Alternatives for Inspecting Outer Continental Shelf Operations.[5] In the report the Committee emphasized that "compliance does not equal safety." The Committee explained that:

> "[t]he compliance mentality essentially is an abandonment of responsibility and judgment on the part of the operator and the passing of that responsibility to the regulating agency and its inspectors…In much the same way, an inspector may fail to look for blatant safety problems because he has come to believe that, "My job is only to verify that all items on the checklist are OK. As long as I've done that job well, I can't be criticized if something goes wrong."

Further evidence of the "compliance mentality" fostered by the PINC's is found in representative accident/incidents reports published on the BSEE website, District Investigation Reports:

> On 12/17/13 the lessee did not perform all operations in safe and workmanlike manner. An accident occurred that could have resulted in loss of life. A Spartan Offshore employee fell approximately 55 feet from the Texas Deck to the production platform below. BSEE investigators found the following during the investigation. 1) Grating on the Texas Deck was not secured at the time of the incident. 2) Injured employee was not introduced into the JSA. 3) Injured employee did not utilize fall protection properly. 4) Injured person did not have "Fall Protection Including Rescue Planning (OSHA 1926.500) and/or SPRAT Training" as stated in Spartan Offshore training matrix.

Appropriate INCs were issued but no recommendations for long-term corrective actions were made to the operator or the Agency.

> On October 23, 2013…when the second joint of casing emerged from the well and cleared the top of the work basket on the casing jacks, the dead man pad eye for the main hoist line ripped out of the right cord of the crane boom to which it had been welded. The main hoist block, weight indicator and the 1.5" two-part sling in use fell from the boom and was left suspended from the top of the casing to which it was attached…The static load limit was utilized from the load chart rather than the dynamic limit. At 27,000 lbs. of pull, the dynamic limit of 19,710 lbs.

[5] The Committee on Alternatives for Inspection of Outer Continental Shelf Operations National Research Council. Alternatives for Inspecting Outer Continental Shelf Operations (1990). Retrieved from NAP.EDU: http://www.nap.edu/catalog/1517.html. (November 17, 2014).

was exceeded by 7,290 lbs. when initially attempting to free the casing from the well. The installation of the failed dead man pad eye for the main hoist line was performed without an installation procedure, welding procedure, engineered drawing of the pad eye, NDT procedure or any type of approval or guidance from the original manufacturer of the crane, crane service company, or engineer. The incorrect installation of the pad eye led to it being pulled from the crane boom cord.

Again, appropriate INCs were issued without operator or Agency recommendations.

BSEE should review both scenarios and determine why accident investigators would not express greater concern when a fatality incident was narrowly avoided in one instance and a crane's dynamic limit was exceeded by 36% in the other. The stored energy in the crane's boom and cable could have been suddenly released with catastrophic consequences.

The Committee made several recommendations in its 1990 report, two of which are appropriate to this discussion of PINCs:

- …that MMS place its primary emphasis on detection of potential accident-producing situations—particularly those involving human factors, operational procedures, and modifications of equipment and facilities—rather than scattered instances of non-compliance with hardware specifications. ..
- …that MMS encourage its inspectors to uncover emerging kinds of safety risks and changing risks on OCS facilities. The position description, job assignments, and reward structure for MMS inspectors should be modified to reflect the importance of uncovering and reporting safety risks.

The Committee further explained that "[t]he hardware-oriented PINCs seemingly are not tied closely to current accident experience-this observation does not imply that fatalities have not been averted as a result of these PINCs being enforced—rather it is meant to suggest that the safety-enhancement limits of a hardware oriented inspection program are being reached." These observations were made more than fourteen years ago. The PINCs appear to have changed little since the Committee's 1990 report.

5.1.2 Conclusion and Recommendations

The analysis of the current PINC-based inspection program indicates that it relies heavily on a "rote" level of compliance with individualized requirements. The tools provided inspectors are simple restatements of proscriptive and prescriptive regulations and standards incorporated by reference without a clear, comprehensive goal. The sanction guidance in the PINC also needs to be reviewed for consistency with the hazard identified and associated potential consequences.

The current PINCs and sanctions are a "hardware oriented inspection program" and evidence of the "compliance mentality", that was described in the Committee on Alternatives for Inspection of Outer Continental Shelf Operations 1990 report.

The conclusion of this analysis is that the assessment and recommendations of the Committee are still valid. BSEE should:

- Place its primary emphasis on detection of potential accident-producing situations—particularly those involving human factors, operational procedures, and modifications of equipment and facilities—rather than scattered instances of non-compliance with hardware specifications;
- Encourage its inspectors to uncover emerging kinds of safety risks and changing risks on OCS facilities. The position description, job assignments, and reward structure for MMS inspectors should be modified to reflect the importance of uncovering and reporting safety risks.
- Subject all safety of life or high consequence near-miss incidents to a through root case analysis (RCA) that incorporates human factors to generate long-term corrective actions for the industry.

The following recommendations for modifications to the lifting PINCs are provided for BSEE's consideration and intended to improve the oversight of lifting operations on the OCS.

- BSEE should rephrase the PINC questions to emphasize an operator's responsibility to comply with 30 CFR 250.198 and 30 CFR 250.1902(c).
- For a number of the PINCs, BSEE should require an operator produce documentation and demonstrate proficiency in locating information related to his or her duties and responsibilities. Next, the inspector should evaluate it against applicable standards and practices

5.1.3 Updated PINCs

The study team provided recommendations for BSEE's consideration for updating the existing lifting PINCs. The recommendations were circulated amongst internal BSEE stakeholders for feedback. The project team updated the PINCs based on the final direction recommended by the BSEE project sponsors. Changes and modifications to existing lifting PINCs are highlighted and displayed in track changes below. PINCs are provided in Appendix A and will serve as the interim lifting PINCs during a transition from the "As-Is" to the "To-Be" structure.

5.2 Analysis of INCs and OIRs

The objective of this effort was to analyze failure event data to identify trends and key issues that could be addressed in the development of an improved offshore crane and material handling equipment inspection program. This following analysis summarizes the data provided by BSEE.

The scope of this effort included the analysis of PINC, Incidents of Noncompliance (INC), and Offshore Incident Reports (OIR) data as recorded by BSEE over varying periods of time (2004 – 2014).

This analysis involved the review and trending of 846 Incidents for a nominal 5-year time period (i.e., 2009 through 2013) of operations in the GOM Region and Pacific Regions. The analysis focused on sorting and trending the data to identify the failure event trends based on:

- Failure cause
- Incident type
- Lifting Device Failure
- Type of Lift
- Type of facility

- Activity at time of the incident
- Location of the incident
- Contributing Factor to Failure

The analysis results presented in based on the following assumptions:

- The raw failure event data provided by the BSEE were assumed to be accurate and complete.
- This analysis is limited to the data provided by BSEE.
- The Offshore Incidents Reports (OIRs) did not provide sufficient data for analysis and was included from the analysis.

5.2.1 Results

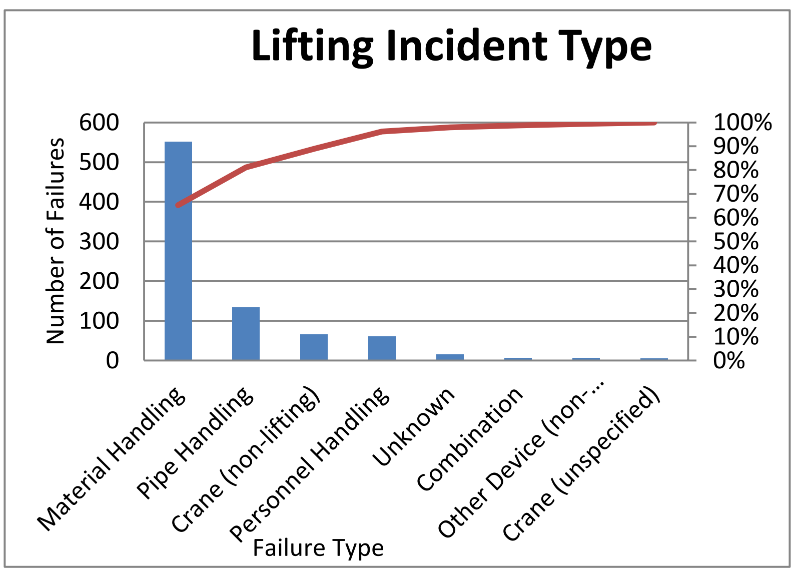
This summary provides an overall view of the dominant failures and failure modes for the cranes and material handling equipment operating in the GOM Region and Pacific Regions. These results are based on the number of recorded incidents and corresponding failure modes included in the BSEE provided data.

Lifting Incident Type

Table 12 provides summary of the lifting incident type based on the categories as provided by the BSEE. Crane non-lifting incidents refer to incidents while the crane was either not engaged in an actual lift such as repositioning or the incident defect was discovered during inspection or maintenance. The majority of the incidents occurred during material handling, followed by pipe handling, and crane (non-lifting)." Non-lifting incident are those that occurred while the crane or material handling equipment was not involved in a lifting evolution, such as when repositioning the boom for maintenance. Also it is evident from the data that there was significant reduction in the incidents during period 2010 which is attributed to the OCS drilling moratorium. After a short decrease in the incident rate, the rate rapidly increased to pre-moratorium levels.

Table 12: Lifting Incident Type

Equipment Type	2009	2010	2011	2012	2013
Crane (non-lifting)	18	7	18	11	12
Material Handling	138	82	81	113	137
Personnel Handling	18	8	10	12	13
Pipe Handling	32	12	20	36	34
Combination	0	0	6	0	0
Other Device (non-lifting)	0	0	1	1	4
Crane (unspecified)	0	0	3	0	2
Unknown	0	0	1	7	7
Total	**206**	**109**	**140**	**180**	**209**



Failure Cause

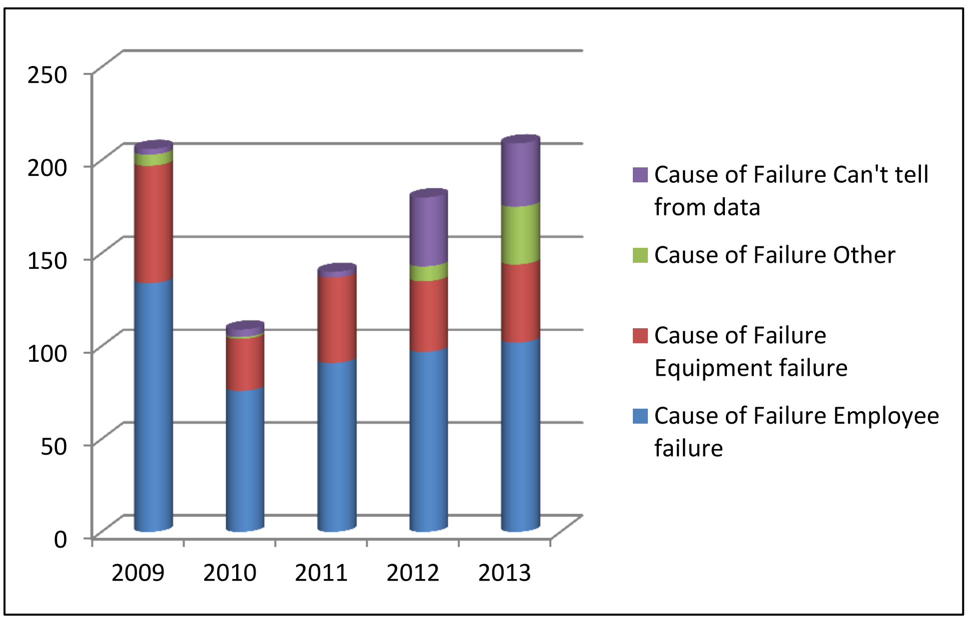
Table 13 provides summary of the failure causes that contributed to the crane incident. As evident from the data, employee failure was the main cause of the incidents from year 2009 to 2013.

The bulk cause of the lifting failures is classified as either "employee failure" or as undetermined. Since the categories of failure are undefined, we assume that "employee failure" is either an intentional or unintentional human error or a routine or exceptional violation of the operator's material handling safety policies or procedures. This would be expected since between 60 and 80 percent of these kinds of incidents are related to human error. However, the data is not classified in a way that lends itself to any meaningful analysis of human error.

Conversely, a large fraction of the data could not be classified due to a lack of specificity or taxonomy in the collection.

Table 13: Failure Cause

Failure Cause	2009	2010	2011	2012	2013
Employee failure	134	76	91	97	102
Equipment failure	63	28	46	38	42
Other	6	1	0	8	31
Unknown	3	4	3	37	34

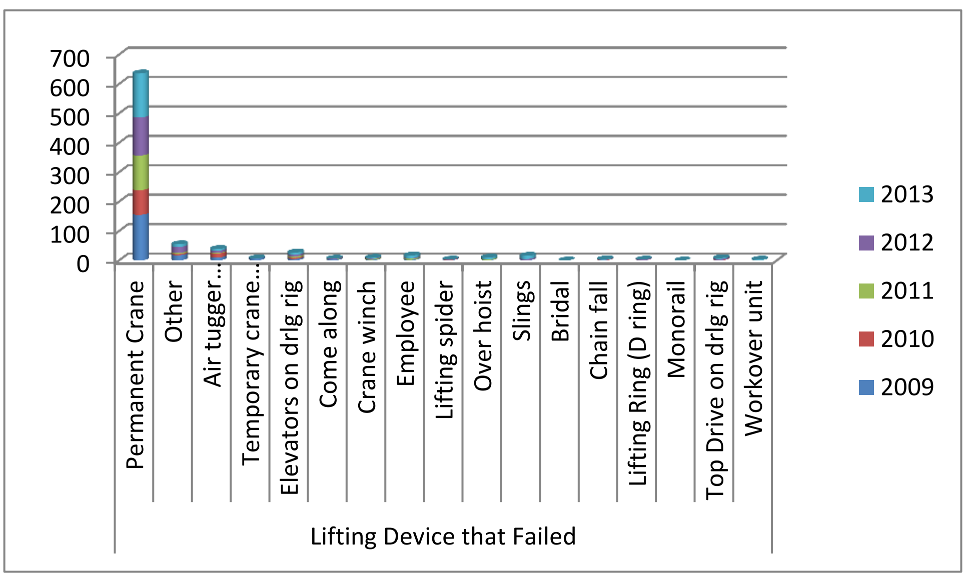


Failed Lifting Device

Table 14 summarizes the incident type based on the lifting device involved. The "permanent crane" category had the highest number of associated incidents. The data analysis is confounded by the inclusion of "employee" as a lifting device.

Table 14: Lifting Device that Failed

Failed Lifting Device					
Permanent Crane	155	84	118	129	150
Other (Unspecified)	18	4	4	20	9
Air Tugger (construction)	10	14	2	7	6
Temporary crane (leap frog)	7	0	0	0	0
Elevators on Drilling Rig	5	4	5	5	8
Come-Along	3	0	1	2	0
Crane Winch	2	0	3	2	2
Employee	2	0	4	2	9
Lifting Spider	1	1	0	1	0
Over Hoist	1	0	3	0	6
Slings	1	0	0	4	11
Bridal	0	0	0	0	0
Chain fall	0	1	0	1	2
Lifting Ring (D Ring)	0	0	0	3	0
Monorail	0	0	0	0	0
Top Drive on Drilling Rig	0	1	0	4	3
Workover Unit	0	0	0	0	3

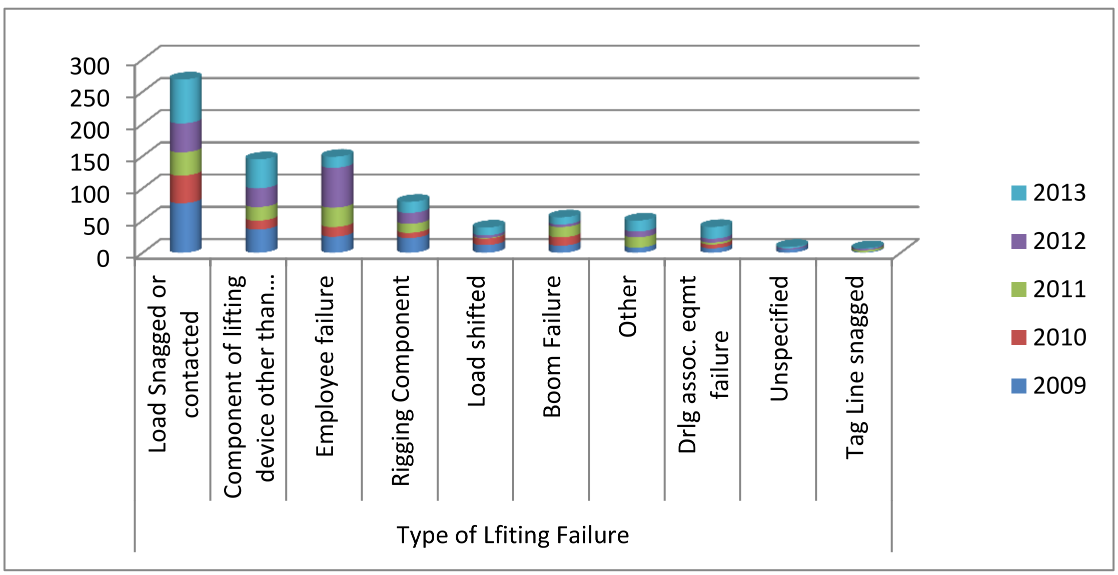


Lifting Failure Type

Table 15 illustrates incident data based on the type of lifting failure. "Load snagged or contacted" was the most prevalent factor contributing to crane incidents, followed by "Employee Failure." Here also, the data analysis is confused by the inclusion of employee failure as a causal factor alongside other mechanical equipment.

Table 15: Type of Lifting Failure

Lifting Failure	2009	2010	2011	2012	2013
Load Snagged or Contacted	77	43	36	45	68
Component of lifting device other than boom (i.e. hoist, wire, etc.)	36	14	21	29	45
Employee Failure	25	15	30	62	17
Rigging Component	23	8	14	17	17
Load Shifted	12	10	1	4	12
Boom Failure	11	13	16	4	11
Other	8	0	16	9	17
Drilling Associated Equipment Failure	7	6	3	6	18
Unspecified	5	0	0	2	2
Tag Line Snagged	1	0	3	2	1

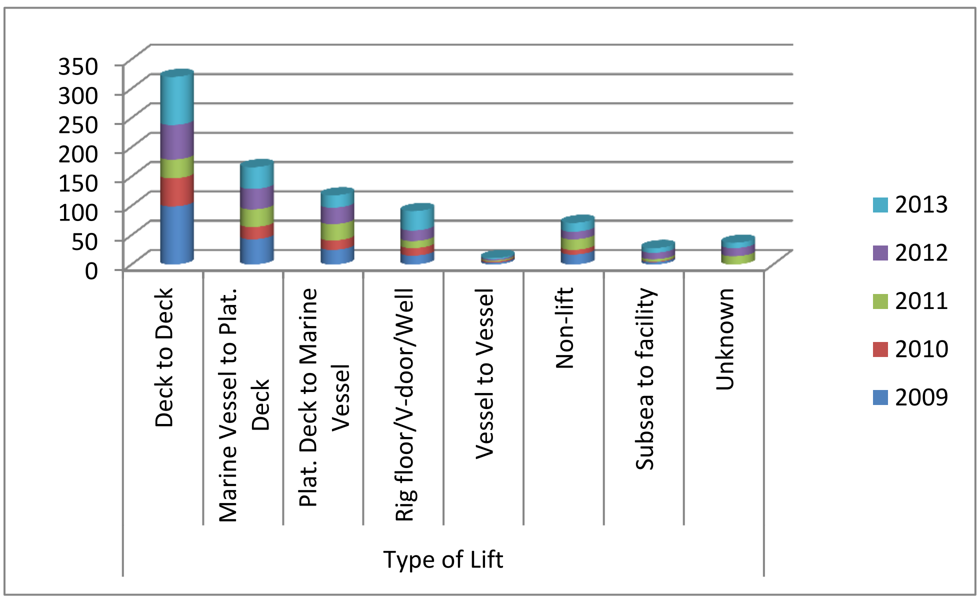


Lift Type

"Deck to Deck" operations accounted for the majority of crane incidents, according to data, as illustrated by **Table 16**. This generally results from conducting critical lifts such as blind lifts from one laydown area on the platform to another laydown area on the platform or picking or landing a load in a congested area. Non-lifting events include events that caused a failure or incident when the equipment was not actually engaged in a lift or the damage was discovered during inspection or maintenance.

Table 16: Type of Lift

Lift Type	2009	2010	2011	2012	2013
Deck to Deck	99	48	32	59	82
Marine Vessel to Platform Deck	43	21	30	35	37
Plat. Deck to Marine Vessel	25	16	28	28	21
Rig floor/V-door/Well	15	13	12	18	33
Vessel to Vessel	3	2	2	2	2
Non-Lift	17	8	18	13	15
Subsea to Facility	4	1	4	11	8
Unknown	0	0	14	14	9

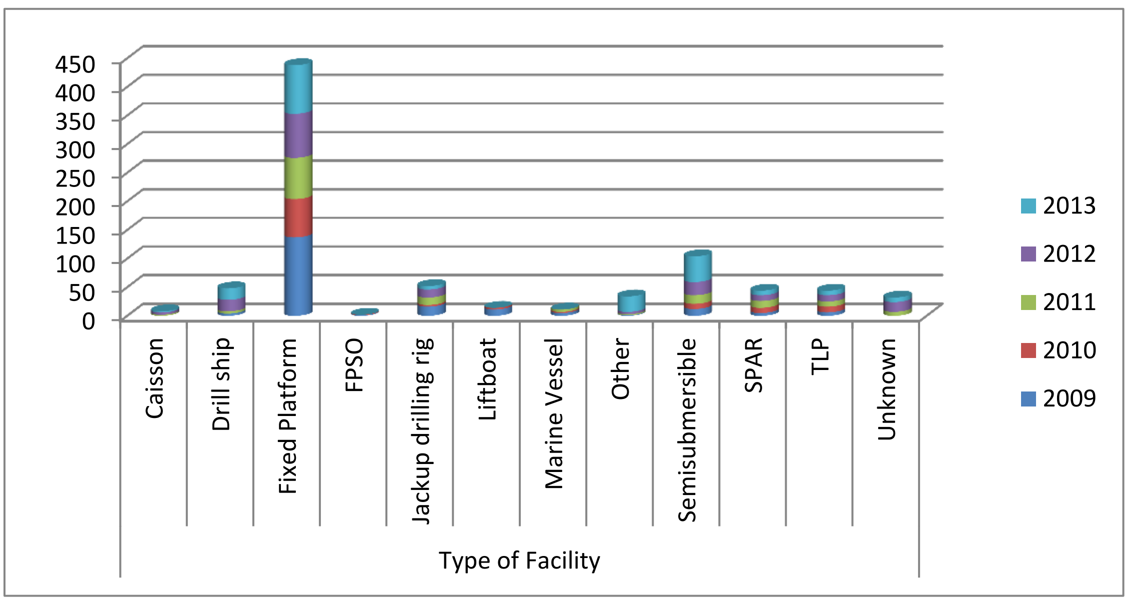


Facility Type

The vast majority of crane incidents on the OCS occurred on fixed platforms, as shown in **Table 17**. This would be noteworthy since fixed platforms are the most stable of offshore facilities and not subject to dynamic loading due to facility motion in a seaway. The data are interpreted to be a skew due to relative population sizes between fixed and floating facilities.

Table 17: Type of Facility

Facility Type	2009	2010	2011	2012	2013
Caisson	0	0	2	4	2
Drill Ship	4	0	4	20	20
Fixed Platform	137	67	72	77	85
FPSO	1	1	0	0	0
Jackup MODU	16	3	13	14	6
Liftboat	11	3	0	0	0
Marine Vessel	5	2	4	0	0
Other	1	0	2	4	27
Semisubmersible MODU	12	9	15	23	45
SPAR	5	9	12	10	8
TLP	6	10	9	11	8
Unknown	0	0	7	17	8

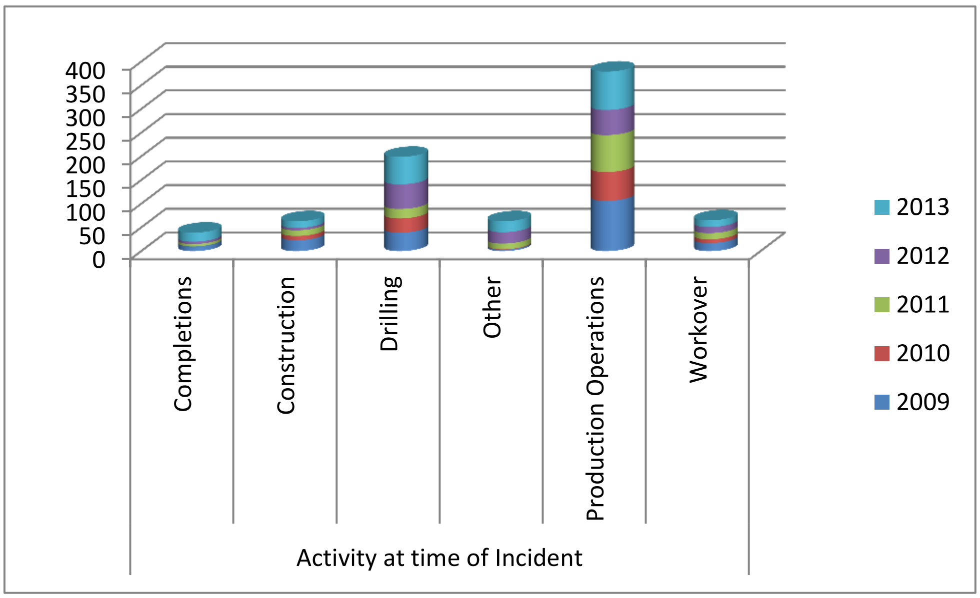


Activity Type

As the majority of lifting operations are conducted in support of drilling and production operations, the data shown in **Table 18** supports a finding that a majority of crane and material handling incidents occurred during production operations.

Table 18: Activity at Time of Incident

Activity Type	2009	2010	2011	2012	2013
Completions	10	0	5	5	19
Construction	23	9	12	5	14
Drilling	39	30	20	52	58
Other	3	1	12	24	23
Production Operations	106	61	78	53	81
Workover	17	8	13	13	14

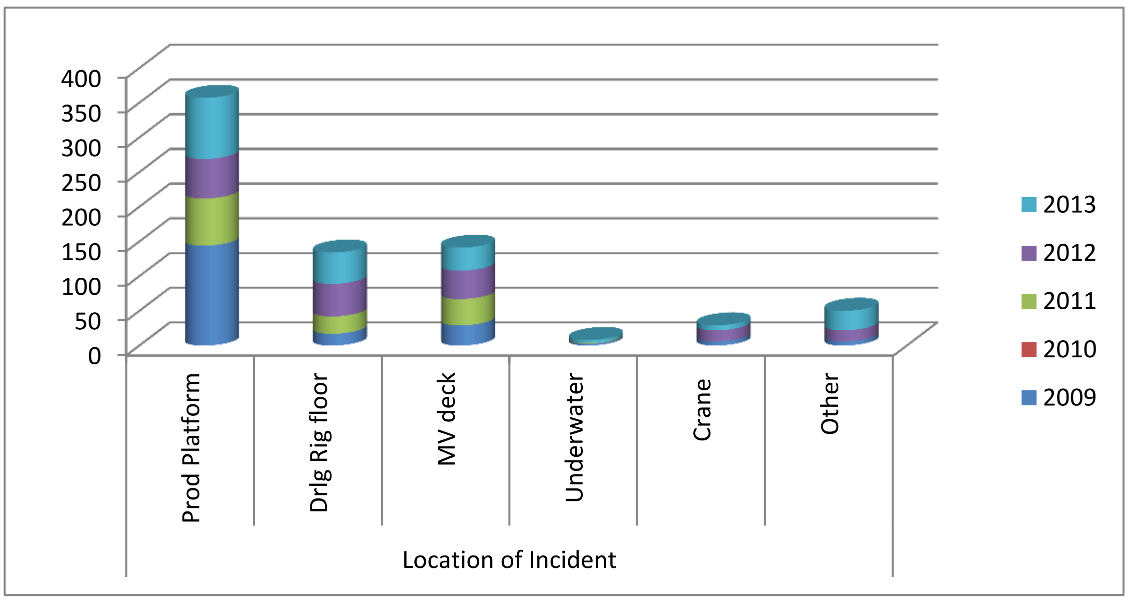


Incident Location

Table 19 shows the locations of the incidents. The high percentage of incidents on the production platform is expected due to population skew. The percentage of drill rig floor and MV deck incidents are interpreted to be due to high congestion and vessel motion, respectively.

Table 19: Location of Incident

Incident Location	2009	2010	2011	2012	2013
Production Platform	144	0	68	57	88
Drilling Rig Floor	17	0	25	47	45
MV Deck	29	0	38	41	33
Underwater	3	0	1	0	4
Crane	6	0	0	16	7
Other	6	0	0	16	28
Unknown	0	0	0	0	0

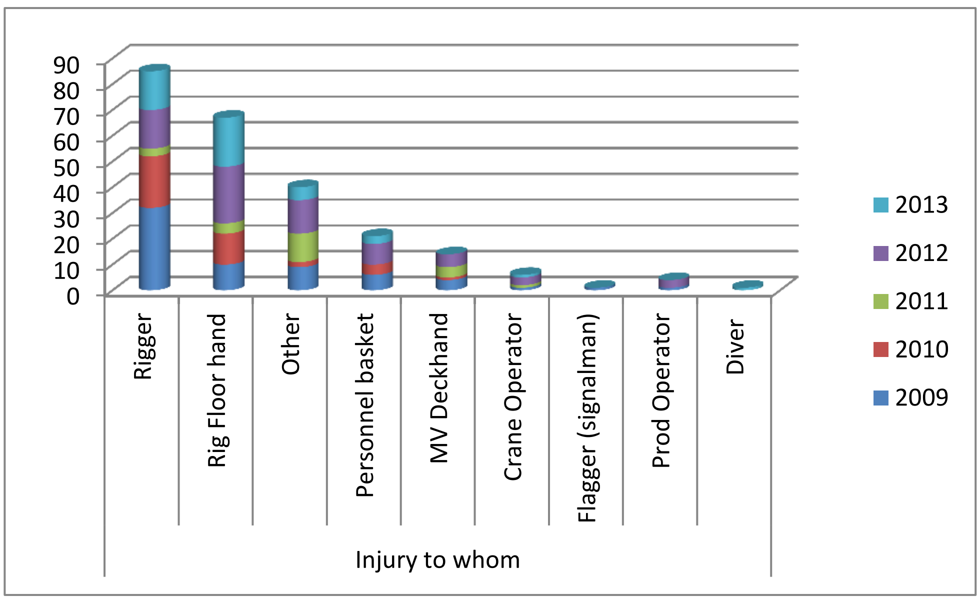


Employees Injured

Table 20 indicates that Riggers and Rig Floor Hands experienced most of the injuries associated with lifting incidents. It is expected that these two categories of workers would be involved in the most incidents since they have the most temporal and spatial exposure to lifting equipment and operation. Mention is made of the number of personnel injured during lifting operations involving the personnel basket transfers.

Table 20: Injury to Whom

Employee Type	2009	2010	2011	2012	2013
Rigger	32	20	3	15	15
Rig Floor Hand	10	12	4	22	19
Other	9	2	11	13	5
Personnel Basket	6	4	0	8	3
MV Deckhand	4	1	4	5	0
Crane Operator	1	0	1	3	1
Flagger (Signalman)	1	0	0	0	0
Production Operator	1	0	0	3	0
Diver	0	0	0	0	1

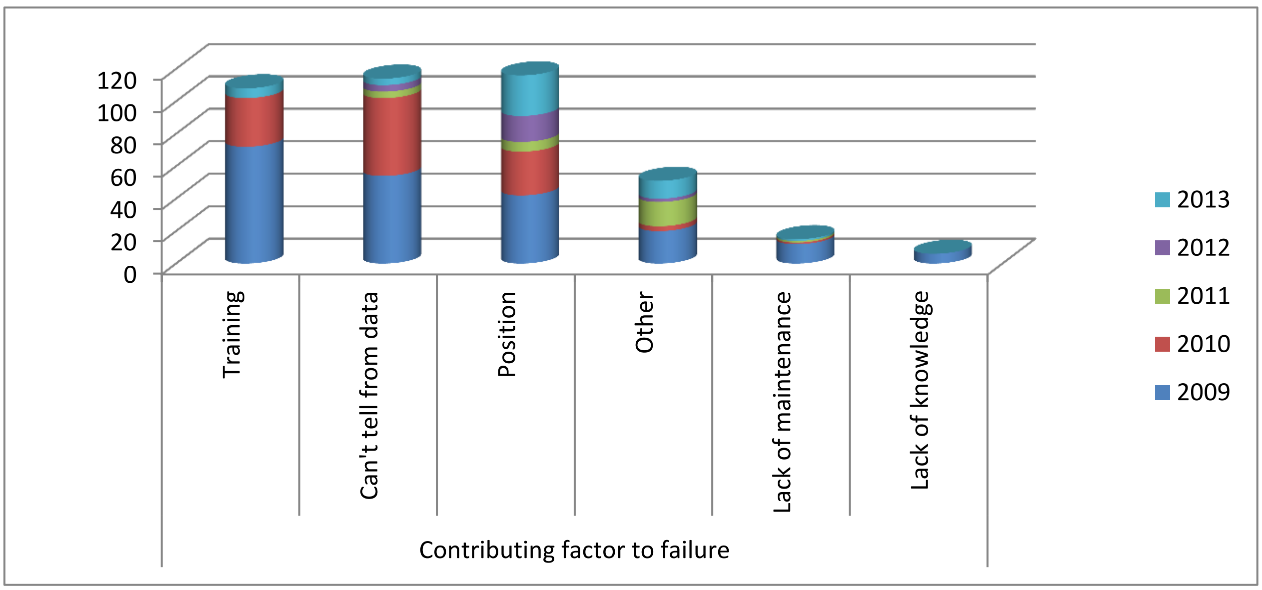


Contributing Failure

Table 21 shows the contributing factor to lifting failure. The three major contributors to lifting failures in descending order were (1) Position, (2) Can't Tell from Data and (3) Training. In addition, a significant number of the incidents (51) were attributable to "Other." Any inferences or trends drawn from this data are uncertain due to the significant number of contributing factors that are undefined or unidentified.

Table 21: Contributing Factor to Failure

	2009	2010	2011	2012	2013
Training	72	30	0	0	6
Can't Tell from Data	54	48	4	4	4
Position	42	27	6	16	25
Other	20	3	15	2	11
Lack of Maintenance	12	1	1	0	1
Lack of Knowledge	6	0	0	0	0



5.2.2 Conclusion and Recommendations

INC data provided by BSEE provided basic numerical information concerning involved mechanical components, generic operating parameters, and location. However, the data are not organized in any systematic way which would lend itself to reliable analysis. All categories and taxonomies of data are those supplied by BSEE. It was not possible to determine what many of these taxonomies included in the data. Thus, gaps in the data identified by categories such as "other", "lack of maintenance", "employee failure", "unspecified", and "unknown", undermine the credibility of any inferences or trends. For example, "employee failure", "training" and "lack of knowledge" are all human-centric contributing factors; but lack of knowledge could be the result of improper or incomplete training. For example:

- How is employee failure defined?
- Was the failure a mistaken application of an acquired psychomotor skill or the correct accomplishment of an incorrect procedure?
- In what type supervisory environment did the failure occur?
- Was the procedure involved established or ad hoc or were the operators freelancing?
- In what operational environment did the failure occur?
- Was there an actual or implied pressure from upper management to meet an operational deadline or goal?

Incident data must to be collected with the goal of identifying undesirable circumstances and behaviors, which can then be targeted by strategies to mitigate future occurrences. The data provided by BSEE appears to be collected without any strategic goal other than to document incidents that have occurred on the OCS. There is no unified or cohesive taxonomy which would allow analysis to predict where inspection and enforcement mitigation efforts should be applied. Therefore, it is difficult or impossible to conclude any definitive findings or produce recommendations from the data set provided. Offshore Incident Reports (OIR) were even more generic and provided little detail so they were excluded from the data.

BSEE data collection should be organized with a taxonomy that classifies the incidents in a way that allows comprehensive data analysis. This analysis can then be used to guide and increase the efficiency of regulatory surveillance efforts. INC data can be customized to the desired end state and data collection effort. This facet of data collection must be aimed at accumulating "leading indicators" that could point to active and latent hazards, which could then be targeted for elimination or mitigation. Leading indicators identify hazards and deficiencies before they achieve negative results. Examples of leading indicators would be:

- Interval between mishap/incident and final report
- Number of incident report recommendations actually implemented
- Number of supervisory/management personnel with formal incident investigation training
- Number of supervisory/management personnel with formal human error prevention training

- Overtime ratios
- Near miss reports
- Span of control ratios
- JSA's spot checked by Safety Personnel
- Policy and procedural review intervals

It is recommended that BSEE adopt the root cause analysis (RCA) methodology promulgated in ABS Guidance Notes on the Investigation of Marine Incidents. This incident methodology provides an effective and efficient approach for investigating marine incidents of any magnitude, including offshore material handling and crane operations. It provides a technique that will guide BSEE investigators in identifying, documenting, classifying and trending the causes of mishaps (incidents and accidents) and allow analysis as to whether the mishap is related to safety, the environment, human error, or mechanical failure. The data collection process and storage is easily adapted to this methodology through its numeric coding of causal factors and root causes of the mishap. This numeric coding can then be easily analyzed to guide regulatory surveillance efforts.

6 Analysis of Industry Standards

The study team analyzed lifting standards, inspection methodologies and strategies to identify best practices and provide recommendations for BSEE's consideration in the incorporation of these practices into an inspection strategy. The following sections summarize the analysis and results.

6.1 Domestic and International Inspection Methodologies

The study team evaluated other inspection methodologies being applied domestically and internationally on cranes and material handling equipment. The objective was to compare the procedures and guidance of existing crane inspection methodologies with the PINC methodology. The comparison validates the PINC methodology and informs future improvements.

6.1.1 Comparison of Existing Inspection Methodologies

There is a long list of manufacturers that design and build lifting equipment for installation and use offshore. There is an impressive array of crane types, configurations and capabilities. Many cranes have been in operation for multiple decades. The inherent complexities of crane operation and inspection require that inspectors have a broad scope of technical knowledge and operational experience to effectively employ any inspection methodology that purports to assess compliance with offshore regulations and standards.

Currently, BSEE inspectors employ an inspection methodology that evaluates an operator against PINC. PINCs are "checklist items which BSEE inspects to pursue safe operations on the OCS. This list of inspection items is derived from all regulations for safety and environmental standards."

PINC as a Baseline for Comparisons

PINC specific to offshore cranes are coded as "I-1xx." Each numbered PINC consists of a single question or challenge that targets a specific standard or criteria, i.e. API RP 2D, PARAGRAPH 3.1.5a. Included in the PINC is a regulatory reference, level of sanction and inspection procedure. An example of a crane-specific PINC is displayed below.

I-144 **HAVE MONTHLY INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE OPERATOR/INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.3 AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS?**

Authority: 30 CFR 250.108 Enforcement Action: W/C

Note:

1. Applies to Heavy Usage Category cranes. An Operator's failure to document usage category will cause the crane to default to the Heavy Usage category. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2b.
2. Reference Appendix 24 for definition of "Monthly" and description of "Usage Category."

INSPECTION PROCEDURES:

Verify that:

1. Monthly inspections are performed by qualified personnel.
2. Verify that records are readily available and are maintained for a period of 4 years.
3. Verify that records include date and time of inspection and name/initial of person performing the inspection.

IF NONCOMPLIANCE EXISTS:

Issue a warning (W) INC if records indicate that monthly inspection was missed or did not occur on schedule, but the most recent monthly inspection was completed.

Issue a component shut-in (C) INC if:

1. Records of monthly inspections are not available or are not maintained for a period of 4 years.
2. Records do not indicate that a monthly inspection has been performed.
3. The monthly inspection currently due has not been performed.

INSPECTION COUNT/ INC

Enter one item checked/ issue one INC for each crane inspected.

Figure 7: Sample I PINC

This inspection method has several important elements:

- Objectivity: Each PINC targets a specific, published and authoritative standard which is known or available to the entity being inspected.
- Procedural Standardization: Each PINC includes appropriate procedural guidance to promote predictability and standardization across the inspector cadre.

- Sanction Guidance: The PINC provide appropriate sanctions for non-compliance, as well as the conditions under which non-compliance will be assessed. This feature benefits all parties by removing guesswork and the subjectivity inherent in human interpretation.

For purposes of analyzing and comparing other inspection methodologies, the current PINC system is a natural template. To be comparable, an inspection method needs to possess at least those elements that comprise the PINC, i.e. published standard, specific procedural guidance, conditions of non-compliance, means of enforcement and exact character of sanction. For this discussion, a "methodology" needs to tell an inspector what to do, and how and when to do it. Simply listing technical criteria falls short of the utility needed by BSEE personnel. These utilitarian features are even more critical if BSEE anticipates delegating inspection authority to non-governmental third parties.

Comparisons to PINC

The task order identifies several "inspection methodologies" that are may be applied domestically and internationally on cranes and material handling equipment:

- IADC Crane Inspection and Maintenance Program
- API RP 2D Crane Inspectors Training Course
- International Association of Oil and Gas Producers (OGP), Lifting & Hoisting Crane Safety Recommended Practice
- DNV-Recommended Practice-DET Norske Veritas DNV Standard Certification 2.22, Lifting Appliance, October 2011
- American Bureau of Shipping (ABS), Guidelines for certification of Lifting Appliances, JULY 2007 (Updated October 2013)
- Offshore Cranes and Lifting Appliances International & European maritime Legislation and Standardization with special emphasis on the Norwegian petroleum activities sector 3rd Edition, December 2011.

In addition, two ISO standards were reviewed:

- ISO 23814:2009, Competency Requirements for Crane Inspectors
- ISO 17020:2012, Requirements for the Operations of Various Types of Bodies Performing Inspections

When evaluated against the PINC characteristics listed above, none of the documents or publications identified can be considered as "methodologies," per se. The distinction is not merely semantic; it is drawn along functional lines. BSEE's current PINC approach provides a single source of tools that a qualified inspector can take to an offshore facility and efficiently evaluate and document the compliance state of an operator. The publications listed in the task order do not reach the minimum level of utility required for this analysis. The reasons for this determination are discussed below.

- API RP 2D Crane Inspectors Training Course – The course is not a complete inspection methodology. It is a training course, offered by multiple commercial training providers which results in a certification that the participant has met the requirements of API RP 2D for qualified inspector or authorized surveyor. An Internet search of training providers advertising this specific training yielded a sampling of the offerings available to industry:

  - JCD Training (http://www.jcdtraining.com)
  - Alford Safety Services, (www.alfordservices.com)
  - Energy Cranes, (www.energycranes.com)
  - Chevron Employee Resource & Training Center, (www.chevron.com)
  - Global Training & Environmental, (www.globaltraining.com)
  - PTTCO Ltd. (www.pttco.org)
  - Seatrax Inc. (www.seatrax.com)
  - Sparrows Offshore, (www.sparrows.biz)
- IADC Crane Inspection and Maintenance Program – This program is not an inspection methodology. It refers to a body of training courses endorsed by the International Association of Drilling Contractors (IADC). The IADC provides accreditation to training providers who demonstrate compliance with the IADC curriculum requirements for courses that lead to operator and inspector certification. The Drilling Industry Training Accreditation Systems (DIT) offers a variety of accreditation opportunities for training institutions, providers and programs.
- International Association of Oil and Gas Producers (OGP), Lifting & Hoisting Crane Safety Recommended Practice – This document does not put forth an inspection methodology. It describes lifting and hoisting safety elements to be incorporated into a management system that is consistent with the OGP Guidelines for the development and application of a health, safety and environmental management systems (OGP Report 210). This information would be valuable in an operator's crane operation manual, Safety and Environmental Management System (SEMS) or similar document. It could serve as a reference or companion publication imbedded in an inspectors training and reference material.
- DNV-Recommended Practice – DET Norske Veritas DNV Standard Certification 2.22, Lifting Appliance, October 2011 – This document is not an inspection methodology. It provides criteria and guidance for certification and verification of the design, materials, fabrication, installation, testing and commissioning of lifting appliances. Appropriate elements of this publication could be included in the criteria and specifications a qualified inspector or surveyor could use to determine the status of a crane with respect to its original design. The document is most properly employed during the initial certification and classification of the appliance. It may also be a reference document for on-site inspectors when technical data are required. The information might be useful if a BSEE or third party inspector needed to verify the specifications to which an appliance had been certified or classed.
- American Bureau of Shipping (ABS), Guidelines for Certification of Lifting Appliances, JULY 2007 (Updated October 2013) – The guidelines contains provisions for the certification of lifting appliances installed aboard vessels and/or offshore floating/fixed structures. It is not, per se, an inspection methodology in the sense that it could be used, as is, by an on-site inspector. It is more properly a companion document to API RP 2D and API Specification 2C. It could also serve as a reference publication imbedded in an inspector's training and reference material. Offshore Cranes and Lifting Appliances International & European Maritime Legislation and Standardization with Special Emphasis on the Norwegian Petroleum Activities Sector 3rd Edition, December 2011 – This document is not an inspection methodology, standard or regulation. It is

a compendium and synopsis of international offshore regulatory bodies and associated regulations and contact points.

- ISO 23814 – The standard contains five sections and two annexes, A and B, which cover recommended crane inspector categories and criteria for technical knowledge. The standard relies heavily on other referenced standards and guidelines. The emphasis of ISO 23814 is inspection organization independence, impartiality, and integrity, as well as technical knowledge, experience requirements, and techniques for crane inspection. The technique section specifies training of crane inspectors. The conclusions reached in the analysis of API 2C and 2D was that although ISO 23814 provides some helpful insights, it does not provide a significant additional value beyond the usefulness of API Spec 2C and API RP 2D, used in tandem.
- ISO 17020 – The standard layouts the general requirements for the operation of various types of bodies performing inspection. This document does not offer a complete inspection methodology. Application of this standard promotes confidence in the entities performing inspections. Although this standard does not target offshore crane inspections, it has features that BSEE might incorporate into its own inspection processes.

Z-PINC compared to CG 5432

The US Coast Guard also has regulatory responsibilities on fixed offshore facilities that relate to safety of life at sea (SOLAS). CG Form 5432, FIXED OCS FACILITY INSPECTION REPORT, documents the results of inspections conducted to determine compliance with applicable maritime regulations. In 1988, the USCG promulgated self-inspection regulations to shift the burden for conducting the annual inspection of the USCG-regulated items on each OCS platform to the owners and operators, and required them to document their inspections on Form CG 5432.

Via a Memorandum of Understanding (MOU), dated 27 November 2012, and Memorandum of Agreement (MOA) OCS-09, dated 19 September 2014, BSEE inspectors cover USCG SOLAS responsibilities using Z-PINC. A representative Z-PINC is displayed below.

Z-110 IS EYEWASH EQUIPMENT IMMEDIATELY AVAILABLE NEAR THE DRILL FLOOR,

MUDROOM, AND OTHER AREAS WHERE THERE IS A REASONABLE PROBABILITY THAT EYE INJURY MAY OCCUR?

Authority: 33 CFR 142.4 Enforcement Action: W/C

Note:

1. Eyewash equipment must be located within 10 seconds of the hazard and on the same level.

2. The path of travel to the eyewash equipment must be unobstructed.

INSPECTION PROCEDURE:

1. Verify that operable portable or fixed eyewash equipment is located in required areas on all manned fixed platforms.

2. Verify that required eyewash equipment is adequately maintained.

3. Verify that personnel are knowledgeable of the location, purpose, and operation of the eyewash equipment.

IF NONCOMPLIANCE EXISTS:

Issue a warning (W) INC if:

1. Portable or fixed eyewash equipment is not immediately available near the drill floor, mudroom, and other areas where there is a reasonable probability that eye injury may occur.

2. Personnel working in the area are not knowledgeable of the location, purpose, and operation of the eyewash equipment.

3. Eyewash equipment is not adequately maintained.

Issue a component shut-in (C) INC for the operation if present during an operation in which eye injury may occur and portable or fixed eyewash equipment is not immediately available and/or operable.

INSPECTION COUNT/ INC

Enter one item checked/ issue one INC for each platform inspected.

Figure 8: Sample Z PINC

The Z-PINC mirrors the requirements of CG Form 5432, FIXED OCS FACILITY INSPECTION REPORT. On closer analysis, the Z-PINC appear to be more “inspector friendly” than CG Form 5432 in that they provide more specific guidance on how to evaluate compliance and rely less on inspector knowledge of specific regulatory technicalities. Form CG 5432 is reproduced below.

U.S. DEPARTMENT OF HOMELAND SECURITY U.S. COAST GUARD CG-5432 (REV. 06/04)	**FIXED OCS FACILITY INSPECTION REPORT** *(INSTRUCTIONS ON REVERSE)*	OMB NUMBER 1625-0044

Facility Name ______	Manned ____ Unmanned ____	Number of Persons on Board ______
OCS Area/Block ____ MMS Lease No.____	Operator(s) ______	Owner(s) ______
Person in Charge ______	Name and Address ______	Name and Address ______
Facility Telephone ______	______	______

INSPECTION ITEMS-ALL FACILITIES	Def.	Cor.	Out
1. Workplace Safety 33 CFR PART 142			
2. Rails/Guards/Grating 33 CFR 143.110			
3. Personnel Landings 33 CFR 143.105			
4. Means of Escape 33 CFR 143.101			
primary-			
secondary-			
5. Helo Deck Perimeter 33 CFR 143.110			
6. Lights/Warning Devices 33 CFR 143.15			
7. Firefighting Equip 33 CFR 145:			
portable__________-			
semi-portable_________-			
fixed____________-			
location-			
size-			
agent-			
INSPECTION ITEMS-UNMANNED FACILITIES			
8. Lifesaving Equipment 33 CFR 144.10-1			
9. Other Lifesaving Equipment 33 CFR 144.10	(See Instructions)		
INSPECTION ITEMS-MANNED FACILITIES			
10. Emer. Comms. Equip. 33 CFR 144.01-40			
11. Station Bill 33 CFR 146.130			
12. Emergency Drills 33 CFR 146.125			
conducted monthly-			
record keeping			
13. Life Preservers 33 CFR 144.01-20			
number:__________-			
equipment-			
markings-			
stowage-			
14. Work Vests 33 CFR 146.20			
number:__________-			
separate stowage-			
15. Ringbuoys 33 CFR 144.01-25			
number:__________-			
equipment-			
markings-			
stowage-			
16. General Alarm System 33 CFR 146.105			
markings 33 CFR 146.135-			
17. Manning of Survival Craft 33 CFR 146.120			
18. First Aid Kit 33 CFR 144.01-30			
19. Litter 33 CFR 144.01-35			

INSPECTION ITEM	Def.	Cor.	Out
20. Lifesaving Appliances 33 CFR Part 144			
a. Type:			
Lifefloat___ Liferaft___ Lifeboat___			
approval number__________			
location			
condition			
equipment/markings			
servicing (date __________)			
launching devices			
weight test (date __________)			
operational test (date __________)			
b. Type:			
Lifefloat___ Liferaft___ Lifeboat___			
approval number__________			
location			
condition			
equipment/markings			
servicing (date __________)			
launching devices			
weight test (date __________)			
operational test (date __________)			
c. Type:			
Lifefloat___ Liferaft___ Lifeboat___			
approval number__________			
location			
condition			
equipment/markings			
servicing (date __________)			
launching devices			
weight test (date __________)			
operational test (date __________)			
d. Type:			
Lifefloat___ Liferaft___ Lifeboat___			
approval number__________			
location			
condition			
equipment/markings			
servicing (date __________)			
launching devices			
weight test (date __________)			
operational test (date)			
21. Personnel Record Location 33 CFR 141.35			

LIST OF OUTSTANDING ITEMS/COMMENTS (Attach additional pages as necessary)

FACILITY OWNER'S OR OPERATOR'S ACKNOWLEDGEMENT

NAME	TITLE	SIGNATURE	DATE

Figure 9: CG Form 5432

6.1.2 Inspection Authority Delegated to Third Parties

Third party inspectors are currently used extensively by BSEE and USCG. In the case of BSEE, third party inspectors exercise a sub-set of inspector authority. For the USCG, third party inspectors perform the complete facility inspection required by USCG regulations.

Limited Authority for BSEE Crane Inspections

The periodic inspections required by API RP 2D for cranes are conducted and documented by non-governmental operator/facility personnel. API RP 2D defines an initial inspection and four periodic inspections that are based upon frequency of use: pre-use, monthly, quarterly and annually. The initial, quarterly and annual inspections must be conducted by a Qualified Inspector; a qualified crane operator may perform the pre-use and monthly inspections.

A Qualified Crane Operator is designated by the crane owner and should have been trained in accordance with API RP 2D, Appendix A1. Worldwide, there are many organizations that provide formalized training for Qualified Crane Operators that meet or exceed the requirements of API RP 2D.

A Qualified Inspector is designated by the crane owner and should be trained in accordance with API RP 2D, Appendix A2. Qualified Operators and Inspectors perform and document the crane inspections that are audited by BSEE personnel during facility visits. BSEE inspectors cannot be expected to maintain the proficiency required by API RP 2D on the myriad of crane types found on the OCS and therefore must rely on the competence and integrity of the qualified crane operators and inspectors who perform and document required crane inspections offshore.

Limited Authority for USCG Facility Inspections

Third party inspectors are used extensively by USCG. In accordance with 33 CFR 140.103, the USCG performs the initial inspection of a new facility to ensure compliance with safety related items under USCG purview. Subsequent inspections of USCG safety items are performed by a person designated by the facility owner/operator and documented on the Fixed Platform Self-Inspection form (Form CG-5432). The USCG verifies compliance with their annual inspection requirement via periodic on-site inspections. In support of oversight efforts, BSEE inspectors use Z-PINC to assess operator compliance on the behalf of the USCG, and in so doing, accept the inspection results of third party inspectors.

Full Authority for BSEE and USCG Inspections

The Executive Branch has recently released a plan to permit petroleum exploration and drilling in the Atlantic OCS. According to the Wall Street Journal, January 27, 2015, "…the government would hold drilling lease sales between 2017 and 2022 off the coast from Virginia to Georgia…" If the plan moves forward as outlined, the decision will greatly increase BSEE and USCG responsibility and constructively reduce their inspection forces. BSEE and USCG cannot expect that increases in inspector staffing will keep pace with the expansion of offshore activity into the Atlantic OCS. Existing responsibilities can expect to be "triaged" to make room for newer, exigent priorities.

Most likely, BSEE will not be able to simply increase the number of third party inspectors with limited authority. Consideration must be given to vesting non-governmental agencies or individuals with authority to perform all BSEE inspector functions under supervision and oversight of qualified, experienced BSEE inspectors. Two examples of programs with extensive third party inspection authority are the Federal Aviation Administration (FAA) Designated Examiner program and the Institute of Nuclear Power Operations (INPO). Both of these programs are reviewed below.

These two programs are concerned with industries that can have issues with immediate and serious consequences to public health and safety. The regulatory oversight of these industries is at least as critical as that of the industries related to the OCS.

FAA Designated Examiner Model

A model for a third party inspector system can be found in the Designated Examiner (DE) program run by the Federal Aviation Administration (FAA). Designated examiners currently perform more than ninety percent of pilot, flight engineer, mechanic and parachute rigger certifications in the United States. Designees are not FAA employees or contractors of FAA. Their authority is exercised independently or under the auspices of a certificated organization, such as a repair station. They are allowed to charge a "reasonable fee" for their services.

Designated Pilot Examiners (DPEs) conduct practical tests and issue all certifications from student pilot to Airline Transport Pilot to Flight Instructor. They also issue instrument, multi-engine and aircraft type ratings. Designated Maintenance Examiners (DMEs) conduct practical tests and issue certifications for aircraft mechanics, avionics technicians and parachute riggers. Designated Airworthiness Representatives (DAR) and Designated Engineering Representatives (DERs) issue original type certificates for aircraft, engines and components. Aviation Medical Examiners (AMEs) issue 99% of FAA medical certificates.

DEs, like BSEE inspectors, must document extensive industry experience and a broad spectrum of qualifications. In addition to maintain aircraft and instructor qualifications and proficiency, they must attend a week-long training course at the FAA Academy that focuses on evaluation procedures, techniques and documentation. They must be observed conducting actual applicant testing at least once per year, by an FAA Aviation Safety Inspector (ASI).

DPEs and DMEs operate using the same procedural guidance as their ASI counterparts. Each function has comprehensive and detailed guidance on test construction, applicant eligibility and documentation. The DE is provided with specific procedures for successful and unsuccessful test outcomes.

The DE program allows the FAA to leverage its limited inspector force and meet the extensive demands of aviation safety. In Calendar Year 2013, the FAA issued 85, 293 certificates; an average of 7108 per month. There were 67,765 certificates that required evaluation and testing, of which 98.2% were conducted by Designated Examiners. (http://www.faa.gov/).

FAA Organization Designation Authorization Model

The FAA delegates certification and inspection authority to industry organizations known as Organization Designation Authorizations (ODA). The basis for granting an ODA is the same as for other FAA designees, 14 CFR 183. ODAs exercise FAA certification authority for many functions, most of which concern aircraft and component airworthiness. The FAA may also delegate authority to conduct and certify knowledge tests for FAA airman certificates. The principals of ODAs must complete training and qualification requirements similar in scope and complexity to those of Designated Examiners.

This model could be useful to BSEE when determining the process for delegating authority to third party industry groups or companies.

Institute of Nuclear Power Operations /Nuclear Regulatory Commission Model

The Institute of Nuclear Power Operations (INPO) is a non-profit organization established by the nuclear power industry in 1979 in response to a presidential recommendation (not unlike the Final Report for the President's Oil Spill Commission, which recently recommended improvement of self-regulation in the oil-drilling industry) after a serious nuclear power plant incident (Three Mile Island). All of the 60+ U.S. sites with nuclear power reactors are members of the INPO, who "grades" each plant on safety and reliability, and operates on the threat to reveal non-compliance to the Nuclear Regulatory Commission (NRC). The INPO establishes performance objectives, criteria and guidelines for the nuclear power industry. Regular and thorough onsite evaluations of nuclear electric generating facilities are conducted by the INPO. In addition, the INPO provides in-person or online training and accreditation (through its National Academy for Nuclear Training, and accreditation through the independent National Nuclear Accrediting Board), evaluation of internal plant training programs, event analysis, information exchange and other technical or operations management assistance by industry request. Through the INPO information exchange and publication, members communicate lessons learned and best practices throughout the nuclear power industry.

The NRC provides government oversight and enforcement to complement the efforts of the INPO. The NRC's inspection manual provides policy and procedural guidance to inspectors. The NRC's inspection manual's method of standardization normalizes the differences amongst attitudes, training, experience and expertise found across an inspection task force. The NRC's inspection model is a leading example of a highly detailed guidance manual that should be considered by BSEE. The excerpt below is an example of the scope and depth of information the NRC considers important.

NRC INSPECTION MANUAL

0102-04 OVERSIGHT AND OBJECTIVITY REQUIREMENTS AND GUIDANCE

04.01 General. The requirements and guidance provided in section 0102-04 are to be used by NRC managers to verify employee performance and objectivity by direct observation of on-site activities at power reactor facilities and through other available indirect methods as needed. On-site activities include individual or team inspections, examinations, audits, visits, and reviews. NRC employees should use the applicable guidance and requirements of this section in the performance of their on-site activities.

04.02 Individual Inspectors, Team Leaders, and Examiners

a. Inspectors, team leaders, chief examiners, and other staff who lead NRC on-site activities should develop an appropriate plan, brief and receive approval from the line supervisor responsible for the activity on their planned activities, and should provide a copy of the inspection, examination, or audit plan to the responsible regional office Division of Reactor Projects (DRP) supervisor before the on-site activities begin.

b. All NRC staff who leads NRC on-site activities will conduct an entrance meeting with the principal facility personnel before beginning on-site activities. The senior resident inspector (SRI), or the resident inspector in the SRI=s absence, should be invited to all entrance briefings.

c. All NRC staff who leads NRC on-site activities should brief the immediate line supervisors responsible for the activity and the SRI regarding their findings before any exit meeting with the facility licensee takes place.

d. Inspectors, team leaders, chief examiners, and other staff who lead or participate in NRC on-site activities shall maintain a professional, objective relationship with licensee management and staff.

04.03 Senior Resident Inspectors

a. SRIs should routinely brief their immediate supervisor on resident inspection issues and findings and should keep their supervisor informed of scheduled exit meetings. Issue Date: 04/24/13 4 0102 b. SRIs should keep abreast of all NRC on-site activities at the facility to which they are assigned. However, minor issues should not be tracked or trended.
c. SRIs should attend entrance and exit meetings. If the SRI is unavailable, other resident inspectors should attend in their place. For economy of time, meetings for multiple on-site activities should be combined whenever possible.
d. To enhance objectivity, SRIs and resident inspectors shall spend a minimum of one week each year inspecting at another site. This inspection may be accomplished by participating in a team inspection at another site, or by visiting their backup site for familiarization.
04.04 Line Managers
a. Line managers should keep abreast of on-site activities conducted by employees over whom they have supervisory authority.
1. Line managers should discuss on-site activity plans with their employees before on-site activities begin to ensure the employee's activities are properly scheduled, coordinated and focused.
2. Regional DRP line managers should talk with their resident inspectors at each of their sites several times a week.
3. Line managers responsible for an on-site activity should discuss the findings and concerns with the employees assigned to the activity before the facility exit meeting is held. Discussions should focus on potential safety and regulatory approaches to issues to ensure mixed messages are not sent to the licensee.

Figure 10: NRC Inspection Manual

Third Party Inspector Hybrid

BSEE inspectors have a unique set of responsibilities. They also exercise broad regulatory authority on behalf of the taxpayers, some of which cannot be delegated to non-governmental entities. There are many inspector functions, however, which can be reasonably and effectively performed by properly trained and supervised third parties.

Ultimately, the non-governmental entity vested with BSEE authority will be a hybrid of inspector and industry attributes. Delegates will represent the US government and must demonstrate the ability to conduct inspections, audits and evaluations independently, to the same standards as BSEE employees.

BSEE will need to devise training and qualification protocols that are customized to third party inspector roles and responsibilities.

BSEE should consider training and qualifying third party inspectors in the same manner and to the same standards as BSEE inspectors. The curriculum should be shortened and customized to fit the extent of the responsibilities and authority the government decides to delegate.

Although, third party inspectors have the advantage of being "force multipliers" for the government, they also create a burden of oversight and supervision, which must be considered as BSEE seeks options for accomplishing its mandate.

6.2 API Specification 2C

API Specification Spec 2C, "Offshore Pedestal-mounted Cranes," provides requirements for design, construction, and testing of offshore pedestal-mounted cranes. BSEE currently incorporates the sixth edition of this standard by reference in 30 CFR 250.198. The seventh edition of the standard was published in 2012 and has not been incorporated in the Regulation. The following sections address the three most typical contexts for such cranes outlined in API Spec 2C, which are shipboard applications, heavy-lift applications, and offshore oil and gas production.

API Spec 2C gives extended treatment of offshore crane design, construction, and testing specifications. An indication of its comprehensiveness is that it identifies over 20 normative references and notes them as important for application of the specification. A critical reference is API RP 2D, "Recommended Practice for Operation and Maintenance of Offshore Cranes," a sister standard with which API Spec 2C parallels. This particular connection is key for the present analysis of crane safety standards primarily because appropriate crane inspection programs should reflect the complementary nature of API Spec 2C and API RP 2D.

Recommending that API Spec 2C be used for inspection programs, as will be done here, unequivocally implies that API RP 2D be used as well. Indeed, API Spec 2C explicitly encourages the reader to review API RP 2D concurrently. It is clear that the usefulness of API Spec 2C derives in large part from the value of API RP 2D, an interdependency that is especially true in the areas of crane operator training, load handling, crane rating, and crane inspection.

What follows is a more specific review of API Spec 2C, which leads to more specific points regarding its use in inspection programs. The analysis concludes with commentary on some comparisons and contrasts between API Spec 2C and other industry standards. Due to the complementary nature of API Spec 2C and API RP 2D, relevant recommendations for using API Spec 2C in offshore crane inspection programs are deferred to the end of the API RP 2D analysis section.

6.2.1 Analysis

The API Spec 2C standard has improved over the decades by developing clearer definitions of which cranes the standard covers. It has also expanded its list of critical components. Such components have no redundancy; if they fail, the result would be uncontrolled descent of load and/or uncommanded rotation of the upper crane structure. The Spec 2C document is designed to be used as an international standard that reflects realistic criteria. To that end, one particularly useful feature of the standard is its requirement that manufacturers keep their test and inspection records for 20 years. The goal of this requirement is to help ensure that relevant data can be tracked and analyzed for future design, construction, and testing of offshore cranes.

Other key features of API Spec 2C include guidelines on (a) what information the manufacturer must provide the purchaser, (b) what information the purchaser must provide the manufacturer, and (c) what human factors (HF) and health, safety, and environment (HSE) issues must be addressed. There are several detailed sections that describe how to calculate dynamic components of load and structures. The load section facilitates clear calculations of safe working loads by giving three possible methods for computing dynamic forces acting on a crane at sea state. These methods are the Vessel-specific Method, the General Method, and the Legacy Dynamic Method. Each of these methods is discussed at length. The standard even provides an extensive commentary appendix in which the benefits and potential downsides of each method are discussed. The standard repeatedly notes that load estimation for offshore cranes is complex and stresses that the purchaser must provide the manufacturer with as much data as possible on the parameters of the context in which the crane will operate. Variables of particular interest in this respect are wind, ice, and seismic conditions. These considerations, along with several others having to do with structural and mechanical requirements, rely on duty classification. The standard describes four duty classes: (1) Production Duty; (2) Intermediate Duty; (3) Drilling Duty; and (4) Construction Duty. These categories are used as organizing features for several requirements, such as appropriate time between overhaul, limits on frequency of use, and critical component repair.

Commensurate with the sections just mentioned is an entire section devoted to gross overload conditions. Within this section, quite useful specifications for failure mode calculations are given to manufacturers. Examples include: In the event an unbounded gross overload is applied to the block by a moving load, the applicable components supporting the operator control station shall not be the first to fail; the calculations shall assume the wire rope is not paid out from the hoist drums; and the crane shall fail into a safer and less critical situation with respect to the crane operator. Several other relevant requirements are listed.

The human factors (HF) and Health, Safety, and Environment (HSE) section is quite involved, covering several critical issues over nearly ten pages. The fact that so many issues are called out there is a testament to the myriad problems that can arise when cranes are not designed with human capabilities, limitations, and safety in mind. It is excellent that the standard addresses these HF and HSE issues. However, the points are not given the weight of consideration they deserve. Given that the primary goal of the section is to help manufacturers design out error-likely situations, it would be useful if examples of such situations were given.

One such example comes from a human-factors analysis, conducted by ABS Group, concerning a problematic pedestal crane typical of those found offshore. The analysis revealed that the front windscreen contained an opaque horizontal joint approximately one-third of the way from the bottom of the cabin. As a result of its opacity and location, the crane operator often stood up in order to see over the joint and to make visual contact with the hoisted load. In turn, this action required the operator to rotate the palms in the opposite direction, compared to the normal seated position, in order to manipulate the controls. This was an error-likely situation for several reasons, all of which need not be explicated in detail here. Suffice it to say, however, one of the most critical problems arose because in this new hand configuration the same movements of the hands and fingers produced the opposite action of the crane, compared to the normal seated position. It should be noted that other real-world examples from the offshore industry are provided and clearly communicated in API 770, "A Manager's Guide to Reducing Human Errors," which BSEE might consider adopting as a supplement to API Spec 2C, API RP 2D, or both, for inspection programs.

Returning to the present analysis, the annexes contained in API Spec 2C are extensive and informative. They include examples of critical components, API monogram guidelines, and cylinder calculation methods. Perhaps the most useful are the annexes containing involved commentaries and thorough examples of crane design loads, overturning moments, wire rope design factors, and safe working loads.

6.2.2 Inspection

The API Spec 2C standard explicitly touches on the issue of inspection in several ways. As mentioned above, the standard requires the manufacturer to maintain all inspection and testing records for 20 years and that the records be made part of a quality audit program. The manufacturer must also prepare a list of critical components, for each crane, that are subject to especially stringent inspection requirements. Note here that the standard provides an appendix (Annex A), which delineates examples of critical components. However, the reader should consult API RP 2D for explicit definitions of particular inspection schedules. This issue is taken up further in our analysis of API RP 2D.

The API Spec 2C standard goes on to lay out requirements for manufacturers to provide inspection, maintenance, and replacement procedures for all wire rope. It requires that fasteners not immediately accessible for inspection be positively restrained from rotation by nonpermanent means, and that the materials of other critical structural components are made traceable through a process subject to inspection. The standard notes that such components are of particular interest in inspection and that critical structural elements fabricated from steel plate be ultrasonically tested. It describes vital inspection requirements for pre and post heavy-lift load-test periods, fracture toughness, additional nondestructive examination of critical components, and nondestructive examination procedures.

6.2.3 Other Standards

The present review stresses the point that API Spec 2C is extensive and wide ranging. As such, there are no available ISO standards which are comparable. The general ISO approach to crane-related standards has been to separate the many crane-related issues into several individual standards and to give them only slightly more in-depth treatment. For example, there are separate ISO standards solely for the vocabularies associated with different types of cranes. There is an entire family of ISO standards that gives design principles of loads and load combinations for different types of cranes (e.g., ISO 8686). But the cranes are not differentiated based on those crane types typically found offshore. Nor are there recommendations given for how to incorporate the uniquely challenging conditions found offshore, such as wind and seismic loads. For those recommendations, the reader must consult other families of ISO standards (e.g., ISO 4302). Moreover, the depth of each separate ISO standard is essentially comparable to the depth found in API Spec 2C. Given that the relative depths of coverage are similar, but that the API Spec 2C covers so many issues in one standard, it is in the best interest of BSEE to retain API Spec 2C and to incorporate API Spec 2C in their inspection program.

Another set of relevant standards comes from the American Society of Mechanical Engineers (ASME) B30 series. The scope of the series covers construction, installation, operation, testing, maintenance, material handling, and inspection. Though the wide-ranging series contains nearly 30 standards, as can be seen in Table 1 below, it is still more manageable than the ISO series noted above. Moreover, several of the standards can be eliminated from the current discussion about the inspection of offshore cranes because they are generally irrelevant to offshore pedestal mounted cranes.

Table 22: B30 Standards and Topics

B30.1	Jacks, Industrial Rollers, Air Casters and Hydraulic Gantries
B30.2	Overhead and Gantry Cranes
B30.3	Tower Cranes
B30.4	Portal and Pedestal Cranes
B30.5	Mobile and Locomotive Cranes
B30.6	Derricks

B30.7	Winches
B30.8	Floating Cranes and Floating Derricks
B30.9	Slings
B30.10	Hooks
B30.11	Monorails and Underhung Cranes
B30.12	Handling Loads Suspended from Rotorcraft
B30.13	Storage/Retrieval Machines and Equipment
B30.14	Side Boom Tractors
B30.16	Overhead Hoists
B30.18	Stacker Cranes
B30.19	Cable Ways
B30.20	Below-the-Hook Lifting Devices
B30.21	Lever Hoists
B30.22	Articulating Boom Cranes
B30.23	Personnel Lifting Systems
B30.24	Container Cranes
B30.25	Scrap and Material Handlers
B30.26	Rigging Hardware
B30.27	Material Placement Systems
B30.28	Balancing Lifting Limits
B30.29	Self-Erecting Tower Cranes

The standard of the series most germane to the current analysis, which addresses offshore cranes and the crane-type level of analysis, is ASME B30.4, "Portal and Pedestal Cranes." The ASME B30.4 standard is briefly reviewed below, but two things should be noted prior to that review. First, there are several ASME B30 standards that specifically address particular critical components, such as slings, hooks, and winches. Second, several of those components singled-out within their own particular ASME B30 standards are sufficiently addressed by API Spec 2C and API Spec 2D, in tandem. Figure 11 below shows only a small number of exceptions to this general observation, such as derricks, winches, and cableways.

	API SPEC 2C	API RP 2D	ASME B30.4	ASME B30.6	ASME B30.7	ASME B30.9	ASME B30.10	ASME B30.16	ASME B30.19	ASME B30.21	ASME B30.26
Record Retention	•		•								
Critical Components	•		•								
Inspection, Maintenance, and Replacement	•	•	•								
Rotation Restraints	•										
Traceability	•										
Fracture Toughness	•										
Lamellar Tearing Resistance of Plate	•										
Heavy Lift Load Test	•										
Fracture Toughness	•										
Nondestructive Examination of Critical Components	•										
Nondestructive Examination Procedures	•										
Qualified Crane Operator Definition and Training (Appendix A1)		•	•								
Qualified Crane Inspector Definition and Training (Appendix A2)		•									
Qualified Rigger Definition and Training (Appendix A3)		•									
Post Pull / Load Test		•									
Usage Categories for Inspection, Testing, and Maintenance (Appendix C)		•	•								
Initial, Pre-use, Monthly, Quarterly, and Annual Criteria Based on Usage		•									
Initial, Regular, and Periodic Criteria Based on Usage, Wear, Deterioration, or Malfunction			•								
Wire Rope (Replacement / Maintenance)	•	•	•								
Criteria for Hook and Roller Assemblies, King Posts, and Ball/Roller Bearings		•									
Footwalks and Ladders			•								
Derricks				•							
Winches					•						
Slings		•				•					
Hooks	•						•				
Lever Hoists	•									•	
Overhead Hoists	•							•			
Cableways									•		
Rigging	•	•									•

Figure 11: Inspection-related gap analysis results concerning elements API Spec 2C, API RP 2D, and relevant ASME B30 standards[6]

Whereas the API Spec 2C standard addresses inspection throughout the document, the ASME B30.4 standard devotes a specific section to inspection, testing, and maintenance. This is another feature which contributes to the brevity of B30.4 relative to API Spec 2C, along with the fact that the ASME B30 series breaks out relevant issues in several smaller standards.

The inspection section of the ASME B30.4 carves inspection classification into initial inspection, which entails all new, reinstalled, altered or repaired cranes, and regular inspection, which entails two subcategories. The two subcategories are frequent and periodic. The former subcategory could be monthly for light service, weekly for normal service, or daily for heavy service. The latter subcategory, periodic inspection, is done on the order of 1- to 12-month intervals, or as specifically recommended by

[6] The (•) indicates coverage. Empty cells indicate no coverage.

the manufacturer. The standard then lays out several explicit criteria for appropriate inspection on these different schedules. The only critical component given special attention, however, is wire rope inspection and replacement criteria.

Table 2 shows that there are several more inspection-related issues addressed by API Spec 2C that are not addressed by ASME B30.4. One might counter that this observation is invalid because it does not consider the fact that there are many other standards in the ASME B30 series that could, when taken together, cover the same scope. However, Table 2 also shows that several of the issues addressed in those other, singled-out ASME B30 standards are also addressed by API Spec 2C. Thus, API Spec 2C appears to be much more comprehensive. It is also more efficient and cost-effective because the information is found in only one single publication. Lastly, the API Spec 2C relies on a more detailed, rigorous, and well-defined inspection schedule (laid out in API RP 2D). Another notable inspection-related shortcoming of ASME B30.4 relative to API Spec 2C and API RP 2D is the lack of any inspector training requirements. Note again that this issue is taken up more specifically in the accompanying analysis of API RP 2D.

6.3 API Recommended Practice 2D

API RP 2D, "Recommended Practice for Operation and Maintenance of Offshore Cranes," is a guide for crane owners and operators to use for safe operation of pedestal-mounted cranes on fixed or floating offshore platforms, jackup rigs, semi-submersibles, and other types of mobile offshore drilling units. The document, in its sixth addition as of 2007 is currently incorporated by reference in 30 CFR 250.198. It is comprehensive, addressing a wide range of issues in operations, testing, maintenance, and inspection.

API RP 2D is a sister standard to API Spec 2C, as noted in the analysis above. Of particular interest here, are the several inspection-related issues covered in API RP 2D and how they relate to API Spec 2C.

The present analysis precedes much like the analysis of API Spec 2C. Below is a more specific review of API RP 2D, which develops into a more specific analysis of the inspection-related criteria put forth therein. It should be noted that API RP 2D contains many more inspection-related issues compared to API Spec 2C. It should also be understood that nearly all these issues discussed in this analysis can be connected to the issue of inspection in one way or another. The present analysis draws out the most important of these connections.

6.3.1 Analysis

The initial focus of API RP 2D is the general issue of operations, which it breaks into four main parts. The first provides clear and appropriate physical criteria by which a crane operator may become qualified to operate relevant cranes and sets forth additional (minimum) training requirements. Here, the standard references sister standard, API Specification 2C, to point out that any operator should have basic working knowledge of several technical fundamentals. These fundamental requirements concern design, construction, and testing of new offshore pedestal-mounted cranes. Less stringent requirements are set forth for riggers, though a detailed suggested training plan is included in one of several appendices.

Returning to operations, the operator is required to meet several well-defined best practices, as specified in the main document and in a second appendix on operations. Best practices include pre-use verification of crane capabilities, appropriate communication with signal persons, securing the crane before a period of nonuse, and handling personnel transfers. Several useful miscellaneous issues are also treated, such as best practices for refueling, fire protection, load testing, and pull testing.

The API RP 2D standard defines a qualified crane operator as:

> "A person so designated by the employer who has appropriate offshore experience and training. Such appropriate experience and training must comprise minimum amounts of classroom-type sessions and hands-on field training, on cranes specific to the type of crane to be operated by the qualifying Crane Operator."

The definition just reviewed rests on a general definition of the term "qualified," given by API RP 2D as:

> "A person who, by possession of a recognized degree, certificate of professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work."

Together, these definitions can be contrasted with what the Occupational Safety and Health Administration (OSHA) defines as a "competent person," per 29 CFR 1926.32:

> "One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them."

The contrast between "qualified" and "competent" persons is touched on here but more fully addressed in the recommendations given at the end of this analysis. API Spec 2C and API RP 2D do not make such a distinction and should consider making more relevant to offshore crane inspection.

Returning once again to the API RP 2D standard, it is stated that the qualified crane operator should also be sufficiently qualified to perform pre-use crane inspections outlined later in the standard and in this analysis. The exceptions are, as will be made clearer below, the more involved Initial, Quarterly, and Annual inspections. The API RP 2D document provides needed training and refresher requirements. These criteria include, but are not necessarily limited to:

> "…lubricating points; adjustments; principles of crane operation, especially boom operating procedures; safety devices and anti-two blocking systems; the proper use and care of all running cables (wire and rope) and pendants; and the proper reading and understanding of crane lifting capacity and reeving charts, boom and indicator charts and hand signal charts.
>
> Further, the qualifying Crane Operator shall attend hands-on training on the proper inspection, use and maintenance of rigging gear (slings, shackles, hooks, nylon slings, etc.) and be trained in all rigger requirements."

The qualified operator requirements also specify that before a person may be designated a Qualified Crane Operator, he or she is also required to demonstrate hands-on proficiency in the safe operation of cranes he or she is to operate. More concrete requirements for hands-on proficiency are offered.

6.3.2 Inspection

Perhaps the most useful feature of API RP 2D for the current analysis is its inclusion of well-defined crane usage categories in relation to inspection, testing, and maintenance. This inclusion reflects a significant expansion of API RP 2D over the years. The sixth edition is now incorporated by reference in 30 C.F.R. 250.198(h)(48).

The API RP 2D standard defines a qualified inspector as:

> A person so designated by the employer who by reason of appropriate experience and training, has successfully completed classroom-type training on crane maintenance and troubleshooting; on hoist troubleshooting and overhaul; and on the structural aspects of offshore cranes, which gives a knowledge of structurally critical components and critical inspection areas. These minimum training requirements are outlined in Appendix A2 (of API RP 2D). Additionally, individuals recognized by regulatory authorities may conduct inspections of cranes pursuant to this edition, provided they meet the requirements of Appendix A2. With successful completion of this minimum training supplemented with requalification at a minimum of every four (4) years, the inspector is considered qualified to perform the Initial, Pre-use, Monthly, Quarterly, and Annual Inspections.

There are three general usage categories: infrequent, moderate, and heavy. Infrequent usage is defined as 10 hours or less per month, as measured by average over the course of a quarter. Moderate usage is defined as over 10 hours but less than 50 hours per month, as measured by average over the course of a quarter. Heavy usage is defined as 50 hours or more per month, as measured by average over the course of a quarter.

Each of these categories is used to determine the level of inspection that must be applied: Initial, Pre-use, Monthly, Quarterly, and Annually. Infrequent usage requires pre-use and annual inspections. Moderate usage requires pre-use, monthly, quarterly, and annual inspections. Heavy usage requires pre-use, quarterly, and annual inspections

The levels just described are obviously incremental in the sense that the second includes the first, the third includes the second, and so on. Thus, the standard document is redundant here, giving a full list for each inspection level. However, this criticism is minor, mainly because thoroughness is preferred over conciseness. The more important point is that this scheme is rigorous and well outlined.

Another appendix, perhaps the most involved in the entire standard, lays out specific minimum guidelines for usage, inspection, testing, and maintenance. Key issues here are that (a) it is the responsibility of the crane owner to develop a preventative maintenance program in accordance with the manufactures recommendations; (b) the program should dictate a maintenance and inspection schedule based on a duty cycle versus strict time limits; and (c) the program should list specific testing methods to be carried out. The appendix offers several detailed methods.

Specific preventive maintenance guidelines are described and general procedures for repairs and replacements are outlined. The relatively brief treatment given repairs and replacements is acceptable because mechanical components have more failure modes than functionality. Thus, a full treatment of guidelines for repairs would be well outside the scope of the standard. However, specific treatment is given to the very important issues of wire rope and sling inspection. An entire detailed appendix is devoted to education and requirements concerning inspection, storage, handling, installation, and replacement of wire rope. Slings are also included. It provides clear pictures that show both the correct and incorrect methods, and other diagrams that leave very little room for ambiguity.

Of additional help here is a basic inspection guideline for critical crane components in the three main types of swing circle assemblies typically used on pedestal-mounted cranes. Those assemblies are Hook and Roller, King Post, and Ball/Roller Bearings. That the standard separates these assemblies and gives them specific and extended treatment is quite useful, especially for those cranes typically found on the OCS.

The API RP 2D has a few slightly undesirable traits, such as a lack of a threshold limiting the size of cranes to which its requirements apply, ill-defined miscellaneous-section issues, a fuzzy stance on the development of maintenance and operation programs, and essentially absent mention of human factors that make the bulk of mishap root causes. These criticisms notwithstanding, there is no available ISO standard that comes close to covering such a breadth of useful issues for crane operations, testing, maintenance, and, of particular interest here, inspection.

There are shorter ISO standards that individually address some of the issues contained in API RP 2D. Examples include the ISO 23814 standard (Competency Requirements for Crane Inspectors) and the ISO 4309 standard (Wire Ropes, Maintenance and Installation). However, there are several important issues not individually addressed by ISO, and several relevant ISO standards do not specify that they address cranes typically found offshore.

For the above reasons, it is recommended that BSEE retain API RP 2D as the best currently available and most comprehensive standard for the operation, maintenance, and inspection of offshore cranes. It is also recommended that BSEE retain the necessary companion document, API Spec 2C.

6.3.3 Conclusion and Recommendations

Concerning the criticism that API RP 2D gives scant treatment of human factors, it should be noted that the standard gives little guidance on how to assess the physical qualifications of the crane operator. Addressing this issue is pivotal for ensuring that the operator has the physical capabilities required to operate crane controls for appropriate durations. It is recommended that BSEE adopt the physical instructions to physicians for qualifying physical examinations, put forth by the National Commission for the Certification of Crane Operators (NCCCO) as a supplement to API RP 2D. This form provides very clear and explicit instructions for appropriate examinations.

Two other recommendations related to the one just given are (a) that BSEE adopt API 770, "A Manager's Guide to Reducing Human Errors," as a supplement to API Spec 2C, API RP 2D, or both, for inspection programs and (b) that BSEE adopt American Society for Testing and Materials (ASTM) F1166, "Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities." The former provides much-needed and easy-to-understand information that can help decision makers and front-line personnel alike be better able to recognize hazards that stem from the cognitive and biomechanical limitations of humans. These limitations are especially pertinent for qualified inspectors who should be trained to recognize both mechanical and human-factors related hazards.

The human factors standard, ASTM F1166, provides detailed ergonomic design criteria with respect to well-known fundamentals of human performance. Indeed, the best-case scenario for avoiding mishaps entails the consideration and implementation of such factors at the earliest possible stage. It is critical to note here that doing so would not just help curtail negative impacts of cognitive and biomechanical limitations of human operators, but it would also promote positive impacts by making nominal performance more efficient. Incorporating ASTM F1166 in operator and inspector training would not only be fairly easy to accomplish from a logistical standpoint, it would serve as a useful bridge between the general human-factors related hazards described in API 770 and the lower-level details of crane design, operation, and inspection.

Regarding general crane inspection methodologies, it is recommended here that BSEE implement the following practices:

1 – Provide a means for determining whether the crane in question has been inspected frequently by a *competent* operator.[7] Here we return to the distinction between "qualified" and "competent" persons. Competency is demonstrated, not certified. A competent person must show ability to recognize hazards and to take steps in mitigating those hazards. Therefore, it is not only qualified persons who can inspect cranes. Rather, anyone who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them, can, and should, frequently inspect the cranes. Here we take a useful cue from ASME B30.4, which defines "frequent" inspection as the visual examination by the operator, or other designated person. However, ASME B30.4 explicitly suggests that records *not* be required for frequent inspections. We suggest that BSEE require some sort of documentation of frequent visual inspections to help ensure that they are, in fact, conducted. The recommendations can be combined with the useful usage categories laid out by API RP 2D, such that *infrequently* used cranes should receive a visual exam by a competent person monthly, *moderately* used cranes should receive a visual exam by a competent person weekly to monthly, and *heavily* used cranes should receive a visual exam by a competent person daily to weekly. The benefit of allowing frequent inspections by competent persons is that there are often several people at a worksite who can be reasonably defined as competent. This helps increase the chances that hazardous conditions of the cranes are recognized and called to the immediate attention of management. Requiring documentation of these frequent inspections will help ensure that any hazardous conditions are actually called to the attention of management.

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[7] Qualified generally refers to documentation of credentials. Competency is a demonstration of knowledge and manipulative skill to a published standard. Webster's Dictionary defines competent as: "having the required skills for an acceptable level of performance" It defines qualified as: a skill, an ability, or knowledge that makes a person able to do a particular job. The study team found no specific regulatory definitions of these two words.

2 – Provide a means for determining whether the crane in question has been inspected periodically by a *qualified* operator, where “qualified” is defined per API Spec 2C and API RP 2D, and where “periodically” is linked to the usage categories (infrequent, moderate, heavy) and relevant inspection schedules put forth by API RP 2D.

3 – Provide a means for determining whether the crane has been tested by a qualified person. Tests that should be completed are jointly specified by API Spec 2C ad API RP 2D and include fracture toughness testing, heavy lift load tests, nondestructive examination of critical components, pull tests, and nominal load tests.

4 – Provide means for determining whether and how different categories of lifts are addressed. The concern here is that a crane policy is deemed appropriate only if it addresses three main types of lifts: routine, critical, and engineered.

Routine lifts are those lifts involving routine lifting operations governed by standard industry rules and practices, except as supplemented with unique company testing, operations, maintenance, inspection, and personnel certification requirements contained in the company safety policies and procedures manual. These lifts are those mainly addressed by API RP 2D, which, it should be noted here, does not draw a distinction between routine, critical, and engineered lifts.

Critical lifts are those lifts where failure and/or loss of control could result in loss of life, loss of, or damage to major components, or a lift involving special items such as unique articles or major facility components whose loss would have serious contractual, delivery, or operational impact.

Engineered lifts are those lifts whose loads exceed the rated capacity of the crane. Engineered lifts should be performed only in exceptional circumstances and upon express approval of multiple management personnel. Every planned engineered lift shall be treated as an exceptional and separate event.

6.4 ISO Crane Inspection Standards and Regulatory Guidelines

The following analysis overlaps with the analyses performed on API Spec 2C and API RP 2D. The analyses complement each other insofar as the points made previously are used to compare the adequacy and appropriateness of inspection-relevant ISO standards for offshore cranes. It is repeated for emphasis here that API Spec 2C and API RP 2D are rather extensive and wide ranging. It is also noted here and in the previous analyses that there are no available ISO standards which are comparable to the coverage and methodology that API Spec 2C and API RP 2D, provide in tandem. The same conclusion is drawn and reinforced below.

6.4.1 Analysis

As noted before, the general ISO approach to crane-related standards has been to separately address in several individual standards the body of crane-related issues. This practice has led to an inordinate number of standards. In fact, ISO has published approximately 100 separate crane-related standards! Moreover, the scale on which ISO has broken apart the standards is surprisingly and, in our opinion, unnecessarily fine-grained. For example, there are entirely separate ISO standards dedicated solely to providing the vocabularies associated with different types of cranes. The term "separate" is not to be conflated with "unique," however. Given that there is much overlap in crane terminology, this approach seems overwrought.

The main rationale on the part of ISO for breaking up the body of standards into so many constituent parts is that doing so leaves each technical committee able to give the respective issue more in-depth treatment. While it is reasonable to claim that separating the issues can allow the committees to pursue each issue more thoroughly, one can evaluate the standards in usefulness-depth space. Here, usefulness is plotted against the depth of treatment. In such space, usefulness generally increases as depth increases, but there is point at which the usefulness then begins to decline precipitously with increasing depth. The main reason for this decline is mostly logistical – it becomes cumbersome for the readers, many of whom do not have advanced technical backgrounds, to keep track of so many disparate documents and the links which bind them. Note here that each standard gives several normative references to other ISO standards. Our opinion is that the optimal point in usefulness-depth space is exceeded by the current ISO approach to crane-related standards and that whatever depth of treatment it achieves still does not justify the disconnection that arises from having so many standards.

Some more specific reviews and critiques of the most inspection-related ISO standards follow. Table 23 shows those standards and gives their brief descriptions.

Table 23: ISO Standards Related to Crane Inspections

ISO 4301 (Series)	Mobile, Tower, Jib, Overhead Travelling, and Portal Bridge Cranes
ISO 4306 (Series)	Vocabulary for ISO 4301 Series
ISO 4309	Wires, Ropes, Maintenance, and Installation
ISO 9927-1:2013	Inspections – General and Tower Cranes (Only)
ISO 23814:2009	Competency Requirements for Crane Inspectors
ISO 17020:2012	Requirements for the Operation of Various Types of Bodies Performing Inspections

The first critique is related to the first row in Table 23. That is, the ISO crane standards are not differentiated on the basis of those typically found offshore. This is an unfortunate characteristic when it comes to the BSEE goal of promoting safety through improved inspection methods. This observation is also contrasted by API Spec 2C and API RP 2D, which, taken together, more specifically address pedestal-mounted cranes much more typical of those found offshore.

The second critique is related to the first, and it pertains to the ISO 4309 standard. The ISO 4309 document concerns maintenance and installation of wires and ropes typically found on those cranes described by ISO 4306. These cranes include, cable and portal cable cranes, cantilever cranes, such as pillar jib, wall, or walking cranes, deck cranes, derrick and guy derrick cranes, derrick cranes with rigid bracing, floating cranes, mobile cranes, overhead travelling cranes, portal or semi-portal bridge cranes, portal or semi-portal cranes, railway cranes, tower cranes, and, lastly, offshore cranes.

The ISO 4309 standard defines offshore cranes as those mounted on a fixed structure supported by the sea bed or on a floating unit supported by buoyancy forces, though no specific guidance is given on those types of cranes versus any others. The ISO 4306 largely mirrors the guidance given by API Spec 2C and API RP 2D, but it does provides an additional section that lays out slightly more specific criteria for discarding wires and ropes. Note again, however, that there are no specific directions given for how to incorporate the uniquely challenging conditions found offshore, such as wind and seismic loads. For those, the reader would have to consult an entirely different family of ISO standards.

Another inspection-related document, the ISO 9927-1 standard contains very general inspection criteria and offers some more specific guidance for tower cranes. The issue of tower cranes does not concern BSEE in this project, and it should be noted that ISO included in this standard a nearly identical set of inspection guidelines as can be found API Spec 2C, API RP 2D, and AMSE B30.4. There are additional sections including "exceptional inspection," "major inspection," and "enhanced periodic inspection." However, these additional sections are either overcomplicating, unnecessary, or both. Moreover, ISO points out that these standards are still under development, and that ISO 9927 provides an example of the inherent incompleteness that comes with that development. For example, ISO 9927 currently consists only of a part on general inspection and a part on tower cranes. A part on bridge and gantry cranes are said only to be planned at this time.

Perhaps the most pertinent ISO standard to the goal of the BSEE Crane Safety project is ISO 23814, which provides competency requirements for crane inspectors – those who carry out periodic, exceptional, alteration and thorough inspections of cranes. Unlike the system we recommended in the analysis of API Spec 2C and API RP 2D and AMSE B30.4, the ISO 23814 explicitly and unfortunately excludes the day-to-day inspections by crane operators and maintenance personnel.

The ISO 23814 document contains five sections and two annexes, A and B, which delve slightly deeper into recommended crane inspector categories and performance criteria for technical knowledge, respectively. As is typical of the ISO crane-related standards, there are five normative references to track in relation to the standard. The bulk of the information on inspection comes from the last two main sections, which address inspection requirements and training suggestions for crane inspectors. The former entails independence, impartiality, and integrity, technical knowledge, experience requirements, and techniques for crane inspection. The latter specifies training of crane inspectors. Our opinion, however, is that neither section promulgates information that is useful above and beyond the very similar information found in API Spec 2C and API RP 2D. Here again, parsimony and ease of use become the paramount characteristics. Moreover, the number of crane-related ISO standards is so large that it constrains the scope of the competency requirements in ISO 23814 to a topical and general level. Again, this generality is contrasted by the useful offshore-crane specialty of API Spec 2C and API RP 2D.

Finally, there is one more ISO standard that is related, at a higher, more abstract level, to crane inspection on the OCS. It is the ISO 17020, which lays out general requirements for the operation of various types of bodies performing inspection. The overarching goal of the standard is to promote confidence in the various bodies that perform inspections. It should be noted here very definitively that this document does not specifically address offshore crane inspection. However, there are features of the standard that BSEE might be able to draw on to help improve its own inspection processes.

The ISO approach to harmonizing inspection bodies is relatively thorough. As a result, the expansive ISO 17020 document spans several issues of inspection. These issues include:

- General requirements (impartiality and independence);
- Structural requirements (administrative requirements and organizational management);
- Resource requirements for personnel, facilities and equipment, and subcontracting;
- Process requirements (methods, procedures, items, records, complaints, and appeals);
- Management system requirements (documentation and control of records);
- Management review (Internal audits, corrective actions, and preventive actions); and
- Annexes pertaining to additional independence requirements for inspection bodies

Though the ISO approach to inspection body harmonization is thorough, it is not particularly novel. It tends to follow well-established best practices related to the above issues. That it places such a high importance on impartiality and independence is laudable but probably of less importance to BSEE. The same goes for the management system requirements to document and control all records associated with inspections and the relevant structural requirements.

Of particular interest, however, are resource requirements which place emphasis on the ability of inspectors. Appropriate ability is understood as necessitating both theoretical knowledge and practical knowhow. Moreover, the able inspector may likely be required to have familiarity with relevant regulations, technologies, processes, standards, codes, materials, failure modes, and industry practice. This definition is somewhat ill-defined in the sense that the criterion of "familiar" is not formally offered. However, the span of categories listed in the definition just given may help augment the API RP 2D definition of "qualified inspector" we previously described. For reference, that definition was as follows:

> "A person so designated by the employer who by reason of appropriate experience and training, has successfully completed classroom-type training on crane maintenance and troubleshooting; on hoist troubleshooting and overhaul; and on the structural aspects of offshore cranes, which gives a knowledge of structurally critical components and critical inspection areas. These minimum training requirements are outlined in Appendix A2 (of API RP 2D). Additionally, individuals recognized by regulatory authorities may conduct inspections of cranes pursuant to this edition, provided they meet the requirements of Appendix A2. With successful completion of this minimum training supplemented with requalification at a minimum of every four (4) years, the inspector is considered qualified to perform the Initial, Pre-use, Monthly, Quarterly, and Annual Inspections."

Note too, that ISO 17020 places special emphasis on what it calls "effective supervision" of inspectors, which is said to help ensure the quality of inspections. Effective supervision is defined primarily by regular proficiency testing for all inspectors. In addition, it indicates that a quality assurance program be developed for inspections and offers several suggests several methods for doing so. Suggested methods include the following:

- Comparison of findings in which several inspectors inspect an item and their findings are compared for reliability;
- Measurement audits in which an object of inspection with known reference values or qualities be used in a manner similar to the comparison-of-findings method and the variance between the reported results form inspector and referenced value is evaluated;
- Technical witnessing in which an inspector is observed by another inspector;

- Partial-process schemes in which the ability to perform parts of the overall inspection process are evaluated;
- Review of records and supporting materials;
- Client / operator communication in which appropriately structured interviews are conducted to glean information about the inspector's approach, behavior, and performance; and
- Review of produced reports;

The inspection methods information (Section 7) also calls for job-specific sampling plans, where appropriate based on professional judgment, that involve specific analyses about where to sample, how to sample, how much to sample, and what criteria will be used to retain or discard the sampled item(s).

Finally, the ISO 17020 standard also lists detailed content that should be in an inspection report. Potentially relevant information is as follows:

a) Designation of the document, i.e. as an inspection report or an inspection certificate;

b) Identification of the issuing body;

c) Unique identification of report; The report must carry this unique identification on each page;

d) Indication of the total number of pages, each page being numbered for multi-page reports;

e) Identification of the client; Note the owner of the inspected item can be mentioned in the report or certificate if the owner is not the client;

f) Description of the inspection work ordered;

g) Date(s) of inspection;

h) Information on where the inspection was carried out;

i) Identification or brief description of the inspection method(s) and procedure(s) mentioning deviations from, additions to or exclusions from the agreed methods and procedures;

j) Reference to the use of sub-contractors (where appropriate) including identification of the sub-contracted inspection and/or testing results;

k) Identification of the items inspected;

l) Identification of equipment used for measuring / testing;

m) Where applicable, and if not specified in the inspection method or procedure, reference to or description of the sampling methods and information on where, when, how and by whom the samples were taken;

n) Information on environmental conditions during the inspection, if relevant; and

o) Inspection results

p) A statement of conformity where applicable;

q) Statement that the inspection results relate exclusively to the work ordered
or to the items or lot inspected;

r) Information on what has been omitted from the original scope of work;

s) The inspector's mark or seal;

t) Names (or unique identification) of the personnel members who have performed the inspection and in cases when secure electronic authentication is not undertaken

u) Signature or other indication of approval, by authorized personnel;

v) Date of issue of the report;

w) Any other information required by the client.

x) Caveats and assumptions made by the facility, and the basis for these (where applicable); and

y) Clear identification of inspection and test data from non-accredited sources that has been utilized in the inspection (where appropriate);

6.4.2 Conclusion and Recommendations

The foregoing analysis of ISO standards relevant to crane inspection on the OCS makes clear that there are some useful features of the ISO approach. Perhaps the most useful feature is that the standards are written with the goal of harmonizing an international community of crane owners, operators, and inspectors. However, this very challenging endeavor has led to the promulgation of far too many separate and disparate standards. Moreover, offshore cranes, most of which are pedestal-mounted, are not specifically treated like they are in API Spec 2C and API RP 2D; this is true even though there exists this great number of standards. A final and related major criticism is that the standard set is still in development, and it certainly needs to be consolidated some before it can be recommended that BSEE adopts it wholesale.

The most potentially useful components of the inspection-related ISO standards come from ISO 17020. There BSEE is encouraged to find and consider the slightly expanded set of categories that can be used to train and ensure the ability of qualified inspectors. This set can be used to augment the definition of qualified inspectors given by API RP 2D. There are also several "effective supervision" and "quality assurance" methods given for ensuring inspectors perform well and inspections are of the best possible kind. Related benefits might be gained from being very explicit about the components that must be found in an official inspection report.

With the above analysis and conclusions in mind, it is recommended that BSEE retain API Spec 2C and API RP 2D as the best currently available and most comprehensive set of standards for the operation, maintenance, and inspection of offshore cranes.

6.5 ASME B30 Standards

The study team reviewed and analyzed the American Society of Mechanical Engineers (ASME) B30 standard series, concerning crane and material handling equipment, as part of developing inspection strategy and methodologies for BSEE.

The B30 series addresses the construction, installation, operation, inspection, testing, maintenance, and use of cranes and other lifting and material-movement related equipment. The stated purpose of the B30 series is to (a) prevent or minimize injury to workers, and otherwise provide for the protection of life, limb, and property by prescribing safety requirements; (b) provide direction to manufacturers, owners, employers, users, and others concerned with, or responsible for, its application; and (c) guide governments and other regulatory bodies in the development, promulgation, and enforcement of appropriate safety directives (p.viii).

The scope of the analysis covers a general review of the B30 standard series and does not assume specialized knowledge of crane operations. Where appropriate, however, it does focus on whether and how the particular standard being reviewed speaks to the issue of inspection. What follows is the requested review and analyses of the most current version of the B30 documents. The relevant ASME B30 standards addressed by ASBG, per BSEE request, are listed in Table 24.

Table 24: ASME Crane and Material Handling Standards

B30.2:2011	Overhead and Gantry Cranes
B30.4:2010	Portal and Pedestal Cranes
B30.7:2011	Winches
B30.8:2010	Floating Cranes and Floating Derricks
B30.9:2010	Slings
B30.10:2014	Hooks
B30.16:2012	Overhead Hoists
B30.20:2013	Below-the-Hook Lifting Devices
B30.21:2014	Lever Hoists
B30.24:2013	Container Cranes

6.5.1 B30.2: Overhead and Gantry Cranes

The B30.2 includes provisions that apply to the construction, installation, operation, inspection, and maintenance of hand-operated and power-driven overhead and gantry cranes that have a top-running single-girder or multiple-girder bridge, with one or more top-running trolley hoists used for vertical lifting and lowering of freely suspended, unguided loads consisting of equipment and materials. Figure 12 and Figure 13, show schematics of overhead and gantry cranes.

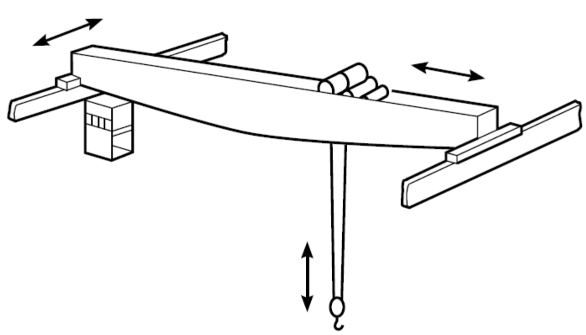


Figure 12: Overhead Crane

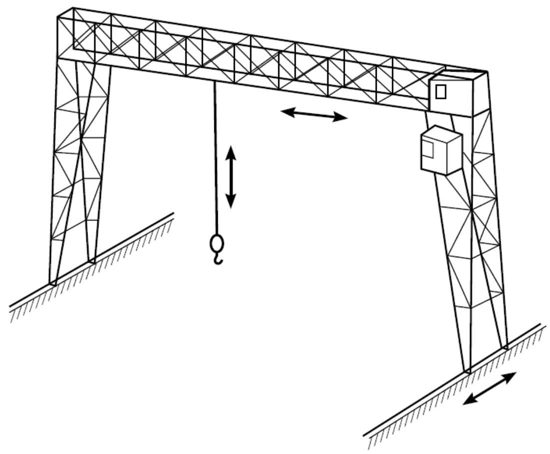


Figure 13: Gantry Crane

There are four major sections of the B30.2 standard; (1) general construction and installation (2) inspection and testing (3) operator training and operation (4) maintenance and maintenance training. Each section is addressed below, with special emphasis on inspection testing, per the scope of work.

The existence and use of appropriate markings are an integral part of any safe crane operation. Therefore, markings need to be considered from the earliest stages of development. The B30.2 standard gives guidance on this issue, calling for intelligible markings for crane load, hoist load, manufacturer identification, multiple hoists, and general warning markings. Where appropriate, the markings must be legible from the ground and must also be available on the controls used by the operator(s). Unfortunately, the document does not define specifics concerning the makeup of the markings (e.g., size, color, font, etc.), but it does reference a useful label standard – the American National Standards Institute (ANSI) Z535.4.

Guidance on clearances, runways, supporting structures, foundations, anchorages, welds, and girders are provided next. The B30.2 addresses these issues topically, though it does a fair job at touching on the important issues while referencing other standards for more in-depth treatment where necessary.

While it is noted that most overhead cranes do not incorporate a cab as do pedestal cranes, a subsequent section concerns the crane cab and control interface. There is an unfortunate paucity of useful information about the design of this critical human-machine interface. For example, the B30.2 states:

> "The general arrangement of the cab and the location of the control and protective equipment should be such that all operating handles are within reach of the operator when facing the area to be served by the load block, or while facing the direction of travel of the cab…"
>
> "…the arrangement of the cab should allow the operator a full view of the load block in all positions. This is an important and desirable condition, but it is recognized that there are physical arrangements that may make this impossible, and, when the load block is in these positions, the operator shall be aided by other means such as, but not limited to, closed-circuit TV, mirrors, radio, telephone, or a signalperson."

However, API Specification 2C which is applicable to offshore pedestal cranes, provides some well-defined human factors recommendations in Section 10. A much more desirable situation would be the adoption and inclusion of more specific and well-understood human factors principles, such as those discussed in American Society of Testing Materials (ASTM) F1166. This document, as well as the American Petroleum Institute (API) 770 standard, gives clear, and easy-to-use guidance on designing operator stations in a way that facilitates human performance and avoids placing operators in error-provocative situations. The ABS Group Consulting Human Factors Engineering Group has performed several analyses of error-provocative crane cabs that have led to several mishaps. It would be in the best interest of BSEE to incorporate the knowledge learned from these analyses, much of which is already reflected in ASTM F1166.

The B30.2 standard offers fairly well-defined specifications for the construction of service platforms and foot-walks, ladders and stairways, and other parts related to control of moving parts, such as trolleys, bumpers, and other braking mechanisms. This section is followed by another detailed one on electrical equipment, including controllers, resistors, switches, conductors, and magnets.

A very important section on hoisting equipment follows. The information contained therein is critical, and those involved in relevant crane construction would do well to pay close attention to it. It includes sheaves, drums, ropes, and hooks. It should be noted, however, that the information is almost entirely qualitative, as opposed to the more quantitative information given in other places (e.g., API Spec 2C).

The section most critical to the BSEE Crane Safety project is the second – Inspection and Testing. The stated purpose of the section is to provide criteria for determining whether the crane can be expected to perform as intended. The standard defines five unique types of inspection. They are:

> Initial inspection – a documented initial visual and audible crane examination concerning any new, reinstalled, altered, repaired, and/or modified equipment;
>
> Functional test inspection – a documented initial visual and audible crane examination, especially concerning operational controls, upper limit devices, and rope, shall be conducted at the beginning of every shift;
>
> Frequent inspection – a documented initial visual and audible crane examination on the basis of whether the crane is in "normal," "heavy," or "severe" service, with respective inspection intervals being monthly, weekly to monthly, and daily to weekly, respectively;
>
> The definitions of normal, heavy, and severe, are as follows:[8]
>
>> *Heavy* – service that involves operating at 85 to 100% of rated load or in excess of 10 lift cycles/hr as a regular specified procedure;
>>
>> *Normal* – service that involves operating at less than 85% of rated load and not more than 10 lift cycles/hr except for isolated instances; and
>>
>> *Severe* – service that involves normal or heavy service with abnormal operating conditions

[8] The items to be inspected are operating mechanisms, upper limit devices, hydraulic components, hooks, hook latches, attachments, rope, and warning devices.

Periodic inspection – a documented initial visual and audible crane examination on the basis of whether the crane is in "normal," "heavy," or "severe" service, with requisite intervals above.[9]

Inspection of equipment not in regular use – a crane that has been idle for a period of 1 month or more, but less than 1 year, shall be inspected before being placed in service in accordance with the requirements listed for frequent inspection, and a crane that has been idle for a period of 1 year or more, shall be inspected before being placed in service in accordance with the requirements listed for periodic inspection.

The standard also states that in addition to the above inspections, any other inspection provisions found in the crane manual should also be followed. All inspections must be performed by a "designated person." There are specific and appropriate guidelines for rope inspection, as well as operational and load tests, including, lifting and lowering, trolley travel, bridge travel, and hoist-limit devices.

Unfortunately, there is little differentiation in B30.2 between types of lifts for overhead cranes and there is no requirement for any pre-lift planning. In our opinion, this is a serious safety defect in both the ASME B30 series standards and in API RP 2D.

Important types of lifts are routine, critical, and engineered, and their definitions are as follows:

Routine – lifts involving routine lifting operations governed by standard industry rules and practices, except as supplemented with unique company testing, operations, maintenance, inspection, and personnel certification requirements. Routine lifts are those mainly addressed by API RP 2D, which, it should be noted here, also does not draw a distinction between routine, critical, and engineered lifts. Routine lifts are often designated from critical lifts by a weight limit as mentioned below.

Critical – lifts where failure and/or loss of control could result in loss of life, loss of, or damage to major components, environmental releases, or a lift involving special items such as unique articles or major facility components whose loss would have serious contractual, delivery, or operational impact. There are few set rules to define whether a lift is considered critical and thereby requires a pre-lift plan. Crane manufacturers and owners or operators often set specific criteria that determine whether a lift plan is required. Some factors which determine whether or not a lift should be designated as critical are:

- When a load is lifted over or near operating equipment or safety areas designated by a dropped object study;
- When two or more pieces of lifting equipment are required to work in unison, including trolleys installed on the same bridge;
- When special lifting equipment such as non-standard crane configurations or purpose built, one-off lifting appurtenances will be used;
- The weight of the load exceeds set limits such as 20 tons;

[9] Aperiodic inspection should address the components listed under criteria for frequent inspection and should include an exhaustive list of additional components specified in the standard.

- The weight of the load exceeds 75 percent of the crane's rated capacity; or
- When making personnel transfers.

Engineered – lifts whose loads exceed the rated capacity of the crane. Engineered lifts should be performed only in exceptional circumstances and upon express approval of multiple management personnel. Every planned engineered lift should be treated as an exceptional and separate event.

Engineered lifts are so exceptional that there should be increased inspection requirements to be met prior to their operation:

One additional requirement is that the crane should be inspected by the crane manufacturer or a qualified third-party inspector in accordance with periodic inspection requirements not more than two days prior to the lift;

Another is that any deterioration or defects found by that inspector shall be considered in design calculations to support the lift;

The crane should also be inspected by the crane manufacturer or a qualified third-party in accordance with periodic inspection requirements after the engineered lift is completed and prior to release for use in normal operations; and

Finally, a record of the engineering lift, including supporting calculations, inspections, weights, and all distances moved, should be placed on file.

Note that B30.2 does address planned engineered lifts but does not compare them specifically to critical or routine lifts. The study team recommends that BSEE note the differences between these lift types and adopt an associated inspection approach to those lifts, such as the one outlined immediately above. Moreover, there should be kept on record specific forms documenting critical and engineered lift operations.

The next section of the B30.2 standard addresses operations and operator training. The operator training is not extensive. It does lay out specific items that should be incorporated into the training regimen, but it suggests very little about the duration, intensity, or frequency of the training. For example, the document states only that "…written and practical examinations that verify that the person has acquired the knowledge and skill to operate the particular crane(s) that will be operated by the person." The document gives more detailed attention to operations criteria and assigns various operations-relevant responsibilities to management and to operators. To meet the operator training requirements of B30.2, the study team recommends that BSEE require an overhead crane operator certification program which is consistent with the requirements of the National Commission for Certification of Crane Operators (NCCCO) for overhead cranes. A copy of the NCCCO candidate handbook for overhead crane operator certification is attached as Appendix A. The NCCCO certification requires both a cognitive and psychomotor demonstration of operator competence. This objective demonstration of crane operator competence cannot be overestimated.

One useful, operations-relevant facet of the B30.2 is the detailed treatment of the standard visual signals that should be given to the operator during lifts. Such signaling is critical to safe operations because verbal communication is unavailable due to ambient noise. A series of clear schematics are given. Thereafter, a miscellaneous section contains various items, such as ladders, cabs, fire extinguishers, and lockout-tagout policies and procedures.

The final section of the B30.2 standard is quite helpful. It not only lays out issues critical to maintenance, but it specifically addresses the training of maintenance personnel. It offers sources of training material and assigns responsibilities to persons involved in crane maintenance. However, the usefulness of this section is curtailed somewhat by the lack of depth in recommendations about the nature of training – basically the same problem noted above with respect to operator training. This observation notwithstanding, the final sections on crane and rope maintenance are appropriately detailed and useful. To meet the inspector training requirements of B30.2, the study team recommends that BSEE require that all frequent and periodic crane inspections be performed by an overhead crane inspector certified by a program which is consistent with the requirements of the National Commission for Certification of Crane Operators (NCCCO) for overhead cranes. A copy of the NCCCO candidate handbook for crane inspector certification is attached as Appendix B. The NCCCO certification requires both a cognitive demonstration of inspector competence and least five years of documented crane inspection experience.

The study team recommends the incorporation by reference of ASME B30.2 in 30 C.F.R. 250.198 and a specification for operation of overhead cranes in accordance with B30.2 in 30 C.F.R. 250.108.

6.5.2 B30.4: Portal and Pedestal Cranes

Some of what follows in this review of B30.4, Portal and Pedestal Cranes, is adopted from the inspection-specific gap analyses conducted in the analysis of API Spec 2C and API RP 2D.

By far, ASME B30.4, "Portal and Pedestal Cranes" is the standard of the B30 series most germane to the offshore community. The reason is simple: Portal and pedestal cranes are the most common crane type found in offshore GOM Region operations. Below, the ASME B30.4 standard is reviewed more deeply than in previous tasks, again with a special emphasis on inspection.

The specific scope of the B30.4 offers provisions that apply to the construction, installation, operation, inspection, and maintenance of electric motor or internal-combustion engine-powered portal and pedestal cranes that adjust operating radius by means of a boom luffing mechanism or by means of a trolley traversing a horizontal boom, that may be mounted on a fixed or traveling base, and to any variation thereof that retain the same fundamental characteristics.

Relevant Definitions

Luffing crane – a crane with a boom pinned to the superstructure at its inner end and containing load-hoisting tackle at its outer end and with a hoist mechanism to raise or lower the boom in a vertical plane to change load radius;

Pedestal crane – a crane consisting of a rotating superstructure with operating machinery and boom, all of which is mounted on a pedestal; and

Portal crane – a crane consisting of a rotating superstructure with operating machinery and boom, all of which is mounted on a gantry structure, usually with a portal opening between the gantry columns or legs for traffic to pass beneath the crane. The crane may be fixed or on a traveling base.

A pedestal crane is shown in Figure 14 and a portal crane is shown in Figure 15, both cranes have luffing booms.

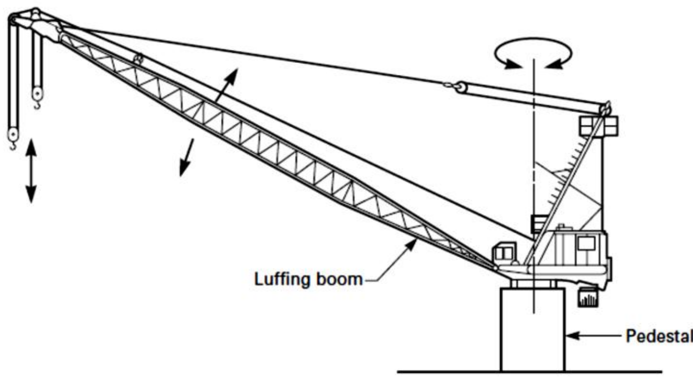


Figure 14: Pedestal Crane

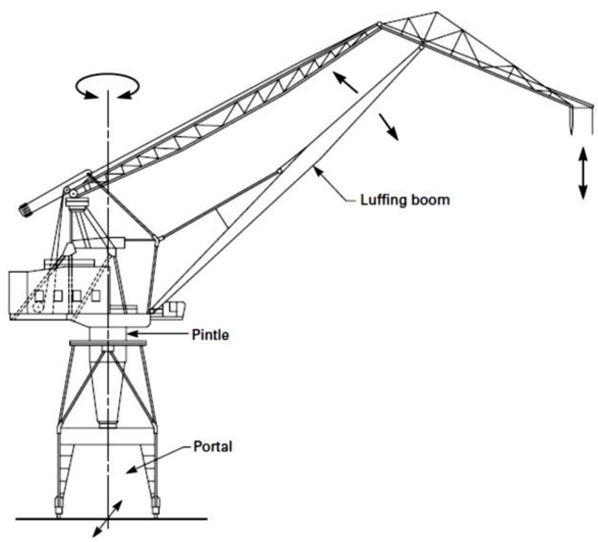


Figure 15: Portal Crane

There are three main sections in the B30.4 standard. The first concerns the erection, characteristics, and construction of pedestal and portal cranes. The second concerns inspection, testing, and maintenance. The third concerns operation.

The first section in B30.4 gives detailed treatment of crane supports, general erection requirements, and pre-operation procedures. The only mention of inspection in these early paragraphs requires crane components to be inspected visually to ensure they are not damaged, prior to erection.

Later paragraphs address load ratings and stability and differentiate between ratings where stability primarily governs lifting performance and where structural competence primarily governs lifting performance. The former category focuses on stipulated operating radii with the boom in the least stable direction. There are directions to manufacturers to consider the most important stability factors when calculating load ratings. These factors include, boom length, jib, or combination of boom and jib mounted, counterweight arrangement, and, when applicable, tower height. Wind forces and lifting attachments that are permanent parts of the crane are also noted as important stability considerations.

The latter category – load ratings where structural competence governs performance – is based on stipulated operating radii in the least favorable direction and at the maximum in-service velocity, per manufacturer specification. The standard is performance based in this regard, because neither the least favorable situation, nor a representative set of unfavorable conditions is well defined. This lack of definition requires the manufacturer to provide case-by-case data for each crane.

Next, clear and important requirements for load rating charts, backward stability, out-of-service stability, and procedures for altered or modified cranes are given. The B30.4 is very clear about the documentation that should be provided to the crane designers in order to meet the structural requirements given site preparation and crane support design data. Other important documentation includes erection instructions for the relevant personnel, operating instructions, maintenance requirements, repair recommendations, and design characteristics affecting safety. These characteristics are spelled out nicely; they include limiting and indicating devices, hydraulic and pneumatic relief valves, and limitations on service life of load-bearing members or mechanisms.

General qualitative requirements for hoisting equipment, including hoist drums, hoist brakes, hoist sheaves, and hoist ropes are addressed before more specific requirements for boom hoist drums, boom hoist sheaves, and load trolley systems. Slewing (swinging) and linear traveling equipment are mentioned, though they are given only short treatment. Similar information is given for brakes, switches and limiting devices, boom and jib support ropes, reeving accessories, and counterweights.

The requirements are for the operating controls and operator cabs are disappointingly similar to those given for overhead and gantry cranes in B30.2. They almost exclusively focus on the failsafe modes of the controls, but do not incorporate human factors information, such as those given by ASTM F1166. Incorporating such principles are well known to not only increase safety, but also to increase optimal nominal performance.

General requirements for the electrical equipment, foot-walks, ladders, and guards for moving parts are all similar to B30.2. However, some notable differences between overhead cranes and pedestal mounted cranes can be observed. For example, there is a requirement that exhaust gases be piped and discharged away from the operator due to the proximity of the engine.

The second major section of the B30.4 is the most important for this analysis – Inspection, Testing, and Maintenance. That these three issues are treated in one section contributes to the brevity of B30.4 relative to API Spec 2C and API RP 2D, along with the fact that the ASME B30 series breaks out relevant issues in several smaller standards.

The inspection section of the ASME B30.4 carves inspection classification into initial inspection, which entails all new, reinstalled, altered or repaired cranes, and regular inspection, which entails two subcategories. The two subcategories of regular inspection are frequent and periodic. The former subcategory could be monthly for light service, weekly for normal service, or daily for heavy service. The latter subcategory, periodic inspection, is done on the order of 1- to 12-month intervals, or as specifically recommended by the manufacturer. The standard then lays out several explicit criteria for appropriate inspection on these different schedules, as noted above. Again, the main critical component given special attention, however, is wire rope inspection and replacement criteria.

Table 2 shows that there is quite a bit of overlap between the inspection requirements given for overhead and gantry cranes (B30.2) and for pedestal-mounted and portal cranes (B30.4). The differences primarily reflect the differences in the crane design and operations. However, the magnitude of the scope of parts to be inspected and the schedule on which they are to be inspected are similar. One difference is that the B30.4 goes into much more detail about what information needs to be recorded in the test record than does B30.2. Note that both require records to be laid down.

The B30.4 goes into much greater detail for rope inspection and replacement as well. It also comments on the maintenance of the rope and gives very specific criteria for thresholds past which the rope should be repaired or replaced. Despite some differences, the fundamental approach to inspection is quite similar across the standards. The table shows the results of an inspection-related comparison concerning the ASME B30 standards. The (•) indicates coverage. Empty cells indicate no coverage. Other B30 series standards are included in the table but analyzed later in this analysis.

	ASME B30.2	ASME B30.4	ASME B30.7	ASME B30.8	ASME B30.9	ASME B30.10	ASME B30.16	ASME B30.20	ASME B30.21	ASME B30.24
Initial Inspection	•	•	•	•	•	•	•	•	•	•
Functional Test Inspection	•	•	•							
Frequent Inspection	•	•	•	•	•	•	•	•	•	•
Periodic Inspection	•	•	•	•	•	•	•	•	•	•
Every-Lift Inspection								•		
Inspection of Equipment Not in Regular Use	•	•	•	•			•	•	•	•
Rope Inspection	•	•	•	•	•		•		•	•
Frequent Rope Inspection	•	•	•	•			•		•	•
Periodic Rope Inspection	•	•	•	•			•		•	•
Operational Tests	•	•	•		•	•	•			•
Lifting and Lowering Tests	•									
Trolley Travel Tests	•	•								
Bridge Travel Tests	•									
Hoist Limit Device Tests	•						•			•
Load Tests	•	•	•			•	•			
Test / Inspection Records	•	•	•	•	•	•	•	•	•	
Winches			•							
Slings					•					
Hooks	•					•			•	
Overhead Hoists							•			
Below-the-Hook Lifting Devices								•		
Lever Hoists									•	

Figure 16: Comparison of Relevant B30 Series Standards

The final section of B30.4 addresses operations. It puts forth qualifications for and conduct of operators and operating practices. Only designated persons, trainees under direct supervision of a designated person, maintenance and test personnel, and crane inspectors shall enter the crane cab. The standard lays out qualifications for operators, which are slightly and usefully more involved than those put forth in B30.2. The same holds for the conduct of operators subsection, which addresses issues such as attention diversion, mental fitness, and response to warning indications. Because pedestal-mounted and portal cranes are versatile, and because they are often used in unique places like the offshore community, the B30.4 also addresses personnel lifting in an extended section. Standard, hand, and special signals are also schematized in the standard, much like in the B30.2.

API SPEC 2C and API RP 2D substantially include all of design, inspection the training requirements of B30.4 with the exception of medical qualifications of the operator, but are aimed at the specific requirements for the offshore environment. Since the API RP 2D standard gives little guidance on how to assess the physical qualifications of the crane operator, addressing this issue is pivotal for ensuring that the operator has the physical capabilities required to operate crane controls for appropriate durations. Thus, the study team recommends that BSEE adopt either ASME B30-4, Portal and Pedestal Cranes, section 4-3.1.2, or the physical instructions to physicians for qualifying physical examinations (attached as Appendix C) put forth by NCCCO as a supplement to API RP 2D. Otherwise, the study team does not recommend the adoption of ASME B30.4 as a substitute for the two API standards already incorporated by reference in 30 C.F.R. 250.108.

6.5.3 B30.7: Winches

The specific scope of the B30.7 standard is to give provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of winches arranged for mounting on a foundation or other supporting structure for moving loads. Winches addressed in this standard are those typically used in industrial, construction, and maritime applications. The requirements included in this Volume apply to winches that are powered by internal combustion engines, electric motors, compressed air, or hydraulics, and that utilize drums and rope.

Importantly, the standard explicitly excludes overhead hoists and winches used with the following:

(a) all-terrain-type recreational vehicles;
(b) drill rig relocation trucks;
(c) tow trucks;
(d) vehicle recovery units;
(e) boat trailers;
(f) amusement park rides;
(g) excavating equipment; and
(h) equipment covered by ANSI A10, A17, A90, A92.

Note that a winch is defined as a power-driven drum that when attached to a load is capable of moving the load. Examples of winches are shown below in Figure 17 and Figure 18 below.

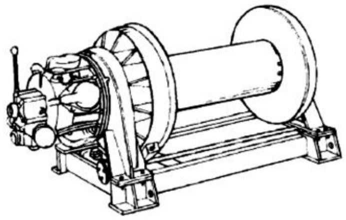


Figure 17: Single-Drum Winch

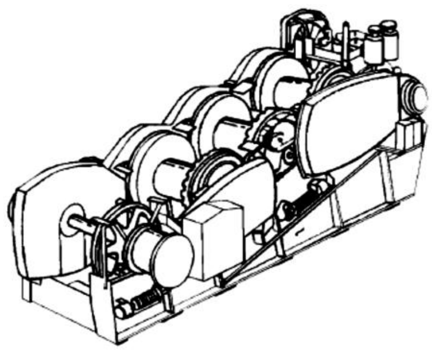


Figure 18: Three-Drum Winch with Attached Swinger

The B30.7 standard on winches adequately addresses ratings, markings, and construction. Especially important sections concern brakes, guards, and ropes. The controls must be marked and must be located within reach of the operator while at the operator station. Electrical winches are to have an interlock that will disconnect all motors from the power source in the event of a power failure and will not permit any motor to be restarted until the controller handle is brought to the off position or a rest switch or button is depressed. Remote-operated winches must stop in the event that the control signal for any motion becomes ineffective. The standard concludes the construction section by making short but important statements on engine clutches, electrical components, and lubrication.

An installation section assigns the responsibility of winch attachments solely to the operator, who should be a qualified person. The installation section is quite short, concluding with a statement that all winches should be installed in a manner that allows proper rope spooling on the drums.

The second section of B30.7 addresses the inspection, testing, and maintenance. Here, the five types of inspection show up again. These are the initial, daily, frequent, periodic, and irregular-use inspections. This common framework is modified as needed for the specific issues involved with winches.

Operational and load tests are specified and required. There are clear and concise preventive maintenance requirements that simply refer the reader to the manual specifications of the winch manufacturer and to ANSI Z244.1 for lockout/tagout procedures to be used during maintenance.

The final section concerns qualifications and conduct of operators. Qualified persons are those who have met the requirements put forth in subsequent paragraphs, trainees under the direct supervision of an operator, and maintenance, inspection, and test personnel who have been trained.

The qualifications and conduct of operators requirements closely mirror those described above. There are specific cautions to personnel with regard to winches that include avoiding crushing or pinch points, not standing in line with a load line that is under tension, standing clear of any slack, loops, or curves while the rope is being tensioned, inspecting the load line paths and operating areas to establish suitable barriers and guards, not placing any portion of the body on a winch line under tension, and not wearing loose clothing around winch operations.

The study team recommends the incorporation by reference of ASME B30.7 in 30 C.F.R. 250.198 and a specification for operation of winches in accordance with B30.7 in 30 C.F.R. 250.108.

6.5.4 B30.8: Floating Cranes and Floating Derricks

This standard applies to cranes and derricks, used for vertical lifting and lowering of loads, mounted on barges or pontoons. An example is shown in Figure 19 and Figure 20 below.

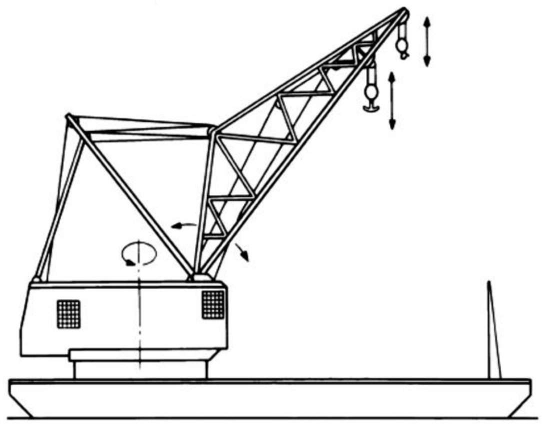


Figure 19: Floating Crane

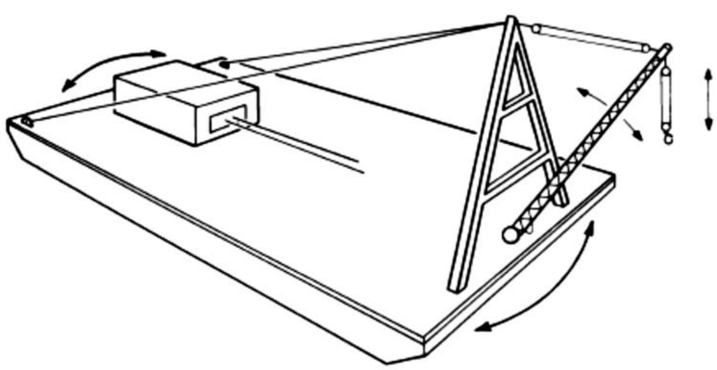


Figure 20: Floating Derrick

The B30.8 standard is structured similarly to B30.4, reviewed above. It has three major sections, which again look at construction and installation, inspection, testing, and maintenance, and operations.

Together, the B30.4 and the B30.8 are the two B-series documents that address those cranes most likely to be found offshore. In the case of the B30.8, which concerns floating cranes and derricks, the standard notes that cranes and derricks can be designed for barge or pontoon mounting, or they can be designed for land but then mounted on barges or pontoons. In the former case, the load ratings are more dependent upon structural competence, rope strength, hoist capacity, the structural attachment to the floating platform, and upon stability and freeboard of the floating platform, barge, or pontoon. In the latter case, the load ratings are more dependent upon stability, structural competence, rope strength, and hoist capacity of the crane or derrick, and also upon the stability and freeboard of the floating platform, barge, or pontoon upon which they are mounted. With these issues in mind, several specific issues relating to rated loads and rated load marking are presented. The standard then focuses on ensuring that the barge or pontoon is capable of withstanding the weight of the crane or derrick plus lift weight and other anticipated deck loads.

To help ensure safe operations, the operational criteria include operating list and trim of the barge or pontoon as a result of the lift. This consideration is schematized in Figure 21 below.

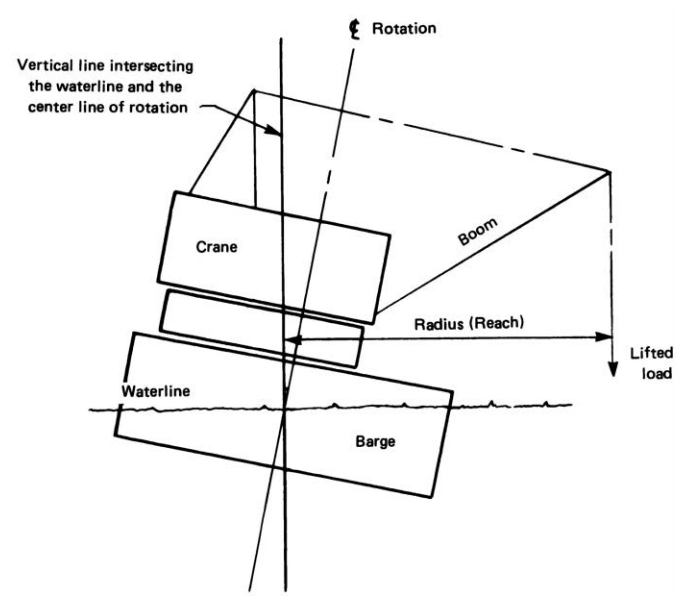


Figure 21: Issues to Consider when Assessing Operating List and Trim

The more specific quantitative considerations are spelled out for floating cranes and derricks designed for barges / pontoons and for land. The standard rightly addresses the general requirements for the pontoons and barges. Critical to this general issue are several more specific ones, such as watertight compartments to avoid capsizing, manholes and hatches, fittings, life preservers, and rescue skiffs.

The crane- and derrick-specific requirements guards on electrical and certain mechanical equipment, and miscellaneous equipment, such as a Coast Guard-approved fire extinguisher, audible warning devices, self-closing filler cap for fuel tanks, and navigational lights. Boom hoists and loads are then specifically addressed, along with the control, braking, and locking of any swing mechanisms. The subsection on controls is nearly identical previous sections on controls reviewed above. Likewise, requirements for ropes, sheaves, cabs, and booms are all given similar treatment.

The inspection, testing, and maintenance section of B30.8 contains now-stock information on initial and regular inspection classifications. However, many of the items to be inspected are unique to floating cranes, derricks, barges, and pontoons. The list is longer and slightly more involved for the periodic inspections, per common practice in the B30 series. Detailed requirements are given for the operational and load tests, also per custom. The maintenance specifications are very similar, though this standard calls for a service history – a historical inspection program including records on examination of ropes removed from service so a link between visual observation and actual condition of the internal structure can be established. This feature is highly desirable, mainly because collecting and analyzing those data can help better predict the condition of the equipment as a function of time and usage.

The operations section is nearly identical to those reviewed above. However, one particular difference of note is the issue of securing booms during nonuse. It is noted that floating crane and derrick booms are not normally designed to resist substantial wind loads. Thus, it is required that unloaded booms not be left at high angles. When not in use, the derrick booms must be laid down, secured to a stationary member, raised to a vertical position an secured to the mast. When not in use the crane booms must be lowered to the deck of the barge and secured and secured on the boom rest or cradle. For both lifting devices there should be engaged positive locking mechanisms on the boom hoist.

There are also some unique issues with providing means suitable for embarking and disembarking barges or pontoons in accordance with regulatory requirements. Floating cranes and derricks also do not meet personnel lifting or elevator requirements and thus should not be operated when anyone is on the hook, load, man-lift platform, boom, or other personnel lifting device attached to the crane load line or boom, unless each several special following conditions are met. The standard lays out those conditions thoroughly.

Finally, there are several requirements put forth for clear communication with the operator. These include those signals mentioned several times above.

Because floating vessels such as barges are not attached to the OCS as are fixed platforms or mobile offshore drilling units, they fall under the jurisdiction of the U.S. Coast Guard and therefore the study team does not recommend the incorporation of B30.8 in 30 C.F.R. 250.198.

6.5.5 B30.9: Slings

Slings are assemblies to be used for lifting when connected to a lifting mechanism. The upper portion of each sling is connected to the lifting mechanism and the lower supports the load. As the interface between the load and the crane, the sling remains an incredibly critical component. Perhaps unsurprisingly, then, ASME devoted an entire 80-page standard to addressing the fabrication, attachment, use, inspection, and maintenance of slings used for lifting purposes. The following is a review and analysis of that information, which covers slings fabricated from alloy steel chain, wire rope, metal mesh, synthetic fiber rope, synthetic webbing, and synthetic fiber yarns in a protective cover.

At a high level, the B30.9 standard takes a nearly identical to all slings made of the different materials just mentioned. The present analysis capitalizes on this observation by laying out, just one time, the general template used by B30.9 with alloy chain slings as an example. The analysis then notes only those important features that differ across the different types of slings subsequently mentioned. In turn, this point points up the fact that the section associated with each type of sling does contain several unique pieces of information. Per the present call order, inspection-relevant issues are drawn into particular focus, though the general template includes training, materials and components, fabrication and configurations, proof tests, sling identification, effects of environment, inspection, removal, and repair, and operating practices.

The first type of slings addressed by B30.9 is alloy steel chain. Examples are shown in Figure 22 below.

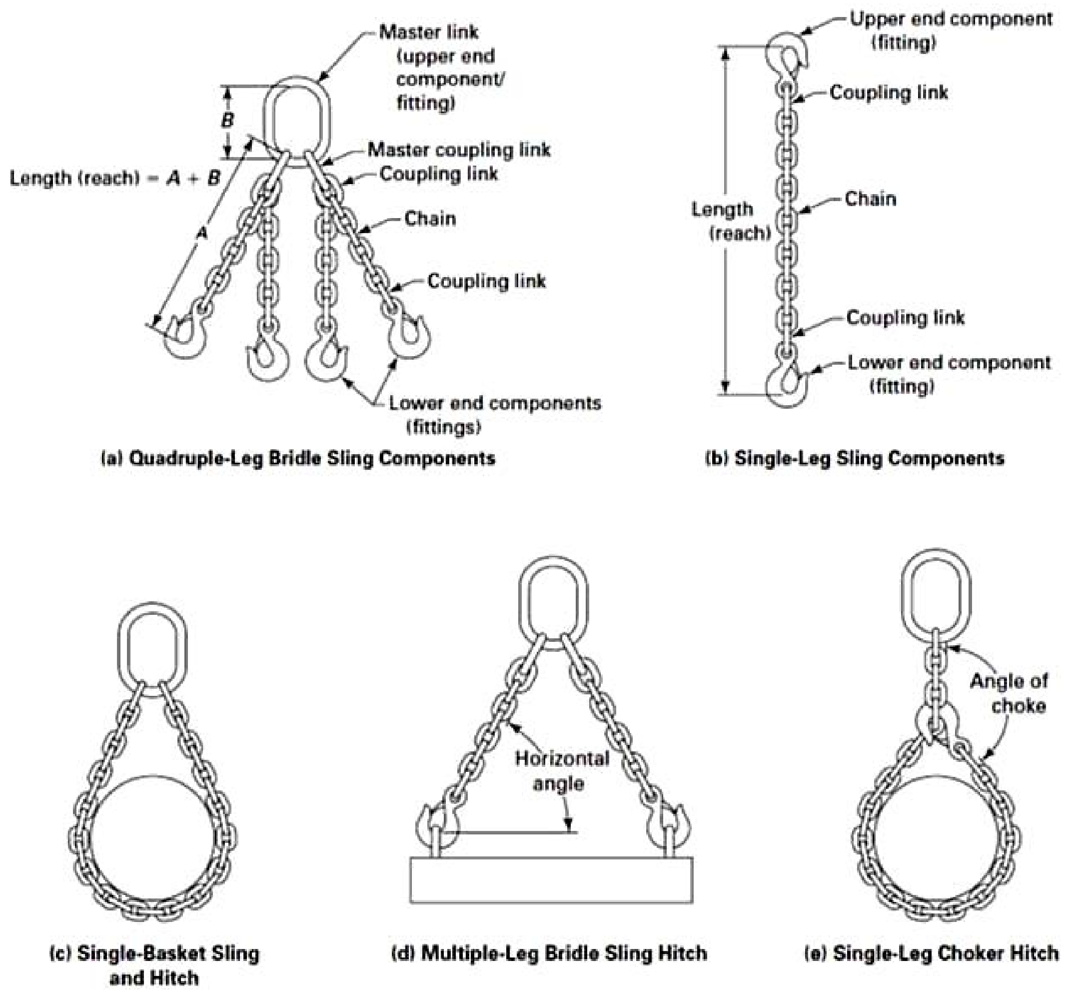
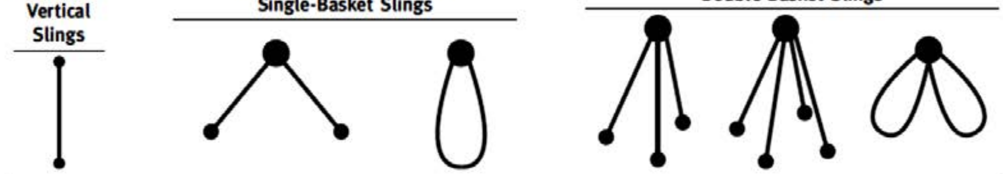


Figure 22: Various Alloy Steel Chains

Alloy chain sling users are supposed to be trained in the selection, inspection, cautions to personnel, effects of environment, and rigging practices. Specific criteria are given for the composition of the primary material – in this case, alloy steel – and for the welding of specific components, such as handles, fasteners, and coupling links. Several ASTM and ASME standards are used as normative references. Different possible configurations are mentioned and explained, along with the relevant design factor. The standard is quite explicit and detailed when it comes to data for rated loads. Figure 23 below shows an example of the detail level to which loads are given. In the standard, another whole table addresses the same data but for Grade 100 alloy steel chain slings. That particular table is not shown here for the sake of brevity.



Nominal Chain Size		Single-Leg Vertical Slings	Double-Leg Bridle Slings, Single-Basket Slings			Triple- and Quadruple-Leg Bridle Slings, Double-Basket Slings		
		Horizontal Angle, deg [Note (1)]						
		90	60	45	30	60	45	30
in.	mm	lb	lb	lb	lb	lb	lb	lb
7/32	5.5	2,100	3,600	3,000	2,100	5,500	4,400	3,200
9/32	7	3,500	6,100	4,900	3,500	9,100	7,400	5,200
5/16	8	4,500	7,800	6,400	4,500	11,700	9,500	6,800
3/8	10	7,100	12,300	10,000	7,100	18,400	15,100	10,600
1/2	13	12,000	20,800	17,000	12,000	31,200	25,500	18,000
5/8	16	18,100	31,300	25,600	18,100	47,000	38,400	27,100
3/4	20	28,300	49,000	40,000	28,300	73,500	60,000	42,400
7/8	22	34,200	59,200	48,400	34,200	88,900	72,500	51,300
1	26	47,700	82,600	67,400	47,700	123,900	101,200	71,500
1 1/4	32	72,300	125,200	102,200	72,300	187,800	153,400	108,400

Figure 23: Rated Load for Grade 80 Alloy Steel Chain Slings — Vertical, Basket, and Bridle Hitches

Proof tests are critical. The standard states that prior to initial use, all new and repaired chain and components of an alloy steel chain sling, either individually or as an assembly, shall be proof tested by the sling manufacturer or a qualified person. Several more specific proof load requirements for various slings are given.

The following items of identification must be present for the life of the sling:

(a) name or trademark of manufacturer;

(b) grade;

(c) nominal chain size;

(d) number of legs;

(e) rated loads for at least one hitch type and the angle upon which it is based;

(f) length (reach); and

(g) individual sling identification (e.g., serial numbers).

The effects of the environment are always a necessary consideration. For alloy steel slings, high or low temperatures, along with chemically active environments are clear performance reducers. Optimal temperature ranges are given, and the standard requires consultation with the sling manufacturer to understand the chemicals which can reduce the performance of the slings.

Initial, frequent, and periodic inspections are required. Written records are not required for initial and frequent visual inspections. Periodic inspections should address each link component. The frequency of periodic inspections are not concretely defined; they are based on the following duty cycle factors:

(1) frequency of sling use;

(2) severity of service conditions;

(3) nature of lifts being made; and

(4) experience gained on the service life of slings used in similar circumstances.

There are guidelines for time intervals. The first is that the period between periodic inspections should not exceed one year. The other guidance criteria are as follows:

(1) normal service — yearly;

(2) severe service —monthly to quarterly; and

(3) special service — as recommended by a qualified person.

A written record of the most recent periodic inspection is required to be maintained and available.

The standard does a good job at laying out fairly specific criteria for removal of the sling. There are 12 criteria in all, and some other ASME B30 series standards are referenced for additional guidance.

Slings are to be repaired only by the sling manufacturer or other qualified persons. A marking is required for those slings that have been repaired – a very good idea. In addition, there are some components that, upon inspection, are deemed inadequate for continued use, must be replaced, not repaired. These components include cracked, broken, or bent chain links.

The final section, on operating practices, gives guidance on sling selection, cautions to personnel, such as clearance for body parts and where to stand during lifts, effects of environment, such as appropriate storage locations, and rigging practices. The last of these practices, rigging, is given particular treatment, with over 15 criteria explicitly laid out in order to avoid problems, such as shock loading, twisting, and kinking.

The second type of slings addressed by B30.9 is wire rope. An example is shown in Figure 24 below.

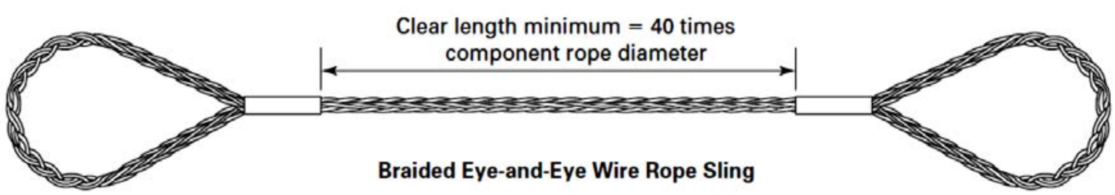


Figure 24: Braided Eye-and-Eye Wire Rope Sling

As noted above, the approach of the standard to all sling types is similarly structured. One key difference for wire rope slings is their versatility in hitch configurations. Because of this versatility, there are several more load ratings given for wire rope per the different possible configurations.

The inspection approach is also quite similar. Initial, frequent, and periodic inspections are required. The period between periodic inspections cannot exceed one year, and written record of only the most recent periodic inspection is required. Several more details are specific to the wire rope sling and its many variants.

The third type of slings addressed by B30.9 is metal mesh. An example is shown in Figure 25 below.

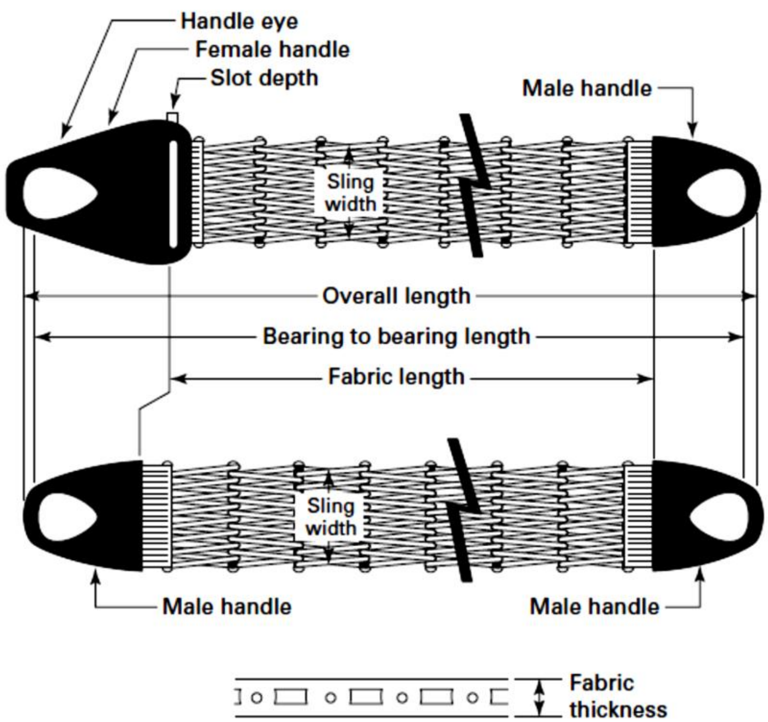


Figure 25: Wire Mesh Sling

The fourth type of slings addressed by B30.9 is synthetic rope. Examples are shown in Figure 26 below.

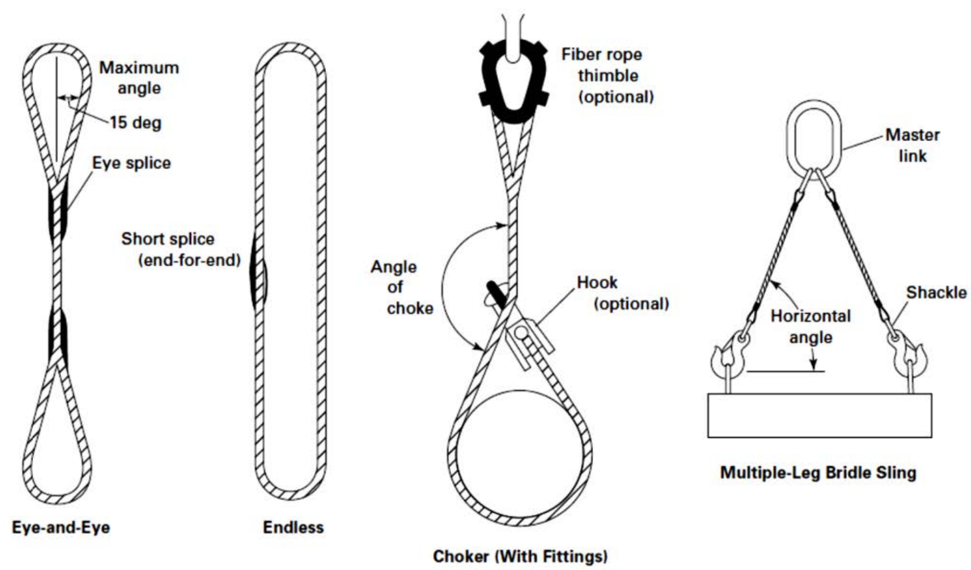


Figure 26: Synthetic Rope Slings

The fifth type of slings addressed by B30.9 is synthetic webbing. Examples are shown in Figure 27.

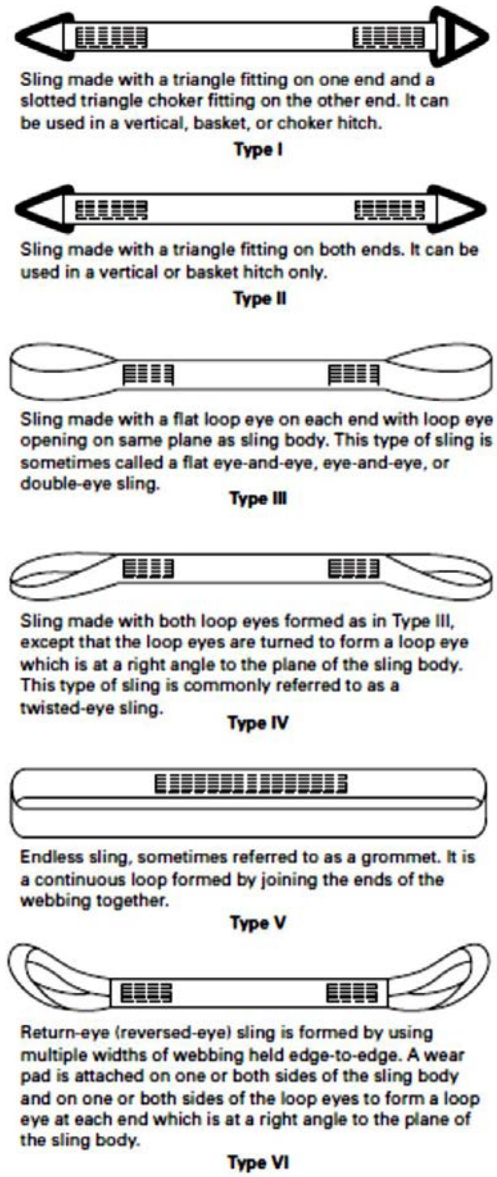


Figure 27: Synthetic Webbing Slings

The sixth type addressed by B30.9 is the synthetic round sling. Examples are shown in Figure 28.

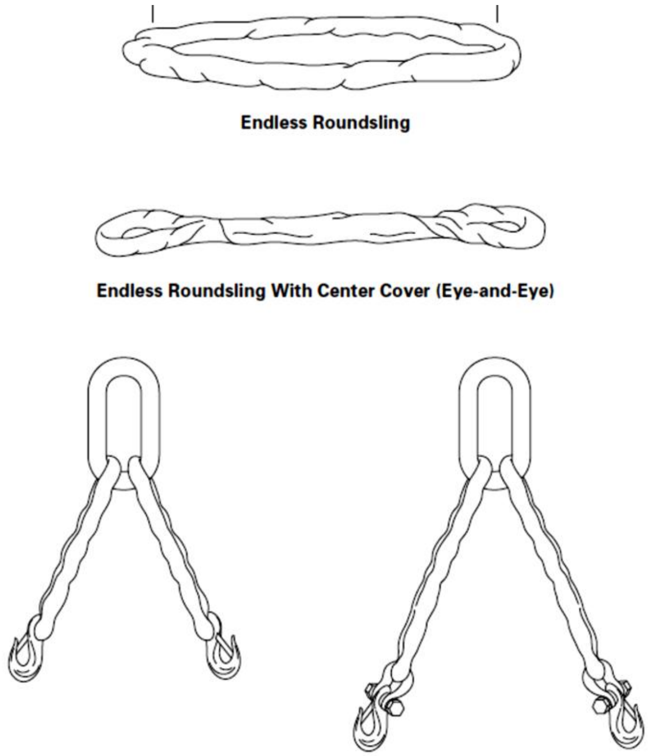


Figure 28: Synthetic Round Slings

API RP 2D Section 5.2.1 incorporates ASME B30.9; therefore, the study team does not recommend incorporating B30.9 in 30 C.F.R. 250.198.

6.5.6 B30.10: Hooks

The B30.10 standard puts forth provisions that apply to the fabrication, attachment, use, inspection, and maintenance of hooks used for load handling purposes, in conjunction with equipment described in other B30 series standards. There are two main sections. The first is the main section, covering selection, use, and maintenance. The second section addresses miscellaneous information.

The first section applies to the types of hooks exemplified in Figure 29. These hooks support the load in the base of the hook, in the bowl, saddle, or pinhole.

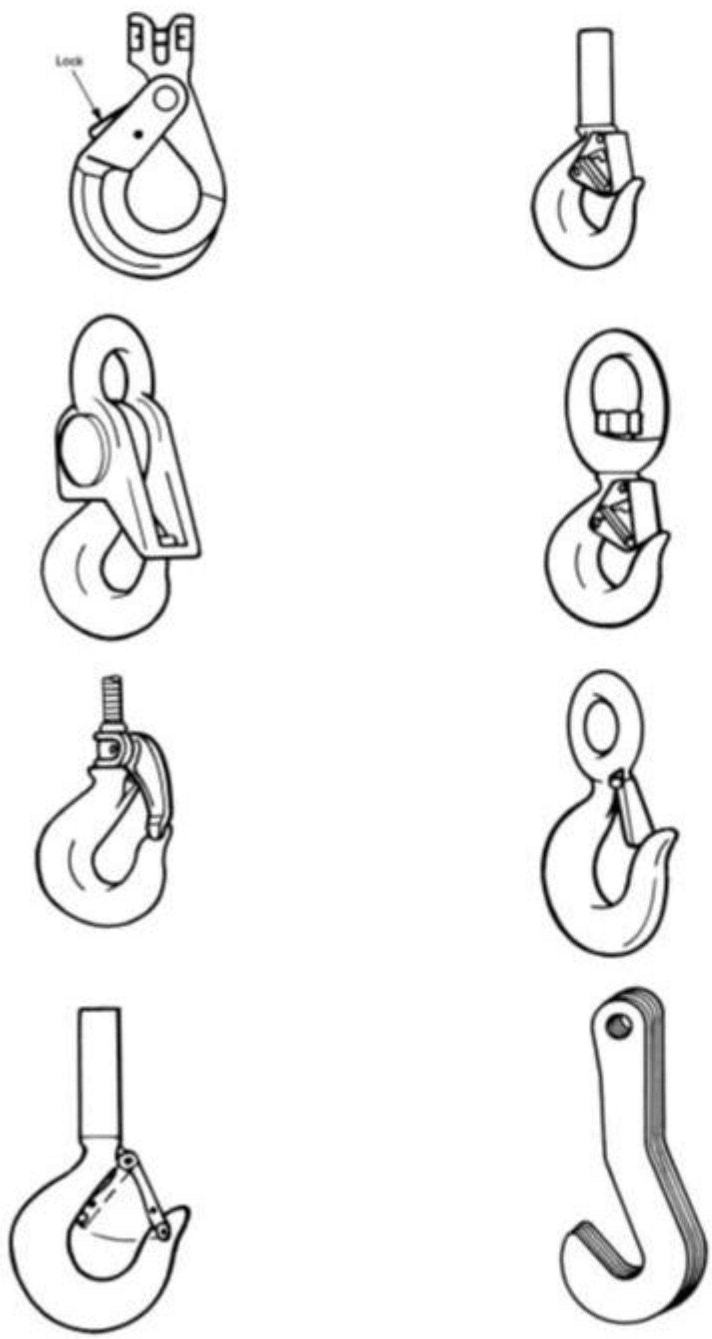


Figure 29: Base-Supporting Hooks

Hooks can be considered parts of other equipment, in addition to being equipment unto their own. Thus, the B30 series gives special attention to hooks in their own standard but also notes that the requirements given therein must be used in addition to any other hook-related requirements given in any other B30 standard.

The document gives suggestions about sources for required training of hook users, who are required to be trained in the selection, inspection, cautions to personnel, effects of environment, and operating practices, as covered by the subsequent sections.

Specific requirements are given for materials and components, fabrication configurations, design factors, and rated loads. Proof test requirements are somewhat involved but appropriate. Temperature and chemical effects of the ambient environment are briefly described and ranges optimal operating ranges are given.

The approach to hook inspection is somewhat unique, given that hooks can be integral parts to other pieces of equipment. All inspections are to be performed by a designated and qualified person. Inspection procedure and record keeping requirements for hooks in regular service are to be governed by the kind of equipment in which they are used. This point means that there are likely to be other requirements for hooks coming from standards on other equipment in which they are integrated. When this occurs, the more stringent of the two sets of requirements (the other set coming from the B30.10) should be used.

The criteria given in the B30.10 include initial, frequent, and periodic inspections, all qualified by the same definitions given in previous sections of this analysis. Written records are required for periodic inspections. Several specific removal criteria are given. Finally, the operating practices are divided into subsections that address single-point hooks and multiple-point hooks separately.

The second, miscellaneous section applies to all hooks that do not support a load in a direct-pull configuration, such as grab hooks, foundry hooks, sorting hooks, and choker hooks. Examples of such hooks are shown in Figure 30. All the other subsections of this second section are laid out identically to the previous section just described. Some information unique to hooks that do not support direct pull populate these subsections. None of that information directly bears on inspection, however.

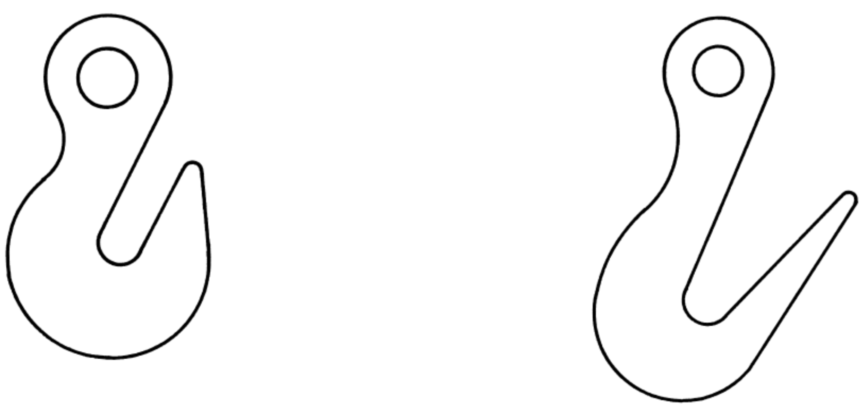


Figure 30: Hooks that Do Not Support Direct Pull

The study team recommends the incorporation by reference of ASME B30.10 in 30 C.F.R. 250.198 and a specification for operation of hooks in accordance with B30.10 in 30 C.F.R. 250.108.

6.5.7 B30.16: Overhead Hoists

The B30.16 standard puts forth provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of hand chain-operated chain hoists and electric- and air-powered chain and wire rope hoists used for, but not limited to, vertical lifting and lowering of freely suspended, unguided loads that consist of equipment and materials. Hoist examples are shown in Figure 31 through Figure 34 below.

Figure 31: Hand-Operated Chain Hoists

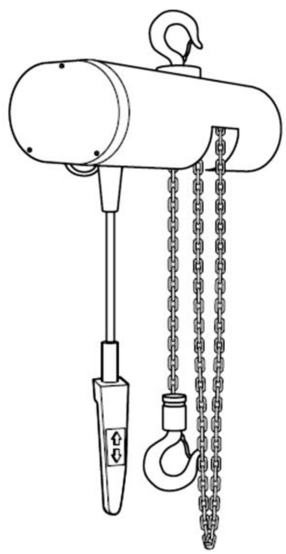


Figure 32: Electrical-Powered Chain Hoist

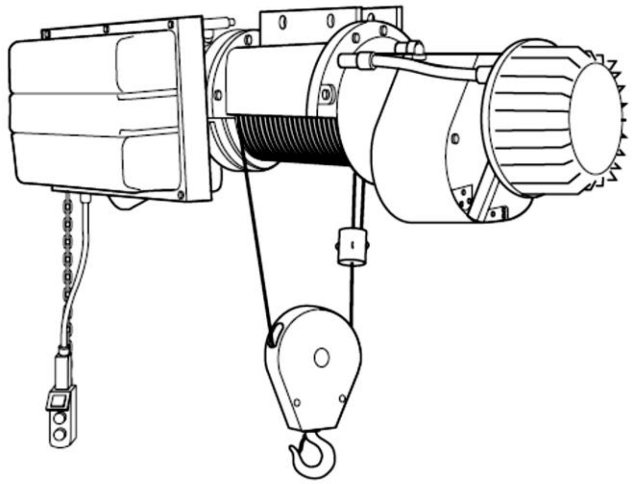


Figure 33: Electric-Powered Wired Rope Hoist

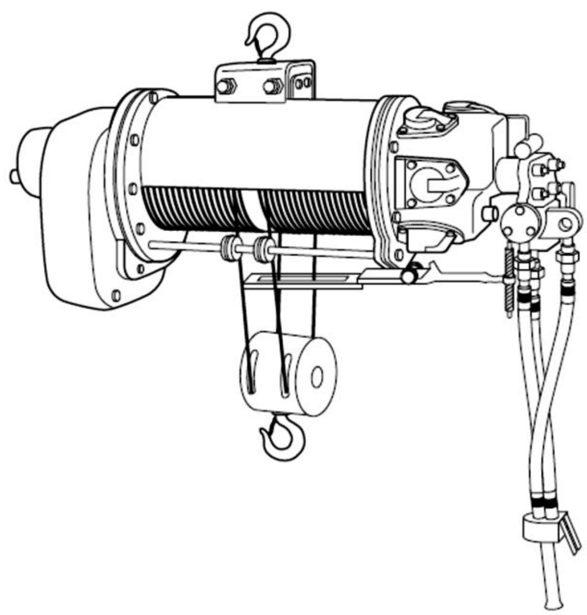


Figure 34: Air-Powered Wire Rope Hoist

Three main sections of B30.16 put forth requirements for marking, construction, and installation, inspection and testing, and operator training and operations. The marking requirements concern making clear the rated loads, the direction of travel related to certain controls, and type identification. There is also a list of product safety information that should be made available, per the standard.

The construction section is straightforward, addressing mechanical, electrical, and design features, along with controls, ropes, sheaves, load sprockets, load chains, hooks, load blocks, and brakes. There is also a series of unique protections required. These include guards against over-travel and power failure. Installation requirements specify procedures, required support, locations, and power connections.

The standard calls for initial inspection but also for a series of other inspections. Inspection procedures for hoists in regular service are divided into three general classifications based upon the intervals at which inspection should be performed. The intervals depend, in turn, on the nature of the critical components of the hoist and the degree of their exposure to wear, deterioration, or malfunction. The three general classifications are designated as pre-operation, frequent, and periodic, with respective intervals between inspections as follows:

(1) pre-operation inspection: visual inspection by a designated person with records not required, performed before the first use of each shift;

(2) frequent inspection: visual examinations by a designated person with records not required;

(a) normal service — monthly;

(b) heavy service —weekly;

(c) severe service — daily; and

(3) periodic inspection: visual inspection by a designated person who makes records of external conditions to provide the basis for a continuing evaluation. An external coded mark on the hoist is an acceptable identification in lieu of records;

(a) normal service —yearly;

(b) heavy service — semiannually;

(c) severe service —quarterly.

Specific requirements are nicely put forth with respect not only to the three inspection categories above, but also with respect to hand chain-operated hoists, and electric- or air-powered hoists. Inspection records for all types are to be kept on hand and available to appointed persons. The section concludes with specific criteria for operational and load tests for the hoist categories discussed above.

Regarding operator training, the standard states that the hoist is a component of equipment addressed by another B30 volume, the training and operation requirements of that volume shall apply. The rest of the operator and operator training sections are very similarly laid out compared to other sections discussed previously in this analysis. It offers sources of training material and assigns responsibilities to persons involved in hoist operations, such as management and operators.

It also addresses planned engineered lifts in a way nearly identical to B30.2. Likewise, B30.16 does not define, compare, or specifically address critical or routine lifts. As noted above, the study team recommends that BSEE incorporate the differences between these types of lifts and adopt an associated inspection approach to those lifts, such as the one outlined in the analysis of B30.2 above. Moreover, there should be kept on record specific forms documenting critical and engineered lift operations.

The fourth and final section of the B30.16 standard puts forth maintenance training and general maintenance requirements. It notes that although there are many different types of hoists that handle many different types of materials in many different locations and capacities, the requirement for training as a hoist maintenance person should be general, consistent, and should apply to all persons who maintain the mechanical, structural, and electrical components of the equipment. Several sources of training material are provided and responsibilities are assigned to maintenance persons. These responsibilities range from very general and to quite specific. For example, the persons are encouraged to become familiar with the manual and relevant standards but also instructed not to use the wire rope, load chain, or hook as a ground for welding. The section calls for the establishment of a maintenance program, which should include preventive maintenance, appropriate procedures, and policies on adjustments, repairs, and replacements. Special instructions are given for replacement and maintenance of welded link chains and roller chains.

6.5.8 B30.20: Below-the-Hook Lifting Devices

This standard includes provisions that apply to the marking, construction, installation, inspection, testing, maintenance, and operation of below-the-hook lifting devices, other than components addressed by other B30 standards used for attaching loads to a hoist. A below-the-hook lifting device is defined as a device used for attaching a load to a hoist. The device may contain components such as slings, hooks, and rigging hardware.

There are five main sections of the B30.20. The first concerns structural and mechanical lifting devices. The second, vacuum lifting devices. The third, close proximity operated lifting magnets. The fourth, remotely operated lifting magnets. And the fifth, scrap and material handling grapples. Some schematic examples of these are shown in Figure 35 through Figure 38.

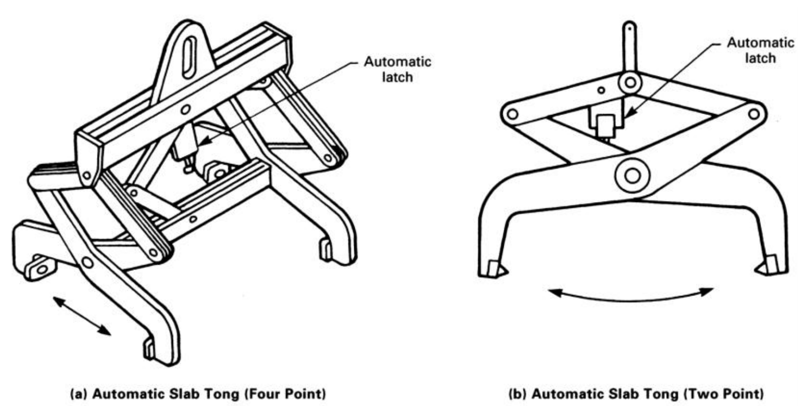


Figure 35: Pressure-Gripping Lifters

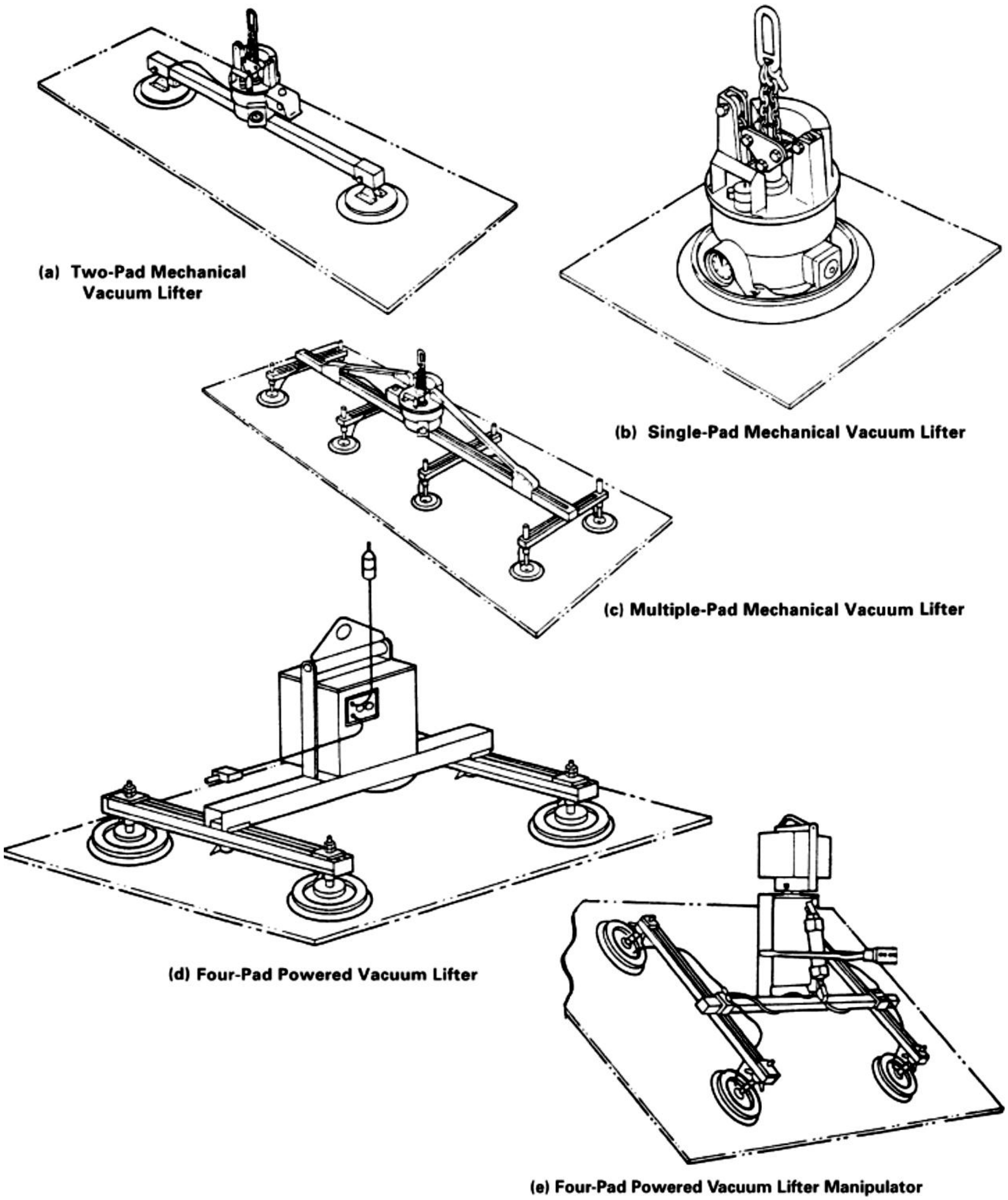


Figure 36: Vacuum Lifters

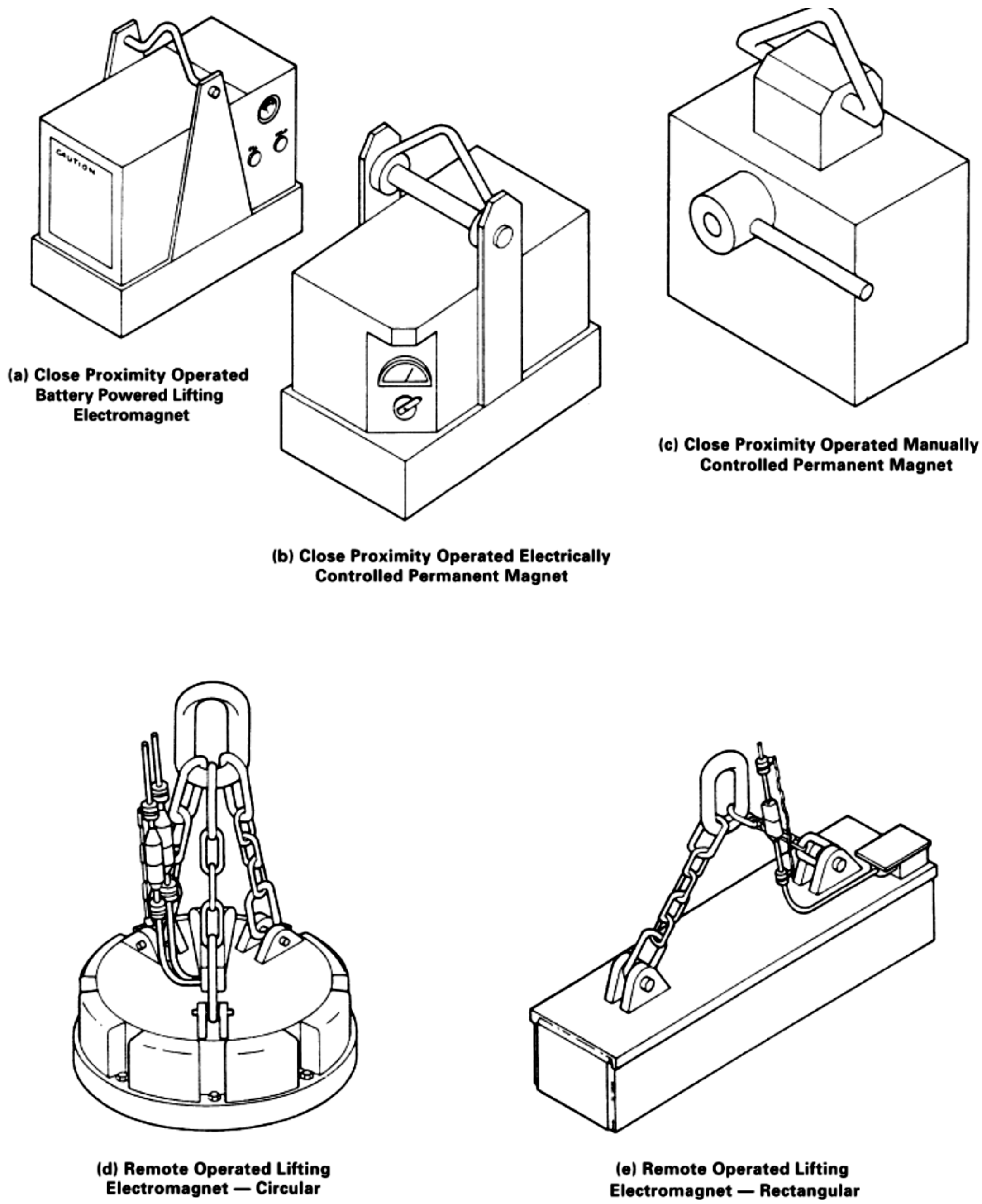


Figure 37: Magnetic Lifters

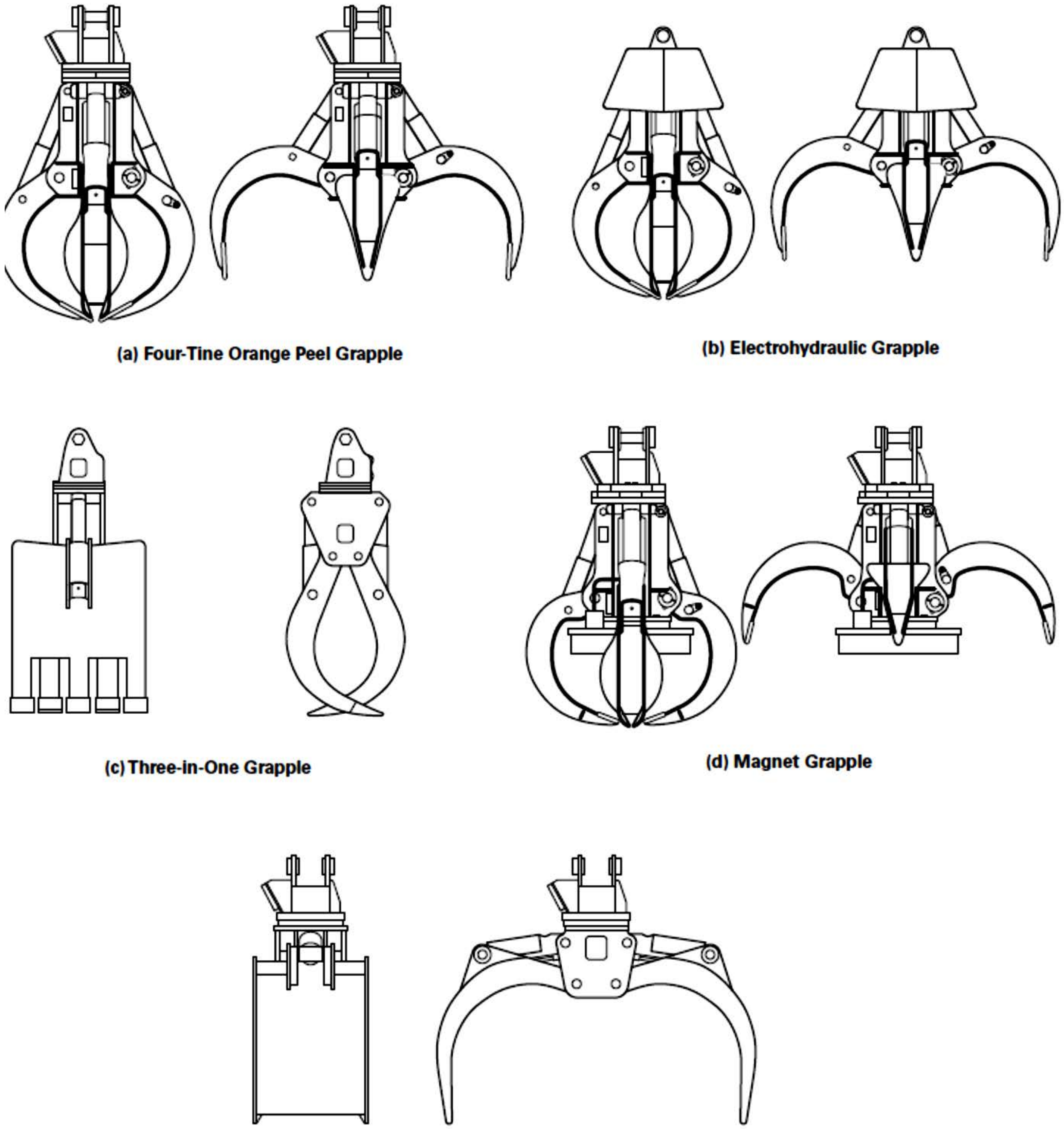


Figure 38: Scrap and Material Handling Grapples

The B30.20 standard clearly specifies the marking for rated loads and identification required for structural and mechanical lifting devices. The construction section specifies criteria for welding, guards for moving parts, electrical equipment, alterations, slings, hooks, and rigging hardware, though information on slings, hooks, and rigging hardware is all outsourced to the relevant B30 series standard.

Structural and mechanical lifting devices are to be inspected by a designated person and any deficiencies identified shall be examined and a determination made by a qualified person. The three general classifications of inspection are every-lift, which requires that the equipment be visually inspected before every lift, frequent, which requires visual inspection by the operator or other designated persons with records not required on the basis of normal, heavy, sever, and special or infrequent service, and periodic, which requires visual inspection with records of apparent external conditions to provide the basis for a continuing evaluation.

The every-lift inspection should address, before and/or during the lift, any indication of damage including surface of the load, condition and operation of the controls, and condition and operation of the indicators and meters when installed. Comparably specific instructions are given for frequent and periodic inspections. Dated inspection reports shall be made on critical items and should be available for each periodic inspection and when the lifter is either altered or repaired.

Operators should be trained, designated persons. They should be instructed in the use of the device by another designated person and should pertain to items such as, special operations, manufacturer suggested operating procedures, storage of the lifter to protect it from damage, and proper attachment of adapters, in addition to several more. Finally, various operational responsibilities are assigned to owners and operators.

The remaining sections, which cover vacuum lifting devices, close proximity operated lifting magnets, remotely operated lifting magnets, and scrap and material handling grapples, are written in nearly identical fashion and format. The notable exception is that there is no requirement for an every-lift inspection for remotely operated lifting magnets or for scrap and material handling grapples. Other than that, details pertinent to the various characteristics of the different lifting devices vary as needed.

Offshore operators often design specialty or one-off below-the-hook lifting devices. ASME BTH-1 provides minimum structural and mechanical design and electrical component selection criteria for ASME B30.20 below-the-hook lifting devices. The provisions in this standard apply to the design or modification of below-the-hook lifting devices. Compliance with requirements and criteria that may be unique to specialized industries and environments such operators on the OCS. Lifting devices designed to this standard must comply with ASME B30.20 reviewed above. ASME BTH-1 addresses only design requirements. As such, ASME BTH-1 should be used in conjunction with ASME B30.20, which addresses safety requirements. ASME BTH-1 does not replace ASME B30.20. The design criteria set forth are minimum requirements that may be increased at the discretion of the lifting device manufacturer or a qualified person. ASME BTH-1 and ASME B30.20 are to be used in conjunction with equipment described in other volumes of the ASME B30 series of safety standards.

The study team recommends the incorporation by reference of both ASME B30.20 and BTH-1 in 30 C.F.R. 250.198 and a specification for design and operation of below-the-hook lifting devices in accordance with B30.20 and BTH-1 in 30 C.F.R. 250.108.

6.5.9 B30.21: Lever Hoists

The B30.21 standard includes provisions that apply to the construction, installation, operation, inspection, and maintenance of ratchet and pawl and friction brake type lever chain, rope, and web strap hoists used for lifting, pulling, and tensioning applications.

Lever hoists are manual lever-operated devices used to lift, lower, or pull a loads and to apply or release tension. Ratchet and pawl types are load-controlling mechanisms consisting of interlocking pawls and ratchet that act to hold the load by mechanical engagement. A ratchet is a toothed member for engagement with the pawl. A pawl is a device that engages the ratchet to prevent rotation. See Figure 39 through Figure 41 for schematic examples.

Friction brake types are load controlling mechanisms are automatic types of brakes used for holding and controlling loads. These unidirectional devices require forces applied to the operating levers to lower the load but do not impose additional lever pulls when lifting the loads.

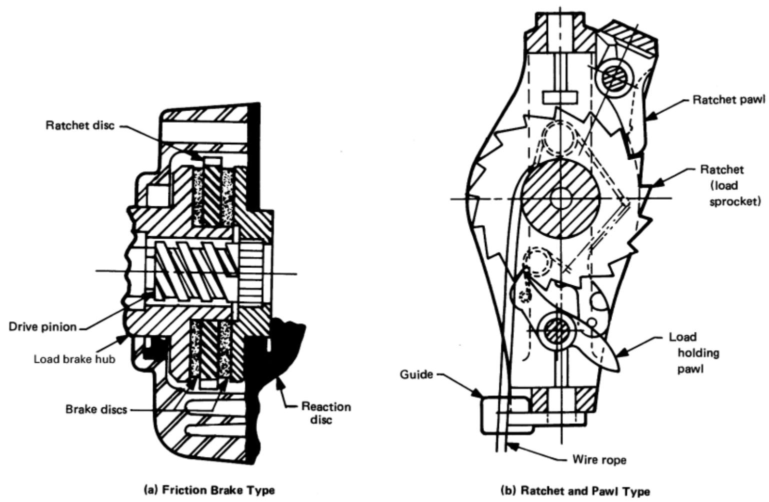


Figure 39: Load Controlling Ratchet and Pawl Type Mechanisms

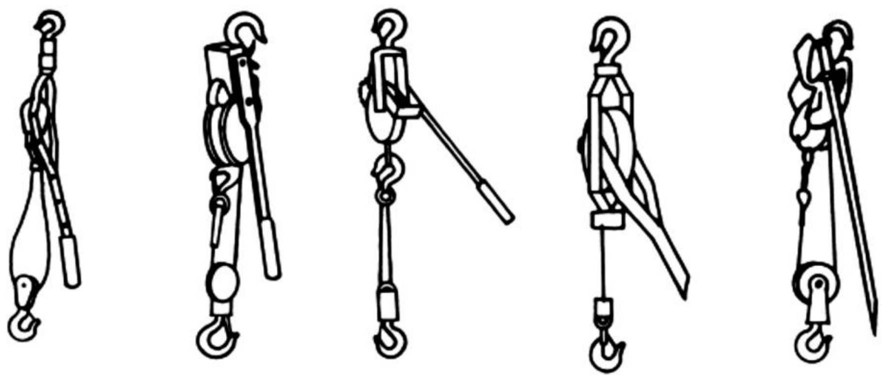


Figure 40: Rope Lever Hoists

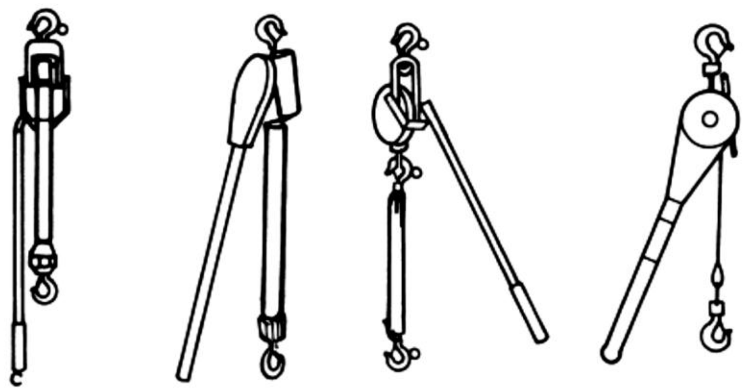


Figure 41: Web Strap Lever Hoists

The first section, on construction and installation, states that rated loads, controls, identification, and product safety information should be clearly marked. The mechanical design, especially in terms of stress loads and modifications are developed. Other critical issues addressed include load sprockets, drums, load chains, rope, web straps, hooks, load blocks, load controlling mechanisms, over-travel restraints, convertible load ratings, and lubrication.

The second section, on inspection and testing, states that inspections shall be performed by a designated person in accordance with the manufacturer recommendations and with the requirements put forth in the B30.21. The general inspection classifications for lever hoists include initial inspection, per-operation inspection, frequent inspection, periodic inspection, and inspection for hoists not regularly in service. There is an entire detailed subsection devoted to the inspection of chain, rope, and/or web strap equipment. This information is indispensable for the proper and safe operation of the lever hoists. Operational and load tests are detailed next. Nothing too special about those specifications, other than that they concern the types of hoists and mechanisms mentioned above.

The third section, on operation and operator training, closely parallels previous operations sections. One difference for the lever hoist standard is that, as the standard states, such hoists are subject to certain hazards that cannot be abated mechanical means but only by the exercise of intelligence, care, common sense, and experience in anticipating the motions that will occur as a result of operating the controls. Thus, the training of lever hoist operators is even more important. With these points in mind, very strict, clear, and required steps to prepare the hoist operation and to handle the load are given.

The fourth and final section, on maintenance and maintenance training, is nearly identical in format to previous sections on maintenance and maintenance training reviewed above. The information is, of course, specific to lever hoists. This information includes welded link chain replacement and maintenance, roller and rollerless chain replacement and maintenance, rope replacement and maintenance, and web strap replacement and maintenance.

The study team recommends the incorporation by reference of ASME B30.21 in 30 C.F.R. 250.198 and a specification for operation of lever hoists in accordance with B30.21 in 30 C.F.R. 250.108.

6.5.10 B30.24: Container Cranes

The B30.24 standard includes provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of container cranes used for lifting purposes. The document includes power-operated container cranes whose power source is either self-contained or provided externally. The box girder construction can be single or double, either on utilizing a trolley and a container-handling spreader or other applicable lifting apparatus, such as a hook, beam, or magnet.

A container crane is a crane with single or multiple girders that uses either a movable or fixed hoisting mechanism that lifts intermodal shipping containers with a trolley and handling spreader assembly.

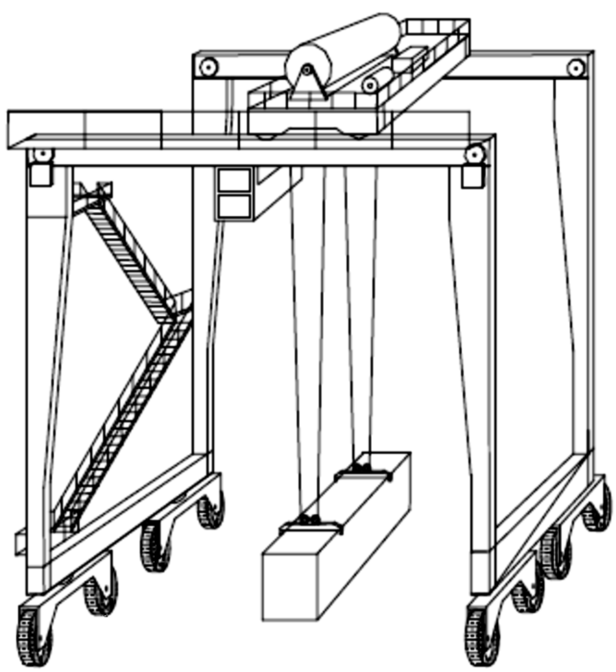


Figure 42: Rubber Tired Container Cranes

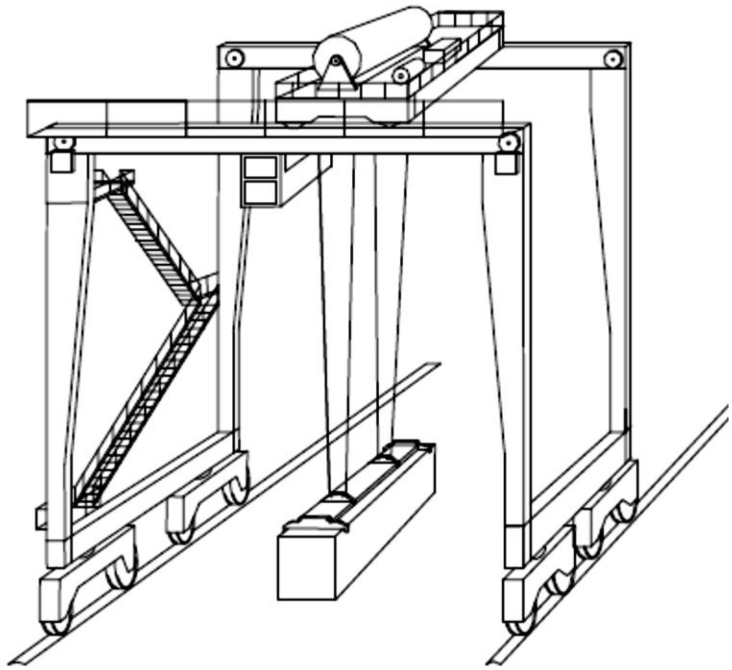


Figure 43: Rail Mounted Container Cranes

The standard has three sections: One on construction and installation, one on inspection, testing, and maintenance, and one on operation. The first lays out a relatively brief number of required markings. These include rated loads, manufacturer ratings applicable to the B30 crane volume, a durable nameplate, weight, and a rated-load marked head block. Because there is usually no intended rotation of container cranes, there is a clear focus on clearances from parallel and perpendicular obstructions. There is also a specific section on pedestrian traffic. There is special concern with the construction of runways for rail-mounted container cranes, and with their runway safeguards, such as bumpers and bumper pads. These stops must be capable of resisting the stall load of the drive motor.

There is heightened concern for wind with container cranes, which tend to be very tall. Wind-indicating devices are mandated, as are overturning moments that do not exceed 80% of the stabilizing or resisting moments. Other specifications are given for welding procedures, crane structural members, truck frame drop limits (for rail-mounted container cranes), machinery housing, gantry drives, spreaders, electromagnetic interference, guards for moving parts, lubrication, fire extinguishers, and other miscellaneous modifications.

There are several construction requirements for the operator cab, most of which exist for safety reasons. Unfortunately, nothing is mentioned about human factors and ergonomics – a problem common to other B30 series standards, as mentioned above.

There is an entire section devoted to lighting systems, which distinguishes this particular standard from the others reviewed in this analysis. The primary reason for this inclusion is that container cranes almost always operate quayside. Therefore, they cannot typically benefit from the ambient lighting provided by facilities (e.g., offshore platforms and vessels) like other cranes do. This observation fits with the previous mention that the most common types of cranes found offshore are pedestal-mounted and portal cranes – not container cranes.

Due to limited visibility that arises during typical container crane operations, there is also a strong emphasis on effective communication. This emphasis is clearly reflected in the B30.24. There are also construction requirements put forth for service platforms, with special emphasis on stairs, ladders, stairways, and emergency egress. These criteria result too from the abnormal height of typical container cranes.

Also prominent in the standard are load control mechanisms, electrical safeguards, and hoisting equipment. This particular standard also uniquely gives a rather extensive set of documentation requirements related to the construction and installation.

The inspection, testing, and maintenance section proceeds much like the others reviewed above. The inspection classifications are initial, frequent, periodic, and not in regular service, which entail some container crane-specific criteria of what to inspect and when, as one would expect. Operational and load tests are laid out, per custom. Preventive maintenance, repair, and wire rope replacement are adequately addressed.

The final section, on operations, is again much of the same. The qualifications for operators entail vision factors, which has not typically been the case in the standards reviewed here. Other physical factors such as strength, endurance, agility, and coordination are mentioned, though specific minimums do not abound in the standard. Typical rules are given for the conduct of operators, such as not diverting attention or operating the crane in an otherwise unfit condition. Finally, other miscellaneous, but important, specifications regarding load weight, moving the load, signal communication, ladders, and other articles to be found in the operator cab are covered.

Container cranes are not used on the OCS, therefore, the study team does not recommend the incorporation by reference of ASME B30.24 in 30 C.F.R. 250.198.

6.5.11 Additional B30 Standards for Consideration

The following analysis of ASME B30 standards is provided because the study team believes they are essential for a complete analysis of the standards to ensure material handling safety on the OCS.

B30.11 Monorails and Underhung Cranes

Monorails and underhung cranes are used extensively in material handling for installation and maintenance of line replaceable units on all offshore facilities. ASME B30.11 Volume B30.11 includes provisions that apply to the construction, installation, operation, inspection, testing, and maintenance of underhung crane and monorail systems, track sections, and load-carrying members, such as end trucks or carriers (commonly called trolleys) that travel either on the external or internal lower flange of a track section. The track sections include single monorail track, crane bridge girders and jib booms, all curves, switches, transfer devices, and lift and drop sections. Provisions apply to both power-driven and hand-operated equipment in which the carriers are independently controlled. Figure 44 shows a typical example of a monorail underhung crane used in offshore maintenance.

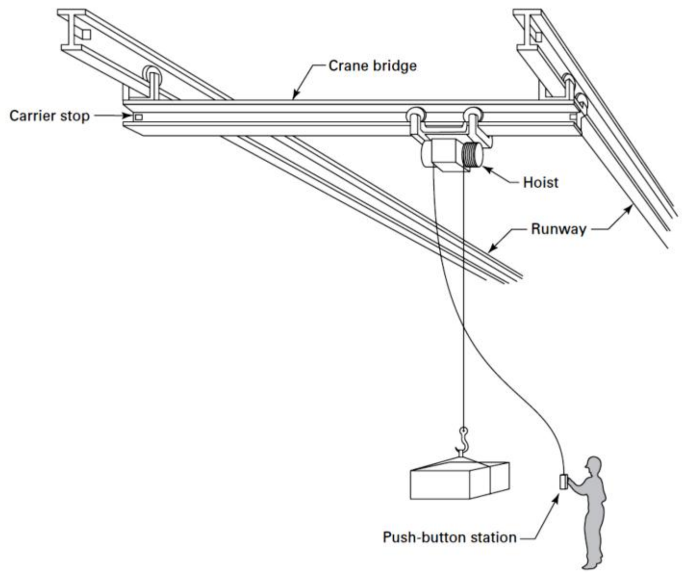


Figure 44: Monorail Crane with Underhung Hoist

The standard includes sections on construction and installation, inspection and testing, operator training, operational procedures, and maintenance and maintenance training.

Inspecting and testing has the typical five types of required inspections: initial, functional test, frequent, periodic, and inspection of equipment not in regular used. Equipment is to be inspected by a qualified person. Inspection of the hoist, limit devices, and wire rope is to be in accordance with ASME B30.16 above. Hooks and latches are to be inspected in accordance with ASME B30.10 above. Because monorails and underhung hoists are extensively used for maintenance tasks on the OCS, the study team recommends the incorporation by reference of ASME B30.11 in 30 C.F.R. 250.198 and a specification for operation of lever hoists in accordance with B30.11 in 30 C.F.R. 250.108.

B30.12 Handling Loads Suspended from Rotorcraft

Material handling by external load from a helicopter is frequently conducted on the OCS. ASME B30.12 applies to the protection of flight crews, ground personnel, and property on the surface while working directly with or in the vicinity of rotorcraft conducting external-load operations. The standard applies to the handling of loads suspended from rotorcraft using a cargo sling or powered hoist, or other attaching means, to lift, carry, pull, or tow a jettisonable load outside of the rotorcraft airframe. The standard classifies external helicopter loads in accordance with FAA classifications and provides guidance for lifting components, inspection and maintenance, operating practices, load handling, signals and communications, and limited guidance on fueling and ground-based facilities at the work area. Because rigging of helicopter external loads are unique, specific training in this type of rigging must be provided to all personnel engaged in such operations.

Because of the significant hazards presented by helicopter external load operations, the study team recommends the incorporation by reference of ASME B30.12 in 30 C.F.R. 250.198 and a specification for operation of lever hoists in accordance with B30.12 in 30 C.F.R. 250.108.

B30.17 Overhead and Gantry Cranes (Top Running, Single Girder, Underhung Hoist)

ASME B30.17 is essentially similar to the ASME B30.2 overhead crane standard analyzed above but applies to the construction, installation, operation, inspection, and maintenance of hand-operated and power-driven overhead and gantry cranes that have a top-running, singleg-girder bridge, with one or more underhung hoists operating on the lower flange of the bridge girder, used for vertical lifting and lowering of freely suspended, unguided loads. This differs from ASME B30.2 as that standard applies to top-running single-girder or multiple-girder bridge, with one or more top-running trolley hoists (as opposed to underhung hoists. Otherwise, the standards are nearly identical.

Because there are numerous underhung as opposed to top-running trolleys on service bridge cranes in use on the OCS, the study team recommends the incorporation by reference of ASME B30.17 in 30 C.F.R. 250.198 and a specification for operation of lever hoists in accordance with B30.17 in 30 C.F.R. 250.108.

B30.23 Personnel Lifting Systems

ASME B30.23, Personnel Lifting Systems, establishes the design criteria, equipment characteristics, and operational procedures that are required when hoisting equipment within the scope of the ASME B30 Standard is used to lift personnel. Hoisting equipment defined by the ASME B30 Standard is intended for material handling. It is not designed, manufactured, or intended to meet the standards for personnel handling equipment, such as ANSI/SIA A92 (Aerial Platforms). The equipment and implementation requirements are not the same as that established for using equipment specifically designed and manufactured for lifting personnel. Hoisting equipment complying with the applicable

ASME B30 Standard shall not be used to lift or lower personnel unless there are no less hazardous alternatives to providing access to the area where work is to be performed. The lifting or lowering of personnel using ASME B30-compliant hoisting equipment is prohibited unless all applicable requirements of this B30.23 have been met.

Because personnel transfer by crane, particularly using a personnel basket or "Billy Pugh" system, is a routine operation on the OCS and is extensively covered in API RP 2D and the cranes used are covered by API Specification 2C, the study team does not recommend the inclusion by reference of ASME B30.23 in 30 C.F.R. 250.198.

B30.26 Rigging Hardware

ASME B30.26, Rigging Hardware, includes provisions that apply to the construction, installation, operation, inspection, and maintenance of detachable rigging hardware used for load-handling activities in conjunction with equipment described in other B30 standards. This hardware includes shackles, links, rings, swivels, turnbuckles, eyebolts, hoist rings, wire rope clips, wedge sockets, rigging blocks, and load-indicating devices. The standard has extensive requirements for selection, use, and maintenance of detachable hardware and load-indicating devices. Figure 45 through Figure 50 show various types of detachable rigging hardware.

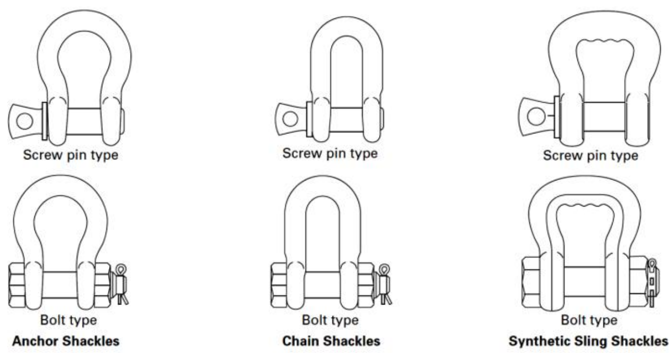


Figure 45: Shackles

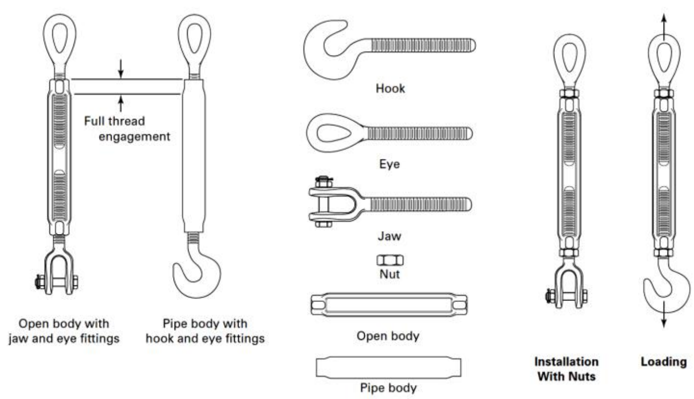


Figure 46: Turnbuckles #1

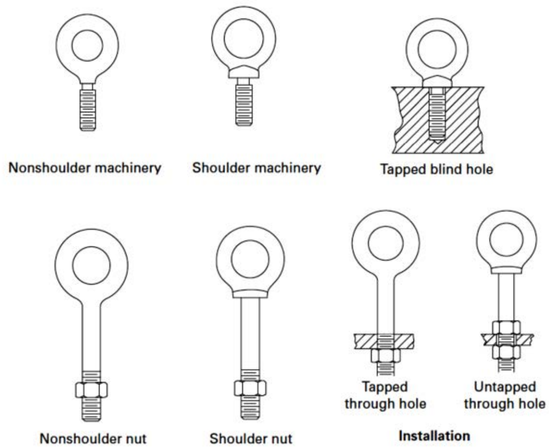


Figure 47: Eyebolts

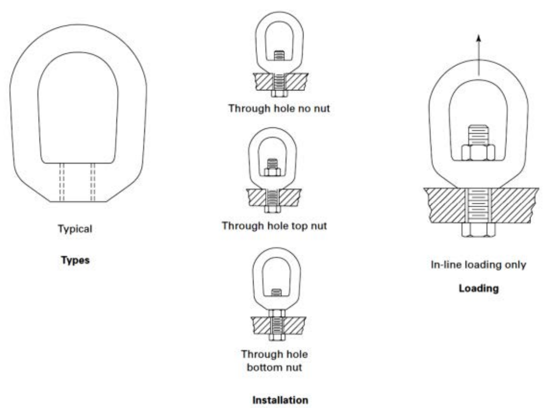


Figure 48: Eyenuts

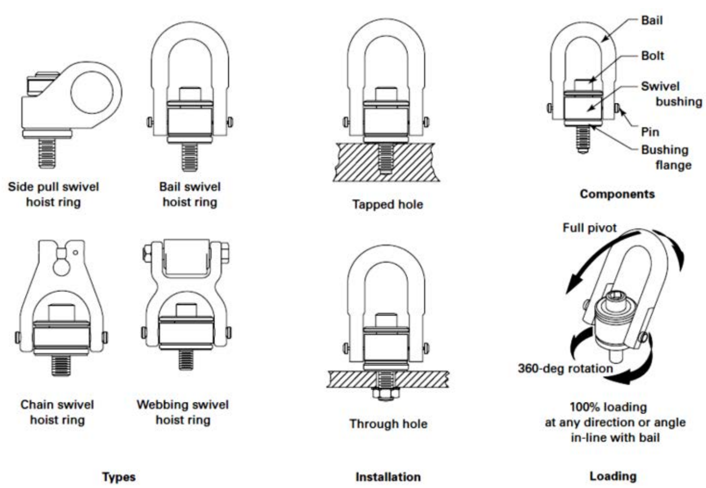


Figure 49: Swivel Hoist Rings

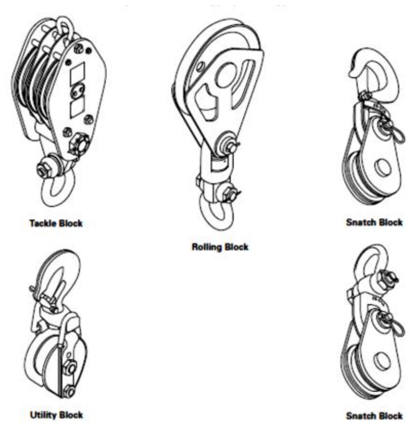


Figure 50: Rigging Blocks

Because detachable rigging hardware is used extensively on the OCS, the study team recommends the incorporation by reference of ASME B30.26 in 30 C.F.R. 250.198 and a specification for operation of lever hoists in accordance with B30.26 in 30 C.F.R. 250.108.

7 USCG MOU/MOA Review

The USCG and BSEE (formerly known as MMS) pursue specific missions to prevent oil spills in offshore waters, limit environmental and economic resource impact in the event of a spill, and ensure safe working conditions on offshore facilities and vessels. BSEE focuses on oil and mineral exploration, drilling and production activities, and regulates offshore oil lease operators is outlined in 30 CFR Part 250. USCG's focuses on the safety of life and property and the safety of navigation and protection of the environment on OCS units and vessels operating on the OCS.

In September 2004, MMS and USCG signed a Memorandum of Understanding (MOU), along with associated Memorandum of Agreement (MOA). The MOU documented a broad agreement for cooperation between MMS and USCG and set forth a framework for MOAs to be issued under this "umbrella" MOU. MOAs address specific topics and establish a cooperative interagency partnership to increase communications, manage shared responsibility, and minimize duplicative or conflicting regulations on the affected industry.

In October 2011, MMS (BOEMRE) was divided into two agencies, BSEE and BOEM. Despite the organizational changes that occurred prior to the formation of BSEE, interagency commitment to cooperative oversight of the offshore oil and gas industry between the USCG and the Department of Interior has remained unchanged. USCG and BSEE renewed their ongoing commitment for oversight of offshore oil and gas industry in the BSEE/USCG MOU signed on November 27, 2012. The MOU superseded the agreement between MMS and USCG that was signed in 2004 but the vision and mission remained of the unchanged. BSEE and USCG agreed shared responsibility in the oversight of offshore oil and gas operations.

The MOU was reviewed in-depth by the technical team during the study.

7.2 USCG MODU Requirements

The study team reviewed and discussed the MOU along with related MOAs with the BSEE technical team. In addition, the study team consulted with USCG subject matter experts (SMEs) in order to determine agency specific requirements and responsibilities as related to the assessment of crane's operating on the OCS.

The USCG crane and material handling certification and inspection strategy is promulgated in 46 C.F.R. §107.258 and 259. According to regulation, the inspection may be conducted by a USCG marine inspector or by one of two authorized third-party inspectors. Typically, the USCG ensures compliance by auditing the results of a third-party inspection or by having BSEE perform some of the USCG mandated inspections in accordance with Z-PINC.

During a working session with the USCG, CDR Jim Rocco provided an overview of USCG responsibilities as related to the regulation of cranes on the OCS. The USCG offshore crane inspection regulations are located at 46 CFR 107, 108.601, and 109. USCG regulations incorporate by reference API Spec. 2C, first edition and API RP 2D, first edition where as BSEE incorporates conflicting editions of each standard in 30 CFR 250.198. USCG's crane certification process in regards to third party inspections is outlined in 46 CFR 107.258. USCG's crane inspection and testing is outlined in 46 CFR 107.259. USCG policy related to cranes is primarily outlined in our Marine Safety Manuals Volumes II and IV.

The USCG released a Notice of Proposed Rulemaking in May 2013 for Crane Regulation Standards located on Mobile Offshore Drilling Units, Offshore Supply Vessels, and Floating OCS Facilities.[10] The revision would update industry standards incorporated by reference with more recent versions, which are already adopted by BSEE. In the proposed rule, the USCG seeks to revise regulations as related to the certification, inspection, and testing of crane including the use of third part inspectors.

Following the discussion of USCG's regulatory responsibilities, CDR Rocco identified related MOAs. BSEE and USCG signed MOA: OCS-08 in June 2013 that outlined the shared responsibilities for regulation, inspection, and oversight of systems and subsea systems MODUs. The MOA identifies the USCG as the responsible regulator for "all matters related to the promotion of safety of life and property, as well as for unregulated hazardous working conditions on the OCS." The agreement identifies BSEE as the responsible regulator "for well operations, including drilling, completions, workover, production and decommissioning when the MODU is temporarily attached to the seabed."

According the USCG inspection policy, any crane deficiencies discovered on an US-flagged MODU would result in a form CG-835. It should be noted that the MODU fleet operating the Gulf of Mexico Region is comprised of 11 US-flagged jack-up MODUs while the remaining working/drilling vessels a foreign flagged. An outstanding deficiency identified on a foreign flagged MODU would result in a "Form B" to the Certificate of Compliance. Each of these deficiencies would be tracked in the USCG Marine

[10] 'Crane Regulation Standards: Mobile Offshore Drilling Units, Offshore Supply Vessels, and Floating Outer Continental Shelf Facilities; Revision (Federal Register Publication). Retrieved from Regulations.gov: http://www.regulations.gov/?p=109#!documentDetail;D=USCG-2011-0992-0001. (October 20, 2014)

Information for Safety and Law Enforcement database. In short, BSEE's regulatory authority is related to operations on fixed facilities while USCG regulatory authority is related to operations on floating facilities.

8 Recommendations

Based on information gathered throughout this study and the analysis, the following recommendations are provided for BSEE's consideration.

8.1 Cranes Regulatory Changes

BSEE is responsible for enforcing of regulations found in 30 CFR 250.108 (a – e), as shown in Figure 51, for cranes installed on fixed OCS facilities. In addition, BSEE requires lessees and operators to comply with API Recommended Practice 2D, sixth edition and API Specification 2C, sixth edition, as found in 30 CRF 250.198.

§250.108 What requirements must I follow for cranes and other material-handling equipment?

(a) All cranes installed on fixed platforms must be operated in accordance with American Petroleum Institute's Recommended Practice for Operation and Maintenance of Offshore Cranes, API RP 2D (as incorporated by reference in §250.198).

(b) All cranes installed on fixed platforms must be equipped with a functional anti-two block device.

(c) If a fixed platform is installed after March 17, 2003, all cranes on the platform must meet the requirements of American Petroleum Institute Specification for Offshore Pedestal Mounted Cranes, API Spec 2C (as incorporated by reference in §250.198).

(d) All cranes manufactured after March 17, 2003, and installed on a fixed platform, must meet the requirements of API Spec 2C.

(e) You must maintain records specific to a crane or the operation of a crane installed on an OCS fixed platform, as follows:

(1) Retain all design and construction records, including installation records for any anti-two block safety devices, for the life of the crane. The records must be kept at the OCS fixed platform.

(2) Retain all inspection, testing, and maintenance records of cranes for at least 4 years. The records must be kept at the OCS fixed platform.

(3) Retain the qualification records of the crane operator and all rigger personnel for at least 4 years. The records must be kept at the OCS fixed platform.

Figure 51: 30 CFR 250.108 - Crane Regulatory Language

The following recommendations for changes to 30 CFR 250.108 are outlined for BSEE's consideration. These recommendations are based on the information gathered and analyses conducted throughout the study and are intended to improve worker safety while operating *cranes* installed on fixed OCS facilities. Recommended changes are labeled in red text as shown in Table 25 below.

Table 25: Recommended Crane Regulatory Changes

§250.108 What requirements must I follow for cranes and other material-handling equipment?
(a) All pedestal cranes installed on fixed platforms must be operated in accordance with American Petroleum Institute's Recommended Practice for Operation and Maintenance of Offshore Cranes, API RP 2D (as incorporated by reference in § 250.198).

(b) All cranes installed on fixed platforms must be equipped with a functional anti-two block device.

(c) If a fixed platform is installed after March 17, 2003, all pedestal cranes on the platform must meet the requirements of American Petroleum Institute Specification for Offshore Pedestal Mounted Cranes, API Spec 2C (as incorporated by reference in §250.198).

(d) All pedestal cranes manufactured after March 17, 2003, and installed on a fixed platform, must meet the requirements of API Spec 2C.

(e) All overhead bridge cranes manufactured after 1 January 2016 and installed on a fixed platform must meet the requirements of CMMA Specification No. 70 – Specifications for Electric Overhead Travelling Cranes (as incorporated by reference in §250.198).

(f) All overhead bridge cranes installed on fixed platforms must be operated in accordance with the American Society of Mechanical Engineers (ASME) B30.2, Safety Standard for Overhead Bridge and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist) or ASME B30.17 Safety Standard for Overhead Bridge and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist), as applicable to the type of crane, (as incorporated by reference in §250.198). Required frequent and periodic inspections (other than daily or operational inspections) of overhead bridge cranes shall be performed by a qualified crane inspector designated by the crane manufacturer or certified in accordance with the requirements of the National Commission for the Certification of Crane Operators (NCCCO).

(g) All operators of overhead bridge cranes greater than 5 tons must be certified in accordance with the requirements of the National Commission for the Certification of Crane Operators (NCCCO). Rigging of loads greater than 5 tons shall be conducted by personnel certified in accordance with API RP 2D or certified in accordance with the NCCCO requirements for Rigger I for loads up to 15 tons and Rigger II for loads over 15 tons.

(h) All crane owners or operators on fixed platforms must have a crane operations safety policy that differentiates between routine, critical and engineered lifts. Routine lifts are those not designated as critical or engineered lifts. Critical lifts are those where the failure or loss of load control could result in loss of life, major structural damage to facilities or equipment, or large environmental release. Some factors, but not all factors, that may be used to determine a critical lift are:

- When a load is lifted over or near operating equipment or safety areas designated by a dropped object study;
- When two or more pieces of lifting equipment are required to work in unison, including trolleys installed on the same bridge;
- When special lifting equipment such as non-standard crane configurations or purpose built, one-off lifting appurtenances will be used;
- The weight of the load exceeds set limits such as 20 tons;
- The weight of the load exceeds 75 percent of the crane's rated capacity; or
- When making personnel transfers.

Engineered lifts are those that exceed the rated capacity of the crane at the required lifting angle (not to include load testing requirements in API Spec 2C). Engineered lifts are so exceptional that there shall be increased inspection requirements to be met prior to operation. For engineered lifts, the crane shall be inspected by the crane manufacturer or a qualified third-party inspector in accordance with API Spec 2D annual inspection requirements not more than two days prior to the lift. Any deterioration or defects found by that shall be considered in design calculations to support the lift. The crane shall also be inspected by the crane manufacturer or a qualified third-party in accordance with annual inspection requirements, including and non-destructive testing required by the manufacturer, after the engineered lift is completed and prior to release for use in normal operations. A record of the engineered lift, including supporting calculations, inspections, weights, and all distances moved, shall maintained in accordance with (i) (2) below.

(i) You must maintain records specific to a crane or the operation of a crane installed on an OCS fixed platform, as follows:

(1) Retain all design and construction records, including installation records for any anti-two block safety devices, for the life of the crane. The records must be kept at the OCS fixed platform.

(2) Retain all inspection, testing, and maintenance records of cranes for at least 4 years. The records must be kept at the OCS fixed platform.

(3) Retain the qualification records of the crane operator and all rigger personnel for at least 4 years. The records must be kept at the OCS fixed platform.

8.2 Material Handling Equipment Improvement

BSEE is responsible for enforcing the regulations found in 30 CFR 250.108 (f), as shown in Figure 52, which applies to material handling equipment installed on fixed OCS facilities.

§250.108 What requirements must I follow for cranes and other material-handling equipment?

(f) You must operate and maintain all other material-handling equipment in a manner that ensures safe operations and prevents pollution.

Figure 52: 30 CFR 250.108(f) – Material Handling Equipment Regulatory Language

BSEE does not incorporate any industry standards by reference in regulation of material handling equipment. Guidance provided to BSEE inspectors for the enforcement of material handling equipment regulation is outline in PINC I190 below. The PINC identifies material handling equipment as including, but not limited to, air hoists, hoists, tugger, air tugger, winch, man-riding winch, come-a-long, monorail, gantry crane, jib (sic).

The subjective nature and overall breath of this PINC instruction to meet the inspection requirements of 30 C.F.R. 250.108 (f) can hardly be overstated. As discussed in the analysis of material handling equipment, this equipment is not defined in 30 C.F.R. 250.105. The I-190 compliance guidance requires inspectors to determine if all material handling equipment is operated and maintained in a manner that ensures safe operation and prevents pollution. The current inspection procedure also requires an inspection of records to ensure material handling equipment is operated "per manufacturers and/or operators specifications." The inspector must also issue a component shut-in (C) incident of noncompliance citation when these conditions are not met as discussed above.

Since the statute does not define material handling equipment, any equipment which moves or manipulates components or material would rightly be subject to 30 C.F.R. 250.108 (f); this includes classified drilling equipment (CDS) and auxiliary material handling equipment such as BOP handling equipment, riser carts, drill floor and derrick lifting equipment, top drive systems, etc. The I-190 PINC guidance to BSEE inspectors subjects the regulated entity to variations in the training, experience, and capriciousness of the inspector, making compliance and inspection difficult. Moreover, the large variation in the motive power and functionality of the equipment makes it highly unlikely that any one inspector would be a subject matter expert (SME) or competent inspector of all of the systems covered by the regulation.

MATERIAL HANDLING

I -190 **IS ALL MATERIAL-HANDLING EQUIPMENT OPERATED AND MAINTAINED IN A MANNER THAT ENSURES SAFE OPERATIONS AND PREVENTS POLLUTION?**

Authority:.30 CFR 250.108(f) **Enforcement Action C**

INSPECTION PROCEDURE:

1) Verify that material handling equipment is operated and maintained in a safe and pollution free manner.

2) Inspect records to ensure material handling equipment is operated per manufacturers and/or operators specifications.

IF NONCOMPLIANCE EXISTS:

Issue a component shut-in (C) INC when;

1) Material handling equipment is not operated and maintained in a safe manner.

2) Material handling equipment is not operated and maintained in a pollution free manner.

INSPECTION COUNT AND INC COUNT:

Enter one item checked / issue one INC for facility inspected.

NOTE - Material handling equipment includes, but is not limited to; air hoists, hoists, tugger, air tugger, winch, man-riding winch, come-a-long, monorail, gantry crane, jib

Figure 53: PINC I190

The following recommendations for changes to 30 CFR 250.108(f) are outlined for BSEE's consideration. As noted above, BSEE does not incorporate any industry-standards in Regulation of material handling equipment. BSEE has worked extensively in the past with the American Society form Mechanical Engineers (ASME) Standards Development Organization (SDO) in reviewed several ASME B.30 series standards on material handling equipment. These recommendations are based on the information gathered and analyses conducted throughout the study and are intended to improve worker safety while operating *material handling equipment* installed on fixed OCS facilities. Recommended changes are labeled in red text as shown in Table 26 below.

Table 26: Recommended Material Handling Equipment Regulatory Changes

§250.108 What requirements must I follow for cranes and other material-handling equipment?

(j) You must operate and maintain all other material-handling equipment in a manner that ensures safe operations and prevents pollution.

(1) All winches, including, but not limited to, wireline winches, pneumatic and hydraulic line tuggers, electric, pneumatic and hydraulic planetary gear hoists and winches, electromechanical and umbilical winches, man-riding winches, or any other power-driven drum devices shall be designed, operated and maintained in accordance with ASME B30.7, Winches (as incorporated by reference in §250.198).

(2) All slings shall be operated and maintained in accordance with ASME B30.9, Slings, which

is incorporated by reference in API RP 2D Section 5.2.1 (as incorporated by reference in §250.198).

(3) All hooks shall be operated and maintained in accordance with ASME B30.10, Hooks (as incorporated by reference in §250.198).

(4) All monorails and underhung cranes shall be operated and maintained in accordance with ASME B30.11, Monorails and Underhung Cranes (as incorporated by reference in §250.198).

(5) All overhead hoists shall be operated and maintained in accordance with ASME B30.16, Overhead Hoists (as incorporated by reference in §250.198).

(6) All below-the-hook lifting devices, including, but not limited to, structural, mechanical, vacuum, close-proximity lifting magnets, plate clamps, or any other device or appurtenance used for attaching a load to a hoist, shall be operated and maintained in accordance with ASME B30.20, Below-the-Hook Lifting Devices (as incorporated by reference in §250.198). Moreover, all below–the-hook lifting devices, including, but not limited to, spreader bars and frames, pad eyes, attachment points, and all other lifting appurtenances shall be designed in accordance with ASME BHT-1, Below-the-Hook Lifting Devices (as incorporated by reference in §250.198).

(7) All ratchet and pawl and friction brake type lever chain, rope, and web strap hoists (come-a-long) used for lifting, pulling, and tensioning applications shall be operated and maintained in accordance with ASME B30.21, Lever Hoists (as incorporated by reference in §250.198).

(8) All detachable rigging hardware used for load-handling activities, including but not limited to, shackles, links, rings, swivels, turnbuckles, eyebolts, hoist rings, wire rope clips, wedge sockets, rigging blocks, and load-indicating devices, shall be operated and maintained in accordance with ASME B30.26, Rigging Hardware (as incorporated by reference in §250.198).

(9) All loads suspended from rotorcraft-helicopters shall be conducted in accordance with Federal Air Regulation 14 C.F.R. Part 133 and ASME B30.12, Handling Loads Suspended from Rotorcraft (as incorporated by reference in §250.198). Personnel rigging external loads must have specialized training in helicopter external load operations.

(10) Rigging of loads greater than 5 tons shall be conducted by personnel certified in accordance with API RP 2D or certified in accordance with the NCCCO requirements for Rigger I for loads up to 15 tons and Rigger II for loads over 15 tons.

(11) All specialty material handling equipment, including, but not limited to, bails, BOP/LMRP service cranes and transporters, crown and traveling blocks, deadline anchors, drilling derricks or masts, draw works, drill floor manipulator arms, drilling elevators, riser handling systems and carts, iron roughnecks, kelly drives, top drives, riser spiders, rotary tables, and drill swivels, shall be operated and maintained in accordance with the manufacturer's recommendation and instructions. Such recommendations and instructions shall be supported by a Failure Modes, Effects and Criticality Analysis (FMECA) in accordance with generally accepted engineering practices to verify the required inspection and maintenance schedules for the service intended.

Design and installation of specialty material handling equipment should consider ASTM F1166, Human Engineering Design for Marine Systems, Equipment and Facilities. All specialty material handling equipment shall also be subjected to a task analysis and job safety analysis by a qualified human factors or safety professional to ensure safe operation. Moreover, all specialty material handling equipment shall be installed, operated, and maintained to ensure that inadvertent leaks or spills of operating fluids do not result in an environmental release.

(k) All owners or operators on fixed platforms shall have a safety policy and procedures that cover all material handling equipment.

(l) All required maintenance on material handling equipment shall be performed by a qualified maintenance or service personnel. All required inspections shall be performed by a qualified inspector or third-party inspection service. A qualified person is one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated their ability to inspect, diagnose and troubleshoot faults, and service or repair the specific equipment.

(m) You must maintain records specific to the material handling equipment installed on an OCS fixed platform, as follows:

(1) Retain all design and construction records, including installation records for any specialty material handling equipment for the life of the equipment. The records must be kept at the OCS fixed platform.

(2) Retain any required operator or daily inspection records for a period of not less than 90 days. The records must be kept at the OCS fixed platforms.

(3) Retain all frequent and periodic inspection and testing records for all material handling equipment for at least 4 years. The records must be kept at the OCS fixed platform.

(4) Retain the qualification records of all material handling maintenance, inspection, and all rigger personnel for at least 4 years. The records must be kept at the OCS fixed platform.

8.3 Lifting Inspection Strategy

The following actions and recommendations are suggested to produce a robust crane and material handling inspection program for offshore facilities which is harmonized with 30 C.F.R §250.108 and 30 C.F.R. §250.1913, et seq. and with the intentions of 46 C.F.R. §107.258 and 259:

1. Create database of offshore facilities having cranes subject to API Spec 2C and API RP 2D and overhead, jib, and gantry cranes with capacities greater than 5 short tons subject to ASME B30.2;
2. Amend regulation 30 C.F.R. §250.108 for pedestal, overhead bridge, and gantry cranes inspection as suggested in Section 8.1.
3. Amend regulation 30 C.F.R. §250.108 for material handling as suggested in Section 8.2.
4. Amend regulation 30 C.F.R. §250.198 to incorporate applicable ASME B30 series standards as identified in Section 8.2 and Section 6.5.
5. Amend PINCs as suggested in Section 5.1.1 to harmonize with the requirements of 30 C.F.R. §250.1900, *et seq*.
6. Train BSEE inspectors to become qualified crane and rigging inspectors as promulgated by API RP 2D and ASME B30 series standards, or audit crane inspection records performed by third-party qualified inspectors similar to the strategy adopted by the USCG in 46 C.F.R. §107.259;

7. Require drilling systems used on MODUs to be certified drilling systems (CDS) and inspected by the marine classification society that issued the CDS certificate.
8. Develop a formal training qualification program for BSEE inspectors in mechanical and electro-hydraulic equipment fundamentals, hazard identification for machine safety, and other OSHA-type hazard identifications and mitigation procedures, as well as general inspection and maintenance auditing procedures as suggested in Section 4.1.
9. Inspect or audit third-party inspections to ensure that the cranes and material handling equipment are designed, maintained, and operated in accordance with the standards promulgated by marine classification societies, API, or ASME and regulations promulgated by 30 C.F.R. 250.108 and 30 C.F.R. 250.1913 (d);
10. A human factors analysis in accordance with ASTM F1166 should be required for human-machine interfaces for all CDS material handling equipment.
11. BSEE should require operators to have formal or structured OJT program to produce qualified operators and riggers for material handling equipment;
12. BSEE should require that material handling equipment inspection and maintenance schedules be developed based on a FMECA produced by qualified personnel or from the manufacturer's instructions which are based on a FMECA; and
13. BSEE should verify the qualifications of operational and inspection personnel for all cranes and material handling equipment.

8.3.1 Staff Augmentation

Based on the information gathered throughout the study, analysis conducted, and technical recommendations identified BSEE should consider the following staff augmentation recommendations:

- Augment BSEE inspector force, as necessary, to ensure timely evaluation of documents submitted to comply with SEMS II.
- Augment BSEE inspector force, as necessary, to ensure adequate inspector coverage for future OCS initial and periodic facility inspections. (Section 6.1 offers two examples of third-party inspection options which are currently being used effectively by other Executive Branch agencies).

8.3.2 Develop a Communication Strategy

BSEE should develop key messages for internal stakeholders. The messages for internal audiences should be developed and tailored to the unique needs of BSEE employees. Senior Leadership should be provided with specific messages on their involvement with implementing key initiatives, Regional and District personnel need information on program administration and priorities in order to implement consistent approaches. For example,

All employees need information on what's expected of them, how they are personally involved in achieving BSEE's goals and how they can work together as a team.

BSEE should develop key messages for external stakeholders and audiences. The message for external audience should also be developed and tailored to the unique needs of operators. BSEE should also develop a communication strategy that ensures each lease holder/permit applicants receives the same comprehensive information on the historical, philosophical and statutory foundations of the Safety and Environmental Management Systems Program (SEMS II), 30 C.F.R. §250.1900, et seq. that is provided to BSEE management and inspectors This includes developing tailored messages to different stakeholders that clearly communicates the goals, mission, and vision for the program. For example, BSEE should develop a communications plan that provides OCS lease permit applicants with the guidelines and rubrics which will be used to evaluate documents submitted to comply with SEMS II.

8.3.3 Metric Reporting and Data Collection

BSEE should develop and capture metrics which are leading indicators of lease holders and industry compliance culture. Leading indicators provide a means to change course before a negative result. BSEE focus should be place on capturing leading indicators instead of lagging indicators because they are not predictive of future system performance. Lagging indicators are those that document past events (i.e., lost time incidents, annual injuries by category).

These leading indicators metrics should include:

- Number of supervisory and management personnel with formal human factors and error prevention training.
- Number of supervisory and management personnel with formal incident/accident investigation and root cause analysis training.
- Number of dedicated safety professionals per facility. (A dedicated safety professional is one with formal, comprehensive safety training or credentials and who has no collateral duties on the facility).
- Number of "near-miss" incidents reported.
- Elapsed time from incident/accident occurrence to report submission to recommendation implementation.
- Elapsed time from report submission to recommendation implementation.
- Number of near-miss and incident/accident reports with zero recommendations.

BSEE should require lease holders to immediately report significant financial issues or changes in ownership, mergers and acquisition. This information should be tracked central location that is accessible to BSEE wide. The information is a leading indicator of a potential distressed financial state and should alert BSEE to degradation in maintenance, training, workforce, operating philosophy and corporate culture. The foundations upon which SEMS II program documents were approved may be compromised.[11]

BSEE should employ metrics such as leading indicators to revise BSEE crane and material handling oversight emphasis items and assist individual operators with improving and amending SEMS compliance documents.

8.4 Program Related Recommendations

The following program related recommendations are observations are provided for BSEE's consideration.

8.4.1 Harmonize Various PINC Initiatives

BSEE has various initiatives underway to provide recommendations for changes to PINCs, including The National PINC Team and BSEE funded technical projects (i.e., Crane Safety and Assessment of API Standards). BSEE should align all stakeholders involved in these initiatives and establish a systematic process to review the changes that are being proposed. Alignment across all stakeholder groups would enable success in the development of PINCs by identifying safety concerns amongst industry, inspections needs on the OCS, and timely understanding of support information.

8.4.2 Staff Retention

Staff retention directly impacts BSEE operations throughout the organization. BSEE invests time and money to onboard new employees with no guarantee of commitment. The training and experience that BSEE provides makes employees extremely marketable to the oil and gas industry. Ultimately, many employees leave after gaining experience within the agency. In addition, BSEE cannot compete with industry's compensation packages. For this reason, BSEE is not only losing staff to industry, but finding it increasingly difficult to recruit inspectors with relevant industry experience. This lack of personnel leaves existing staff over utilized. An industry recruitment program to acquire recently retired industry personnel would benefit the agency.

8.4.3 Standards Development Organization Outreach

BSEE incorporates 117 industry-developed standards by reference in Title 30 CFR 250. Incorporation by Reference (IBR) allows Federal agencies to comply with the requirement to publish rules in the Federal Register and CFR by referring to material published elsewhere. BSEE references standards IBR daily while conducting inspections. Standards Development Organizations (SDOs) directly influence the

[11] U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. Investigation of November 16, 2012, Explosion, Fire and Fatalities at West Delta Block 32 Platform E. Washington, D.C.: U.S. Department of the Interior, 2013.)

development of standards incorporated by reference in BSEE regulation. The foundation of BSEE's current inspection methodology is the application of PINCs which reference to standards incorporated by reference in regulation. Therefore, it is necessary that BSEE has active participation in SDOs to provide an understanding the changes and modifications to the standard that may impact a future regulatory need.

It is noted that BSEE is actively involved with many SDOs through committee meetings, conferences, ongoing communication with SDO personnel, and established relationships with committee members. However, BSEE requires additional support staff in order to communicate the events of the standard committee to the appropriate channels at the Headquarters and Regional level.

BSEE should identify additional support staff to develop a standards database. The database would be an asset to BSEE's OORP and the National PINC Team (NPT) in the development and update of standards incorporated by reference in BSEE regulation and the development of inspection PINCs. The database would track the following information on standards incorporated by reference in BSEE regulation and standards not incorporated by reference but indicated a priority to BSEE. The NPT could reference this database during their annual review of inspections PINCs to identify pending changes to standards that should be recommended for BSEE's consideration.

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Appendix A. Revised PINCs

The study team provided recommendations for BSEE's consideration for updating the existing lifting PINCs. The recommendations were circulated amongst internal BSEE stakeholders for feedback. The project team updated the PINCs based on the final direction recommended by the BSEE project sponsors. Changes and modifications to existing lifting PINCs are highlighted and displayed in track changes below.

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CRANE LIFTING OPERATIONS GUIDELINES

LAST UPDATE, ~~2011~~APRIL 2015

Note: The following PINC's only pertain to personnel or loads lifted with cranes, temporary cranes, or other type of lifting equipment mounted on fixed OCS platforms. The personnel or loads lifted may be on fixed OCS platforms, MODUs, or vessels.

OPERATING PROCEDURES

I – 101	**WHENEVER THERE IS ANY DOUBT AS TO SAFETY, DOES THE CRANE OPERATOR STOP AND REFUSE TO HANDLE LOADS OR CONTINUE OPERATIONS AS SAFETY DICTATES IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5a?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: ~~W~~W/C**
	API Reference: API RP 2D Paragraph 3.1.5(a)	
	~~**NOTE:**~~	
	~~PINC (Potential incident of Noncompliance List) can only be used if crane operations continued under adverse conditions and caused an accident or near miss which resulted in injury, death, pollution, or property damage.~~	
	INSPECTION PROCEDURE:	
	Verify that crane operations were restricted during periods of bad weather, such as lightning, high winds or high seas, or when the Crane Operator's ability to see the signal person is impaired by darkness, fog, rain, etc.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if inspection reveals that crane was operated under adverse conditions and caused an accident which resulted in injury, death, pollution, or property damage. Issue a component shut in (C) if inspection reveals that the crane operator does not stop and refuses to handle loads where there is a doubt as to safety (being witnessed).	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected	

(Operating Procedures Continued)

I – 102	**ARE PROPER CRANE OPERATING PRACTICES FOR ATTACHING AND MOVING THE LOAD BEING UTILIZED IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 3.2.1, 3.2.2 AND 3.2.3 AND API ~~RP~~ SPEC 2C, PARAGRAPH 7.5.4.3. ?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: C**
	API Reference: API RP 2D 3.2.1, 3.2.2, 3.2.3, and API RP 2C 7.5.4.3	
	INSPECTION PROCEDURE: 1. Verify that the load is attached to the hook by means of slings or other suitable devices. Sling use shall be in accordance with the guidelines of API RP 2D, Appendix B, paragraph B.3.2.2.c, and Appendix G, paragraph G.5.2.1. 2. Verify that Hooks are equipped with a latch to retain loose lifting gear under non lifting conditions and that the latch is lockable if the hook is used for transporting personnel. 3. Procedures for moving the load are in accordance with the guidelines of API RP 2D, Appendix B, paragraph B.3.2.3.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (C) INC if procedures for attaching and/or moving the load are not within specified guidelines.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Operating Procedures Continued)

I – 103

ARE PROCEDURES FOR PERSONNEL TRANSFER PERFORMED IN ACCORDANCE WITH RECOMMENDED PRACTICES SPECIFIED IN API RP 2D, PARAGRAPH 3.4 AND APPENDIX B, PARAGRAPH B.3.4?

Regulatory Authority:	Enforcement Action: C
30 CFR 250.108(a)	

API Reference: API RP 2D 3.4 and Appendix B 3.4

INSPECTION PROCEDURE:

If at the time of inspection, personnel are being transferred via personnel carrier from vessel to vessel, vessel to platform, or from platform to vessel, verify that:

1. Personnel carrier is of an approved type (Appendix B3.4) and is maintained in a safe condition.
2. All hooks used for support of personnel carrier are equipped with a safety latch.
3. Personnel are riding the carrier in a safe manner and are wearing an approved PFD.
4. Personnel are not raised or lowered directly over a vessel.

IF NONCOMPLIANCE EXISTS:

Issue a component shut-in (**C**) INC for a violation of 1 through 4 above.

INSPECTION COUNT/ INC COUNT:

Enter one item checked/ issue one INC for each crane inspected.

I – 104

ARE CRANES WHICH ARE POSITIONED IN THE PROXIMITY OF HELIDECKS OR APPROACH/TAKE-OFF ZONES NOT OPERATED DURING HELICOPTER OPERATIONS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5M?

Regulatory Authority:	Enforcement Action: ~~W~~C
30 CFR 250.108(a)	

API Reference: ______________

INSPECTION PROCEDURE:

If the crane and helicopter operations are in progress at the time of the inspection, verify that the crane boom is positioned and secured as required and the Crane Operator is out of the cab unless he is in direct voice communications with the pilot.

IF NONCOMPLIANCE EXISTS:

Issue a ______________ INC if the crane boom is not positioned and secured as required or if the Crane Operator remains in the cab without direct voice communications with the pilot during landings/take-offs.

INSPECTION COUNT/ INC COUNT:

Enter one item checked/ issue one INC for each crane inspected.

(Operating Procedures Continued)

I – 105	**IF DEFICIENCIES THAT IMPAIR SAFE OPERATION ARE KNOWN, IS THE CRANE TAKEN OUT OF SERVICE OR ITS OPERATION RESTRICTED TO ELIMINATE THE UNSAFE CONDITION IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5c?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: C**
	API Reference:	
	NOTE:	
	Limited (restricted) service may, in some cases, be continued after the identification and before correction of a deficiency. In such cases, the deficiency must be documented and cautionary notices posted in accordance with API RP 2D, paragraph 1, item c.	
	INSPECTION PROCEDURE:	
	1. Check facility crane inspection records to determine if any deficiencies have been identified. 2. If deficiencies have been identified, verify that cautionary notices have been posted.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if deficiencies have been identified and cautionary notices have not been posted.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

CRANE SAFETY DEVICES

I – 111	**IS AN OPERABLE SWING BRAKE MECHANISM INSTALLED THAT IS CAPABLE OF SMOOTH STARTS AND STOPS WITH CONTROLLABLE RATES OF ACCELERATION AND DECELERATION AS SPECIFIED IN API SPEC 2C PARAGRAPH 9.1 ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?**	
	Regulatory Authority: **30 CFR 250.108(c)**	**Enforcement Action: W/C**
	API Reference:	
	INSPECTION PROCEDURE:	
	Verify that the swing brake mechanisms listed below operate according to the requirements in API SPEC 2C Paragraphs 9.1.3, 9.1.3, and 9.1.4: 1. Parking Brake. 2. Automatic Parking Brake. 3. Dynamic Friction Brake	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC for each crane audit that does not confirm that the operator has records of inspecting each crane swing brake mechanism that does not comply with the requirement in API SPEC 2C, Paragraph 9.1. Issue a component shut-in (**C**) INC for each crane swing brake mechanism inspected that does not comply with the requirements in API SPEC 2C, Paragraph 9.1.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Safety Devices Continued)

I – 112	**IS AN OPERABLE BOOM HOIST HIGH LIMITER OR SHUTOFF PROVIDED TO AUTOMATICALLY STOP THE BOOM HOIST WHEN THE BOOM REACHES A PREDETERMINED HIGH ANGLE, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.1.1, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?**	
	Regulatory Authority: **30 CFR 250.108(c)**	**Enforcement Action: W/C**
	API Reference:	
	NOTE:	
	Low angle limiter or shut off shall not be inspected by	
	INSPECTION PROCEDURE:	
	Verify that the crane boom hoist high limiter or shutoff will automatically stop the boom hoist when the boom reaches a pre-determined high angle.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC for crane audit that does not confirm that the operator has records of inspecting the boom hoist limiter or shutoff as specified in API RP 2D, Paragraph 4.2.2. (monthly, quarterly, and annual inspection) Issue a component shut-in (**C**) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.1.1.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Safety Devices Continued)

I – 113	**ARE BOOM STOPS PROVIDED TO RESIST THE BOOM FALLING BACKWARDS IN A HIGH WIND OR SUDDEN RELEASE OF THE LOAD, AS SPECIFICED IN API SPEC 2C, PARAGRAPH 13.1.2, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?**	
	Regulatory Authority: 30 CFR 250.108(c)	**Enforcement Action: C**
	API Reference:	
	INSPECTION PROCEDURE:	
	Verify that the crane boom stops provided are designed to resist the boom falling backwards. **Note:** Designs for boom stops include one of the following: 1. A fixed or telescoping bumper 2. A shock absorbing bumper 3. Hydraulic boom elevation cylinder(s).	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.1.2.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Safety Devices Continued)

I – 114	**IS A BOOM ANGLE OR LOAD RADIUS INDICATOR READABLE FROM THE OPERATOR'S STATION PROVIDED, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.1.4.1, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?**	
	Regulatory Authority: 30 CFR 250.108(c)	**Enforcement Action: W/C**
	API Reference:	
	INSPECTION PROCEDURE:	
	Verify that the crane boom angle or load radius indicator is provided and readable from the operator's stations.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC for each crane audit that does not confirm that the operator has records of inspecting the boom angle/radius indicators over full range for accuracy as specified in API RP 2D, Paragraph 4.2.2 & Appendix C 4.1.2(c)(d). Issue a component shut in (**C**) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.1.4.1.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

I – 115	**HAVE SECURELY FASTENED GUARDS BEEN INSTALLED ON EXPOSED MOVING PARTS WHICH MAY CONSTITUTE A HAZARD, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.2, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, AND ON EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?**	
	Regulatory Authority: 30 CFR 250.108(c)	**Enforcement Action: C**
	API Reference:	
	INSPECTION PROCEDURE:	
	1. Verify that exposed moving parts such as gears, set screw, projecting keys, chains chain sprockets, and reciprocating or rotating parts which may constitute a hazard under normal operating conditions are guarded. 2. Verify that an appropriate sign is posted if a guard is impractical to install on the above crane components.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut in (**C**) INC for each crane inspected that does not comply with the requirements in API SPEC 2C, Paragraph 13.2.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Safety Devices Continued)

I – 116	**HAS AN ANTI-TWO BLOCK DEVICE BEEN PROVIDED TO PROTECT HOIST ROPES, STRUCTURAL COMPONENTS AND MACHINERY FROM DAMAGE WHICH MAY OCCUR WHEN TWO SHEAVE GROUPS (e.g., LOAD BLOCK AND BOOM HEAD) COME INTO CONTACT AS THE HOIST CABLE IS DRAWN IN, AS SPECIFIED IN API SPEC 2C, PARAGRAPH 13.7, ON EACH CRANE ON A FIXED PLATFORM INSTALLED BY MARCH 16, 2005?**	
	Regulatory Authority: 30 CFR 250.108(c)	**Enforcement Action: W/C**
	API Reference:	
	Inspectors do not test stalling mechanisms for hoist drum. A control override device or proximity warning device may be used. Stalling of the hoist drum is acceptable where damage or loss on control would not result.	
	INSPECTION PROCEDURE:	
	1. Verify that a means to protect hoist ropes, structural components and machinery from damage is provided on all cranes. 2. Verify that the operator is documenting the proper inspection of the controls override or proximity warning device as specified in API RP 2D, Paragraph 4.2.2.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC for each crane audit that does not confirm that the operator has records of inspecting the control override or proximity warning devices as specified in API RP 2D, Paragraph 4.2.2 & C.4.1.2(b),(c),(d). Issue a component shut in (**C**) INC for each crane inspected that does not have an operational control override or proximity warning device installed.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Safety Devices Continued)

I – 117	**IS THERE A FIRE EXTINGUISHER OF APPROPRIATE SIZE AND TYPE KEPT IN THE CAB OR VICINITY OF THE CRANE IN ACCORDANCE WITH AP1 RP 2D, PARAGRAPH 3.5.2?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: C**
	API Reference:	
	NOTE:	
	ASME B30.4c recommends a portable fire extinguisher with a basic minimum extinguisher rating of 10 BC. (10 = 10 lbs., B = Flammable Fluids, C = Energized Electrical)	
	INSPECTION PROCEDURE:	
	Verify that a fire extinguisher is located in the crane cab or near the crane.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if fire extinguisher: 1. Is not located where required. 2. Is not of the appropriate size or type. 3. Does not exist or is inoperable.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

LOAD RATING AND TESTS

I – 131	**IS THE CORRECT LOAD RATING CHART FOR THE CRANE CONFIGURATION IN USE AT THE PRIMARY CONTROL STATION IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.2.1?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: C**
	API Reference:	
	INSPECTION PROCEDURE:	
	Verify that the load chart is legible, posted and visible in the primary control station for the crane configuration in use.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC for the crane if the correct load rating chart is not posted and visible at the primary control station for the crane.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

I – 132	**ARE WRITTEN REPORTS ON LOAD TESTS PREPARED BY A QUALIFIED CRANE INSPECTOR SHOWING LOAD TEST PROCEDURES AND RESULTS WHEN LOAD TESTS ARE REQUIRED IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.2.3?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: C**
	API Reference:	
	NOTE:	
	Load tests are required under the following conditions: 1. New cranes being placed in service. 2. Cranes that are being permanently relocated. 3. Temporary/rental cranes after each rig-up or relocation. 4. When repairs or replacement do not meet the requirements of API RP 2D, paragraph 4.3.3.	
	INSPECTION PROCEDURE:	
	Verify from facility crane records that load tests were conducted when required by a qualified crane inspector using API RP 2D, Appendix E, as a reference guide.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if load tests are not conducted when necessary by a qualified crane inspector using API RP 2D, Appendix E, as a referenced guide.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Load Rating and Tests Continued)

I – 133	**HAVE STATIC AND DYNAMIC LOAD RATING CHARTS BEEN ESTABLISHED FOR ALL CRANES IN ACCORDANCE WITH API RP 2D, PARAGRAPH 3.1.5h?**
	Regulatory Authority: **30 CFR 250.108(a)** — **Enforcement Action: C**
	API Reference:
	NOTE:
	1. Static Load Ratings must be established for lifting from or setting on the crane-supporting structure (platform). 2. Dynamic Load Ratings must be established for lifting from or setting on vessels.
	INSPECTION PROCEDURE:
	Verify from facility crane records that static and dynamic load ratings charts have been established for all cranes.
	IF NONCOMPLIANCE EXISTS:
	Issue a component shut-in (**C**) INC if records indicate that: 1. Static and dynamic load ratings have not been established for all cranes 2. Crane has operated without appropriate load rating charts established and posted ~~2.~~3. Records are not visible to the crane operator at control station.
	INSPECTION COUNT/ INC COUNT:
	Enter one item checked/ issue one INC for each crane inspected.

I – 134	**IS THE LOAD BLOCK RATING LABEL(S) PERMANENTLY AFFIXED TO THE HOOK BLOCK, AS SPECIFIED IN AP SPEC 2C, PARAGRAPH 7.5.3.2, ON EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, OR EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003?**
	Regulatory Authority: **30 CFR 250.108(c)** — **Enforcement Action: C**
	API Reference:
	INSPECTION PROCEDURE:
	1. Verify that the load block rating label(s) is permanently affixed to the hook block - 2. Verify that the label includes the following load block requirements a. The maximum static and personnel rated loads. b. The service temperature and assembly weight.
	IF NONCOMPLIANCE EXISTS:
	Issue a component shut-in (**C**) INC for any crane load block that does comply with the requirements in API SPEC 2C, Paragraph 7.5.3.2.
	INSPECTION COUNT/ INC COUNT:
	Enter one item checked/ issue one INC for each crane inspected.

CRANE INSPECTIONS

I – 141	**HAVE MANUFACTURER'S RECOMMENDATIONS BEEN INCLUDED IN ESTABLISHING ALL INSPECTION REQUIREMENTS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2 AND APPENDIX C?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action:** ~~**W**~~**W/C**
	API Reference: **API RP 2D 4.1.2 and Appendix C**	
	INSPECTION PROCEDURE:	
	Verify that the manufacturer's recommendations have been included in establishing all inspection requirements.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if records indicate that manufacturer's recommendations have been excluded from establishing inspection requirements. Issue a component shut-in (**C**) INC for components that have exceeded the manufacture time limit and have not been overhauled or replaced.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Inspections Continued)

I – 142	**HAVE NEW OR RELOCATED CRANES RECEIVED AN INITIAL INSPECTION BY A QUALIFIED INSPECTOR WITH RECORDS MAINTAINED AT AN APPROPRIATE LOCATION FOR FOUR YEARS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.1 AND 4.2.2?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: W/C**
	API Reference: API RP 2D 4.1.2.1 & 4.2.2	
	NOTE:	
	Cranes in this category are required to be load tested in accordance with API RP 2D, Appendix E.	
	INSPECTION PROCEDURE:	
	Verify that: 1. Records of initial inspection are readily available and are maintained for a period of 4 years. 2. Inspection and load test was performed. 3. ~~Records include date and time of inspection and name/initial of person performing the inspection.~~	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if records of initial inspection are not available and/or not maintained for 4 years. Issue a component shut-in (**C**) INC if: 1. The crane was not inspected prior to use when new or prior to use after being permanently relocated. 2. The crane was not load tested.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Inspections Continued)

I – 143	**HAVE PRE-USE INSPECTIONS BEEN PERFORMED PRIOR TO USE (TYPICALLY DAILY) BY A QUALIFIED CRANE OPERATOR/INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 4.1.1.1 AND 4.1.2.2, MAINTAINED AT AN APPROPRIATE LOCATION FOR FOUR YEARS?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: W/C**
	API Reference: API RP 2D 4.1.1.1 and 4.1.2.2	
	NOTE:	
	Applies to all cranes, regardless of usage category. The pre-use inspection must be conducted prior to using the crane. Pre-use inspection record can be a record, a record book, a logbook, a computerized data collector, or an electronic data collector. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2a.	
	INSPECTION PROCEDURE:	
	Verify that: 1. Pre-use inspections are performed. 2. Records are kept at an appropriate location and are maintained for a period of 4 years. 3. Records include date and time of inspection and name/initial of person performing the inspection.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if: 1. Records indicate that a pre-use inspection was missed or did not occur on schedule, but the most recent pre-use inspection has been performed. 2. Records are not maintained for a period of 4 years. Issue a component shut-in (**C**) INC if: 1. Records of pre-use inspections are not available or are not kept at an appropriate location. (lessee's field office) 2. Records do not indicate that a pre-use inspection has been performed. 3. The pre-use inspection currently due has not been performed.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Inspections Continued)

I – 144	**HAVE MONTHLY INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE OPERATOR/INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.3 AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: W/C**
	API Reference: API RP 2D 4.1.2.3 and 4.2.2	
	NOTE:	
	1. Applies to Heavy Usage Category cranes. An Operator's failure to document usage category will cause the crane to default to the Heavy Usage category. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2b. 2. Reference Appendix 24 for definition of "Monthly" and description of Usage Category."	
	INSPECTION PROCEDURE:	
	Verify that: 1. Monthly inspections are performed by qualified personnel. 2. Verify that records are readily available and are maintained for a period of 4 years. 3. Verify that records include date and time of inspection and name/initial of person performing the inspection.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if records indicate that monthly inspection was missed or did not occur on schedule, but the most recent monthly inspection was completed. Issue a component shut-in (**C**) INC if: 1. Records of monthly inspections are not available or are not maintained for a period of 4 years. 2. Records do not indicate that a monthly inspection has been performed. 3. The monthly inspection currently due has not been performed.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Inspections Continued)

I – 145	**HAVE QUARTERLY INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.1.2.4 AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: W/C**
	API Reference: API RP 2D 4.1.2.4 & 4.2.2	
	NOTE:	
	1. Applies to Moderate Usage Category cranes and Heavy Usage Category cranes. An Operator's failure to document usage category will cause the crane to default to the Heavy Usage category. Inspection criteria must be in accordance with API RP 2D, Appendix C, paragraph C.4.1.2c. 2. Reference Appendix 24 for definition of "Monthly" and description of Usage Category."	
	INSPECTION PROCEDURE:	
	Verify that: 1. Quarterly inspections are performed by a qualified crane inspector. 2. Records are readily available and are maintained for a period of 4 years. 3. Records include date and time of inspection and name/initial of person performing the inspection.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if records indicate that quarterly inspection was missed or did not occur on schedule, but the most recent quarterly inspection was completed. Issue a component shut-in (**C**) INC if: 1. Records of quarterly inspections are not available or are not maintained for a period of 4 years. 2. Records do not indicate that a quarterly inspection has been performed. 3. The quarterly inspection currently due has not been performed.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Inspections Continued)

I – 146	**HAVE ANNUAL INSPECTIONS BEEN PERFORMED BY A QUALIFIED CRANE INSPECTOR WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 4.1.1.1, 4.1.2.5, AND 4.2.2, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: W/C**
	API Reference: API RP 2D 4.1.1.1., 4.1.2.5 & 4.2.2	
	NOTE:	
	1. Applies to all cranes, regardless of usage category. Cranes that have been out of service for 12 months or more must have an annual inspection before being used. Additionally, annual inspections must include inspection of crane critical components in accordance with API RP 2D, Appendix C, paragraph C.4.1.2d, items 22, 23, and 24. 2. Reference Appendix 24 for definition of "Annual" and descriptions of "Usage Category."	
	INSPECTION PROCEDURE:	
	Issue a warning (**W**) INC if records indicate that annual inspection did not occur on schedule, but the most recent annual inspection was completed. Issue a component shut-in (**C**) INC if: 1. Records of annual inspections are not available or are not maintained for a period of 4 years. 2. Records do not indicate that an annual inspection has been performed. ~~The annual inspection currently due has not been performed.~~	
	IF NONCOMPLIANCE EXISTS:	
	Verify that: 1. Annual inspections are performed by a qualified crane inspector. 2. Records are readily available and are maintained for a period of 4 years. 3. Records include date and time of inspection and name/initial of person performing the inspection.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Crane Inspections Continued)

<table>
<tr><td rowspan="13">I – 147</td><td colspan="2">HAS A WIRE ROPE INSPECTION PROGRAM BEEN ESTABLISHED IN ACCORDANCE WITH API RP 2D, PARAGRAPH 5.1.2 AND ARE INSPECTION RECORDS MAINTAINED FOR A PERIOD OF FOUR YEARS?</td></tr>
<tr><td>Regulatory Authority:
30 CFR 250.108(a)</td><td>Enforcement Action: W/C</td></tr>
<tr><td colspan="2">API Reference:</td></tr>
<tr><td colspan="2">NOTE:</td></tr>
<tr><td colspan="2">Wire Rope Inspection Program – A wire rope inspection program is an inspection program which takes into consideration crane type, frequency of usage, history of maintenance, wire rope manufacturer's recommendations, and crane manufacturer's recommendations
Note:
1. Inspection records must be maintained per API RP 2D, paragraph 4.2 to determine the time interval for retirement of the wire rope. Records must be readily available until the specific wire rope is retired. All observed wire rope deterioration as listed in API RP 2D, Appendix G, paragraph G.5.2.1b must be recorded on these inspection records.
2. Reference Appendix 24 for descriptions of "Frequency of Usage."</td></tr>
<tr><td colspan="2">INSPECTION PROCEDURE:</td></tr>
<tr><td colspan="2">Verify that:
1. A wire rope inspection program has been established.
2. Wire rope inspection records are available and are maintained for a period of 4 years</td></tr>
<tr><td colspan="2">IF NONCOMPLIANCE EXISTS:</td></tr>
<tr><td colspan="2">Issue a warning (W) INC if:
1. Records are not readily available or are not maintained for a period of 4 years.
2. Records are incomplete or inaccurate, but are sufficient to indicate that a wire rope inspection program has been established.

Issue a component shut-in (C) INC if a wire rope program has not been established.
1. A wire rope program has not been established.</td></tr>
<tr><td colspan="2">INSPECTION COUNT/ INC COUNT:</td></tr>
<tr><td colspan="2">Enter one item checked/ issue one INC for each crane inspected.</td></tr>
</table>

REPAIRS OR ALTERATIONS

I – 151	**HAS A PREVENTATIVE MAINTENANCE PROGRAM BEEN ESTABLISHED WITH RECORDS, IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.3.1, READILY AVAILABLE FOR A PERIOD OF FOUR YEARS?**	
	Regulatory Authority: 30 CFR 250.108(a)(e)	**Enforcement Action: W/C**
	API Reference:	
	NOTE:	
	1. A preventative maintenance program takes into consideration crane type, frequency of usage, history of maintenance, and manufacturer's recommendations. 2. Reference Appendix 24 for descriptions of "Frequency of Usage."	
	INSPECTION PROCEDURE:	
	Verify that: 1. A preventative maintenance program has been established. 2. Preventative maintenance records are readily available and are maintained for a period of 4 years.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if preventative maintenance program records ~~are not immediately available or~~ are not maintained for a period of 4 years. Issue a component shut-in (**C**) INC if records do not indicate that a preventive maintenance program has been established or are not immediately available.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Repairs and Alterations Continued)

I – 152	**ARE WRITTEN REPORTS CONFIRMING ADEQUACY OF REPAIRS OR ALTERATIONS IN ACCORDANCE WITH API RP 2D, PARAGRAPH 4.3.3c, MAINTAINED FOR A PERIOD OF FOUR YEARS?**	
	Regulatory Authority: **30 CFR 250.108(a)(e)**	**Enforcement Action: W/C**
	API Reference:	
	NOTE:	
	All replacement parts must be equal to or better than the original equipment. No welding repairs may be made to critical components, such as booms and swing circle assemblies, without specific repair procedures and recommendations from the original crane manufacturer or other similar qualified source.	
	INSPECTION PROCEDURE:	
	Verify that: 1. Written reports confirming the adequacy of major repairs or alterations are available. 2. The reports are maintained for a period of 4 years.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if written reports confirming the adequacy of repairs or alterations are not immediately available or are not maintained for a period of 4 years. Issue a component shut-in (**C**) INC if written reports: 1. Were not prepared confirming the adequacy of repairs or alterations performed. 2. Are incomplete or inaccurate	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Repairs and Alterations Continued)

I – 153	**ARE REPAIRS OR REPLACEMENTS OF CRITICAL COMPONENTS MADE ~~———~~ IN ACCORDANCE WITH API RP 2D,**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: C**
	API Reference:	
	NOTE:	
	All replacement parts must be equal to or exceed the original equipment. No welding repairs may be made to critical components, such as booms and swing circle assemblies, without specific repair procedures and recommendations from the original crane manufacturer, or other qualified source. Repairs or replacements of critical components should be made as soon as practical (API RP 2D, Appendix F.4.3.3) ~~Promptly means "Done Without Delay."~~	
	INSPECTION PROCEDURE:	
	1. Check facility crane records for evidence of crane repair or replacements of critical components. 2. If repair or replacement has been made, verify work was done promptly and accomplished in accordance with API RP 2D, Appendix F, paragraph F.4.3.3, item b.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if records indicate that work is not done promptly or accomplished in accordance with API RP 2D, Appendix F, paragraph F.4.3.3, item b.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

SLINGS

I – 161	**ARE SLINGS OF ALL TYPE, GRADE, AND CONSTRUCTION IDENTIFIED AS REQUIRED IN API RP 2D, PARAGRAPH 5.2.4b?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: C**
	API Reference:	
	NOTE:	
	Sling identification includes sling manufacturer's name, pertinent working load limits, proof test certification number, length, diameter, and date of proof test.	
	INSPECTION PROCEDURE:	
	Verify that the slings have the specified ID tags attached legible.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if sling identification tag is missing.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

I – 162	**ARE SLINGS PROPERLY STORED WHEN NOT IN USE IN ACCORDANCE WITH API RP 2D, APPENDIX G, PARAGRAPH G.5.2.1?**	
	Regulatory Authority: 30 CFR 250.108(a)	**Enforcement Action: W/C**
	API Reference: API RP 2D Appendix G 5.2.1	
	NOTE:	
	Slings should be stored in an area where they will not be exposed to water, extreme heat, or corrosive fumes, liquids and sprays. Slings should not be stored on the deck. All slings, when not in use, should be kept on a rack. Use of a rack minimizes accidental damage and allows easier monitoring of condition between regular inspections. If space limitations require that slings be stored along the side of the platform, they should be secured in a manner to prevent abrasion due to rubbing and maintained in a manner to minimize corrosion.	
	INSPECTION PROCEDURE:	
	Visually inspect areas near cranes for slings which are not properly stored and maintained	
	IF NONCOMPLIANCE EXISTS:	
	Issue a warning (**W**) INC if slings are not properly stored. Issue a component shut-in (**C**) INC if slings are not maintained in a manner to prevent loss of integrity due to abrasion or corrosion.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

CERTIFICATION

I – 171	**IS THE LESSEE ENSURING THAT THE MANUFACTURER IS CERTIFYING EACH CRANE MANUFACTURED AFTER MARCH 17, 2003, OR THAT EACH CRANE ON A FIXED PLATFORM INSTALLED AFTER MARCH 17, 2003, MEETS THE DESIGN, MATERIAL AND DIMENSIONAL SPECIFICATIONS USED IN THE CALCULATIONS AND HAS BEEN AUTHENTICATED IN ACCORDANCE WITH API SPEC 2C, PARAGRAPHS 5.5 AND 6.2?**	
	Regulatory Authority: **30 CFR 250.108(c)**	**Enforcement Action: C**
	API Reference: API SPEC 2C 5.5 and 6.2	
	INSPECTION PROCEDURE:	
	1. Verify that a nameplate is installed in compliance with API SPEC 2 C. 2. In the absence of the nameplate, verify that the lessee has the required manufacturer's information.	
	IF NONCOMPLIANCE EXISTS:	
	Issue one component shut-in (**C**) INC for each crane certification audited if the Lessee does not comply with API SPEC 2 C, Paragraph 5.5 and 6.2	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

PERSONNEL QUALIFICATIONS

I – 181	**DO ONLY QUALIFIED PERSONNEL PERFORM RIGGING OPERATIONS IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 2.44, 3.1.3, AND 3.1.4?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: C**
	API Reference: API RP 2D 2.44, 3.1.3, and 3.1.4	
	DEFINITION:	
	Rigger - Anyone who attaches or detaches lifting equipment to loads or lifting devices (API RP 2D 2.44) and who has received training in accordance with API RP 2D~~, paragraph~~ 3.1.4 and ~~Appendix A2~~Appendix A3.	
	INSPECTION PROCEDURE:	
	If rigging operations are in progress at the time of inspection, verify that personnel involved are qualified	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if rigging operations are in progress and personnel involved are not qualified.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

(Personnel Qualifications Continued)

I – 182	**ARE CRANES OPERATED ONLY BY QUALIFIED PERSONNEL IN ACCORDANCE WITH API RP 2D, PARAGRAPHS 3.1.1?**
	Regulatory Authority: 30 CFR 250.108(a) — **Enforcement Action: W/C**
	API Reference:
	NOTE:
	Qualified Person: A person who has met and passed the requirements of API RP 2D, paragraphs 2.42 and 3.1.2; 1. A trainee under the direct supervision of a Qualified Crane Operator; 2. Appropriate maintenance and supervisory personnel, when it is necessary for them to do so in the performance of their duties. **Note:** No one other than the personnel specified above should enter a crane cab.
	INSPECTION PROCEDURE:
	1. Verify from facility records that crane operations were performed by qualified personnel or under direct supervision of a qualified crane operator (a trainee). 2. If crane is in operation, verify that the person operating the crane is qualified or under direct supervision of a qualified crane operator (a trainee). **Note:** 1. A crane operator is not qualified if qualifications are not maintained, at a minimum, every four years 2. A written document from the facility operator stating that qualifications have been met is sufficient
	IF NONCOMPLIANCE EXISTS:
	Issue a warning (**W**) INC if facility records indicate that the crane was previously operated by unqualified personnel. Issue a component shut-in (**C**) INC if the crane in operation during the inspection is operated by unqualified personnel
	INSPECTION COUNT/ INC COUNT:
	Enter one item checked/ issue one INC for each crane inspected.

Personnel Qualifications Continued)

I – 183	**ARE CRANE INSPECTORS QUALIFIED IN ACCORDANCE WITH API RP 2D, PARAGRAPH 2.43?**	
	Regulatory Authority: **30 CFR 250.108(a)**	**Enforcement Action: C**
	API Reference: ______________	
	DEFINITION:	
	Qualified Crane Inspector - A person so designated by the employer who by reason of appropriate experience and training, in addition to meeting the requirements of Qualified Crane Operator, has attended formal training in and successfully completed courses on crane maintenance and troubleshooting, hoist troubleshooting and overhaul, and on structural aspects of offshore cranes, which gives a knowledge of structurally critical components and critical inspection areas for non-mechanical and/or mechanical cranes, as applicable.	
	INSPECTION PROCEDURE:	
	Verify from facility crane records that duties requiring a qualified crane inspector have been performed by qualified personnel. **Note:** 1. A crane inspector is not qualified if qualifications are not maintained, at a minimum, every 4 years. 2. A written document from the Operator stating that qualifications have been met is sufficient.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (**C**) INC if records ______________________ indicate that duties requiring a qualified crane inspector have been performed by unqualified personnel.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked/ issue one INC for each crane inspected.	

MATERIAL HANDLING

I – 190	**IS ALL MATERIAL-HANDLING EQUIPMENT OPERATED AND MAINTAINED IN A MANNER THAT ENSURES SAFE OPERATIONS AND PREVENTS POLLUTION?**	
	Regulatory Authority: 30 CFR 250.108(f)	**Enforcement Action: C**
	API Reference:	
	INSPECTION PROCEDURE:	
	1. Verify that material handling equipment is operated and maintained in a safe and pollution free manner. 2. Inspect records to ensure material handling equipment is operated per manufacturers and/or operators specifications.	
	IF NONCOMPLIANCE EXISTS:	
	Issue a component shut-in (C) INC when; 1. Material handling equipment is not operated and maintained in a safe manner. Material handling equipment is not operated and maintained in a pollution free manner.	
	INSPECTION COUNT/ INC COUNT:	
	Enter one item checked / issue one INC for facility inspected. **NOTE -** Material handling equipment includes, but is not limited to; air hoists, hoists, tugger, air tugger, winch, man-riding winch, come-a-long, monorail, gantry crane, jib	