Recommended Practice for Procedures for Inspections, Maintenance, Repair, and Remanufacture of Hoisting Equipment

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Contents

Recommended Practice for Procedures for Inspections, Maintenance, Repair, and Remanufacture of Hoisting Equipment

1 Scope

This document provides guidelines and establishes requirements for inspection, maintenance, repair, and remanufacture of items of hoisting equipment manufactured according to API 8A, API 8C, or ISO 13535 used in drilling and production operations, in order to maintain the serviceability of this equipment.

Items of drilling and production hoisting equipment covered are:

- crown-block sheaves and bearings;
- traveling blocks and hook blocks;
- block-to-hook adapters;
- connectors and link adapters;
- drilling hooks;
- tubing hooks and sucker-rod hooks;
- elevator links;
- casing elevators, tubing elevators, drill-pipe elevators, and drill-collar elevators;
- sucker-rod elevators;
- rotary swivel-bail adapters;
- rotary swivels;
- power swivels;
- power subs;
- spiders, if capable of being used as elevators;
- dead-line tie-down/wireline anchors;
- drill-string motion compensators;
- kelly spinners, if capable of being used as hoisting equipment;
- riser-running tool components, if capable of being used as hoisting equipment;
- wellhead-running tool components, if capable of being used as hoisting equipment;
- safety clamps, capable of being used as hoisting equipment;
- top drives;
- casing running tools.

2 Normative References

The following referenced document is indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9712 [1], *Non-destructive testing — Qualification and certification of personnel.*

3 Terms, Definitions, and Abbreviated Terms

For the purposes of this document, the following terms, definitions, and abbreviated terms apply.

3.1 Terms and Definitions

3.1.1
critical area
Highly stressed region of a primary-load-carrying component as defined by the manufacturer.

3.1.2
expendable parts
Parts normally used up or consumed in service.

EXAMPLE Seals, gaskets, filters, packing, V-belts, covers, guards, breathers, drains, and miscellaneous hardware and fasteners.

3.1.3
inspection
Comparison of equipment conformity to predetermined standards, followed by a determination of action required.

3.1.4
load test
Test wherein a load is applied under controlled and monitored conditions to verify the serviceability of equipment.

3.1.5
maintenance
Actions including inspection, adjustments, cleaning, lubrication, testing, and replacement of expendable parts, as necessary to maintain the serviceability of the equipment.

3.1.6
manufacturer
Individual or company that makes or processes equipment or material covered by this document.

3.1.7
owner
Individual, legal entity, or organization holding legal title to the equipment.

3.1.8
primary load
Axial load to which the equipment is subjected in operation.

1 International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.

3.1.9
primary-load-carrying component
Component of the equipment through which the primary load is carried.

3.1.10
remanufacture
Action performed on equipment that involves a special process or re-machining.

3.1.11
repair
Action performed on equipment that involves replacement of parts, other than expendable parts, but excludes remanufacture.

3.1.12
serviceability
Condition of a piece of equipment at any point in time that affects the ability of the equipment to perform its function(s) as intended.

3.1.13
special process
Operation that can change or affect the mechanical properties, including toughness, of the materials used in equipment.

3.1.14
testing
Action carried out on a piece of equipment to ensure that it can perform a required function.

3.1.15
user
Individual or company that uses equipment or material, or implements standards.

3.2 Abbreviated Terms

MT magnetic particle testing

NDT non-destructive testing

PSL product specification level

PT liquid penetrant testing

RT radiographic testing

UT ultrasonic testing

4 General Principles

4.1 Procedures

4.1.1 General

Users/owners of hoisting equipment shall establish written procedures for inspection, maintenance, repair, and remanufacture of each item of equipment.

4.1.2 Procedure Development

4.1.2.1 User/owner and Manufacturer Joint Procedure Development

The user/owner and manufacturer should jointly develop and update inspection, maintenance, repair, and remanufacture procedures consistent with equipment application, loading, work environment, usage, and operational conditions.

These factors may change as a result of new technology, product improvements, or fundamental changes in service conditions.

4.1.2.2 User/owner Procedure Development

If the manufacturer of the equipment no longer exists or is unable for any reason to provide suitable recommendations, the user/owner shall develop inspection, maintenance, repair, and remanufacture procedures consistent with widely-accepted industry practices.

4.1.2.3 Parts and Tooling

NDT, maintenance, and dismantling equipment shall be properly selected and adapted to the parts to be inspected and maintained.

4.2 Personnel Qualification

4.2.1 NDT Personnel Qualification Levels

4.2.1.1 Qualification

Inspectors shall be aware of the type of equipment to be evaluated and the NDT methods to apply.

The users/owners shall verify that the NDT inspector has the following information:

— assembly drawings and drawings identifying critical areas;

— rejection criteria.

In addition, the users/owners may provide the history of grinding or remanufacture, if available.

In the absence of critical area drawings, all areas of primary-load-carrying components shall be considered critical.

These data shall be used by the inspector to adapt the inspection procedure.

4.2.1.2 Certification

The NDT inspector shall be certified according to ISO 9712 or by other recognized NDT certification programs or standards.

4.2.2 Welding Personnel Qualification Levels

Welders shall be qualified to a recognized standard.

5 Inspection and Maintenance

5.1 General

5.1.1 Criteria

Inspection and maintenance are closely linked. Inspection and maintenance actions may be initiated based on, but not limited to, one or more of the following criteria:

- specific time intervals;
- measurable wear limits;
- load cycle accumulation;
- non-performance of equipment;
- environment;
- experience (history);
- regulatory requirements.

5.1.2 Safety Considerations

Operators shall review safety considerations applicable to the site where the maintenance activity is performed.

5.2 Maintenance

5.2.1 General

Maintenance of equipment consists of actions such as adjustments, cleaning, lubrication, and replacement of expendable parts. The complexity of these activities and the safety risks involved shall be considered in the assignment of appropriate resources such as facilities, equipment and qualified personnel.

5.2.2 Procedures

In addition to the procedures developed in accordance with 4.1, the manufacturer should define any special tools, materials, measuring and inspection equipment, and personnel qualifications necessary to perform the maintenance. The manufacturer should also specify those procedures that should be performed solely by the manufacturer, either within the manufacturer's facility or within another approved facility.

5.3 Inspection

5.3.1 General

The existence of cracks can indicate severe deterioration and impending failure. Their detection, identification and evaluation require accurate inspection methods.

Prompt attention is then required either to remove the equipment from service immediately or to provide appropriate service and/or repair.

Caution shall be exercised to take into account the increased susceptibility to brittle fracture of many steels when operating at low temperatures.

If any manufacturing defects are discovered, they should be reported to the manufacturer or supplier.

5.3.2 Inspection Categories

5.3.2.1 General

The objective of these inspections is to detect service defects, possible hidden manufacturing defects, and potential dropped objects.

Inspection results shall be reported on equipment files and drawings.

5.3.2.2 Category I

This category involves observing the equipment during operation for indications of inadequate performance.

When in use, equipment shall be visually inspected on a daily basis for cracks, loose fits or connections, elongation of parts, and other signs of wear, corrosion, or overloading. Any equipment found to show cracks, excessive wear, etc., shall be removed from service for further examination.

The daily inspection shall include visual inspection for potential dropped objects and retention devices or features that can be damaged, in need of adjustment, or missing. Any potential dropped objects or damaged/missing retention devices shall be immediately corrected.

The equipment shall be visually inspected by a person knowledgeable in that equipment and its function.

5.3.2.3 Category II

This is Category I inspection plus further inspection for corrosion, deformation, loose or missing components, deterioration, proper lubrication, visible external cracks, and adjustment.

5.3.2.4 Category III

This is Category II inspection plus further inspection, which should include NDT of critical areas and may involve some disassembly to access specific components and to identify wear that exceeds the manufacturer's allowable tolerances.

5.3.2.5 Category IV

This is Category III inspection plus further inspection for which the equipment is disassembled to the extent necessary to conduct NDT of all primary-load-carrying components as defined by manufacturer.

Equipment shall be:

— disassembled in a suitably-equipped facility to the extent necessary to permit full inspection of all primary-load-carrying components and other components that are critical to the equipment;

— inspected for excessive wear, cracks, flaws, and deformations.

Corrections shall be made in accordance with the manufacturer's recommendations.

Prior to Category III and Category IV inspections, all foreign material such as dirt, paint, grease, oil, scale, etc. shall be removed from the concerned parts by a suitable method (e.g. paint-stripping, steam-cleaning, grit-blasting).

5.3.3 Frequency

5.3.3.1 Periodic Inspection

The user/owner of the equipment should develop schedules of inspection based on experience, the manufacturer's recommendations, and one or more of the following factors:

— environment;

— load cycles;

— regulatory requirements;

— operating time;

— testing;

— repairs;

— remanufacture.

As an alternative, the user/owner may use Table 1 guidelines. Long-term planning shall be adjusted in order not to interfere unnecessarily with the running operations.

5.3.3.2 Non-periodic Inspection

A complete, on-job, shut-down inspection equivalent to the periodical Category III or Category IV (for the concerned equipment) should be made before (if anticipated) and after critical jobs (e.g. running heavy casing strings, jarring, pulling on stuck pipes, and/or operating at extreme low temperatures).

5.3.4 Inspection of Remanufactured Components

5.3.4.1 Unless specific and more stringent recommendations apply, welds of primary-load-carrying components shall be inspected as follows:

a) immediately after grinding;

b) after welding, but no sooner than 24 h after the part has reached ambient temperature;

c) in service, after a period of time to be specified in the user/owner/manufacturer's procedures except (unless otherwise recommended by the manufacturer) for non-accessible inner parts remanufactured under the full guarantee of the manufacturer.

5.3.4.2 The same NDT methods and procedures that detected the initial defects shall be used after remanufacture. In the event of remanufacture of primary-load-carrying components by welding, at least two of the most appropriate of the following methods shall apply with regard to 5.3.4.1 (b).

a) MT, for ferromagnetic materials, or PT, for non-ferromagnetic materials, to detect possible surface defects.

b) UT to detect possible defects below the surface. RT may be used as an alternative to UT if shown to be at least as effective as UT on the same configuration.

c) Proof load test in accordance with 8.3, followed by surface NDT of the tested component(s).

Table 1—Periodic Inspection and Maintenance—Categories and Frequencies

Equipment	Frequency							
	Days		Months			Years		
	1	7	1	3	6	1	2	5
	Inspection Category							
Crown-block sheaves and bearings	I	II			III			IV
Drilling hooks (other than sucker-rod hooks)	I	II			III			IV
Traveling blocks, hook block, and block-to-hook adapter	I	II			III			IV
Connectors and link adapters	I	II			III			IV
Tubing hooks and sucker-rod hooks	I	II			III	IV		
Elevator links	I	II			III	IV		
Casing elevators, tubing elevators, drill-pipe elevators, and drill-collar elevators;	II				III	IV		
Casing Running Tools	II				III	IV		
Sucker-rod elevators	II				III	IV		
Rotary swivel-bail adapters	I	II			III	IV		
Rotary swivels	I	II			III			IV
Power swivels	I	II			III			IV
Top Drives	I	II			III			IV
Power subs	I	II			III			IV
Spiders, if capable of being used as elevators	I	II			III	IV		
Dead-line tie-down/wireline anchors	I	II			III			IV
Drill-string motion compensators	II				III			IV
Kelly spinners, if capable of being used as hoisting equipment	I	II			III			IV
Riser- and wellhead-running tools, if capable of being used as hoisting equipment	II				III	IV		
Safety clamps, if capable of being used as hoisting equipment	II				IV			
NOTE The above recommended frequencies apply for equipment in use during the specified period.								

Other NDT techniques applied to hoisting equipment shall be submitted for the specific approval of both user/owner and manufacturer.

5.3.5 Results of Inspections

5.3.5.1 Acceptance Criteria

Acceptance criteria shall be established based on experience and manufacturer's recommendations. Worn equipment that does not meet the acceptance criteria shall not be accepted for operation.

5.3.5.2 Rejected Equipment

Rejected equipment shall be marked and removed from service.

5.3.5.3 Surface Indications

Surface indications identified by NDT may be allowable or non-allowable depending on their size, shape, and location, as defined by the manufacturer.

5.3.5.4 Allowable Surface Indications

Allowable surface indications are surface indications of such a size, shape, and location that they need not be removed.

5.3.5.5 Non-allowable Surface Indications

Non-allowable surface indications shall be classified as follows.

a) Minor surface indications:

   Minor surface indications may be removed by filing or grinding if this can be achieved within the limits specified by the manufacturer, otherwise they shall be classified as major surface indications. Caution should be exercised to prevent heating to an extent that could change the mechanical properties, including toughness, of the material.

a) Major surface indications:

   Major surface indications, which require material removal beyond the limits specified by the manufacturer, should be corrected by remanufacture.

5.3.6 Inspection and Maintenance (Lubrication) of Wire Rope

Inspection and maintenance (lubrication) of wire rope used in hoisting shall be carried out on a regular basis. API RP 9B [1] may be consulted for further information on inspection and maintenance of wire rope.

5.3.7 Wear Limits for Square Shoulder Elevator Bores

Wear limits for square shoulder elevator bores for casing and tubing shall be as specified in Annex A.

5.3.8 Inspection and Maintenance for Top Drive/Power Swivel Misalignment with the Wellbore

Inspection and maintenance for top drive/power swivel misalignment with the wellbore should be carried out as noted in Annex B.

6 Repair

6.1 Procedures

Manufacturers should provide adequate information to allow the equipment user/owner to identify the nature of repairs that may be required. Repairs shall be performed using methods or procedures established in accordance with 4.1.

6.2 Bearings

Anti-friction bearings play an important part in the serviceability of equipment. The most likely causes of the need for bearing replacement are very loose or bent cages (rolling element retainers), corrosion, abrasion, inadequate (or improper) lubrication and spalling due to fatigue. Excessive clearance may indicate improper adjustment or assembly and should be corrected. Repair of anti-friction bearings should not be attempted by field or shop personnel. The equipment manufacturer should be consulted in the event of unexplained or repeated bearing failure.

6.3 Replacement Parts

All replacement primary-load-carrying components shall meet or exceed the original manufacturer's criteria and the following requirements:

a) the primary-load-carrying components shall be subject to the same minimum requirements and standards as the original equipment components;

b) the documentation and traceability requirements shall be the same as for the original equipment components.

7 Remanufacture

7.1 Procedures

Remanufacture of equipment shall be performed using methods and procedures developed in accordance with 4.1. The material used for the remanufacture shall be qualified to the manufacturer's requirements for mechanical properties, ductility and toughness. The equipment rating resulting from remanufacture should be in accordance with the equipment manufacturer's recommendations. Equipment that cannot be remanufactured shall be destroyed.

If welding is necessary, it shall be performed in accordance with a written procedure that has been qualified in accordance with a recognized standard.

7.2 Verification

Following remanufacture, verification shall be performed in accordance with 5.3.4.

8 Load Testing

8.1 General

Two types of load test are described, as follows.

8.2 Performance Load Test

A performance load test may be used to verify the function of the equipment and/or its ability to perform under specific conditions or in conjunction with other equipment or materials (e.g. it may be used to determine the effects of gripping a specific pipe with a given elevator). A performance test may consist of any number of cycles (as needed) of loads up to, but not exceeding, the rated load of the equipment under test.

8.3 Proof Load Test

A proof load test is performed by applying a load equal to 1.5 times the rated load of the equipment for a period of not less than 5 min. Proof load tests should not consist of more than one cycle and shall not be used in lieu of performance load tests. Hoisting equipment should be proof load tested only once following manufacture or remanufacture, since loads above the rated load may cause cumulative (fatigue) damage. A proof load test shall be followed by surface NDT. Materials that are prone to delayed cracking should be subjected to surface NDT no earlier than 24 h after proof load testing.

9 Documentation and Records

9.1 General

The user/owner shall maintain an equipment file containing pertinent information regarding the equipment. The equipment file should include the following:

a) documentation delivered by the manufacturer;

b) documentation established by the user/owner during the life of the equipment.

9.2 User/Owner Equipment File

9.2.1 General

The user/owner shall build, for each item of equipment, equipment file which includes the following information, where available:

a) equipment description, type and style, serial number, PSL, specifications, manufacturer;

b) nominal capacities;

c) list of components and assembly drawings, highlighting the steel grades, PSL, and minimum service temperature of critical components. Critical areas shall be clearly defined;

d) categories/frequencies of recommended inspection/maintenance and related safety measures;

e) repairable defects with their (maximal) dimensions and location (as applicable);

f) activity records;

g) effective running time (when possible) and critical jobs.

9.2.2 Identification/traceability

Unit serial number or identification marking provided by the manufacturer should be maintained on the equipment. Identification marking shall be provided by the user/owner for unidentified equipment. Serial numbers or identification marking shall be recorded in the equipment file.

9.2.3 History

Changes in equipment status that could affect equipment safety, serviceability, or maintenance should be recorded in the equipment file.

9.3 Activity Records

Records of Category III and Category IV inspections shall be entered in the equipment file as well as any load test data related to or indicating the load-carrying capacity of the equipment.

Entries describing repair, remanufacture and testing activities shall be included in the user/owner equipment file.

Records shall indicate:

a) significant defects (type, dimensions) reported on a drawing;

b) location and extent of repairs;

c) NDT methods and results;

d) primary-load-carrying components replaced or remanufactured;

e) the date and the name of the responsible person(s) involved in the inspection, maintenance, repair, or remanufacture.

Annex A
(normative)

Wear Limits for Square Shoulder Elevator Bores

A.1 Evaluation of Casing or Tubing Coupling (or Load Shoulder)

The ability of the casing or tubing coupling (or connection load shoulder) to support the required load is affected by wear of the elevator bore, which reduces the area of contact between the coupling (or connection load shoulder) and the elevator load shoulder. The capacity of casing or tubing connections to support a specific load should be determined with the assumption that the elevator bore is approaching the value listed in Table A.1. The load capacity of lift nubbins (or other devices providing a load face perpendicular to the centerline of the tubular), intended to support the tubular load via contact with the square shoulder load face of elevators bored for a nominal tubular diameter equal to the tubing or casing upset, shall be evaluated with the same assumed elevator bore and wear.

A.2 Elevator Wear Limits

Square shoulder elevators such as single joint, center-latch, side-door, and similar lift devices on which the load face is perpendicular to the centerline of the tubular shall be subject to the wear limits of Table A.1. Elevators for which the bore measurements exceed the Table A.1 limits shall either be remanufactured or scrapped.

Table A.1—Wear Limits for Square Shoulder Elevator Bores for Non-upset Casing and Tubing

Nominal Casing or Tubing Size D	Maximum Allowable (Worn) Load Shoulder Bore D_{MA}
$D < 4^1/_2$ in.	1.001 x (D x 25.4) + 3.43 mm [a] 1.001 x D + 0.135 in. [b]
$4^1/_2$ in. ≤ D < $12^7/_8$ in.	1.0175 x (D x 25.4) + 2.03 mm [a] 1.0175 x D + 0.080 in. [b]
$12^7/_8$ in. ≤ D ≤ 20 in.	1.0175 x (D x 25.4) + 1.40 mm [a] 1.0175 x D + 0.055 in. [b]
20 in. < D < 42 in.	1.0125 x (D x 25.4) + 3.96 mm [a] 1.0125 x D + 0.156 in. [b]
42 in. ≤ D	1.010 x (D x 25.4) + 7.62 mm [a] 1.010 x D + 0.300 in. [b]

Localized wear allowances

When the load shoulder bore diameter is measured, if localized portions of the bore are found to measure larger than D_{MA} (computed above), the bore need not be rejected if all of the following conditions are met:

a) The depth of wear, grinding, or other damage in localized portion(s) of the bore shall not exceed 3.2 mm ($^1/_8$ in.);

b) The surface of a localized wear, grinding, or other damage, shall be blended back to the adjacent bore surfaces with a transition not less than 3 to 1 (length to depth);

c) After blending, the total length (measured around the bore surface) of all such areas of localized wear, grinding, etc., including the transitions to the bore surface, shall not exceed (the nominal diameter x 0.25) in length.

[a] The computed value of D_{MA} is expressed in SI units of millimeters.

[b] The computed value of D_{MA} is expressed in USC units of inches.

Annex B
(informative)

Top Drive/Power Swivel Misalignment

B.1 Top Drive/power Swivel Misalignment with the Wellbore

The top drive/power swivel main shaft assembly is subjected to the highest tensile and torsional loads. As wells are drilled to greater depths and higher deviation, the combination of tensile and torsional loads may reach a level that represents a high percentage of the strength of the material. When this occurs, only a small amount of cyclic loading is required to drastically reduce the number of cycles before fatigue failure occurs. Further, when a top drive/power swivel is misaligned with the drill-string while drilling in these conditions, the amplitude of the resulting bending moment acting on the main drive shaft assembly components can create high reversing stresses that will result in premature fatigue failure of top drive/power swivel components. This section identifies some of the major causes of misalignment and their solutions.

B.2 Top Drive/power Swivel Main Shaft Assembly

The top drive/power swivel main shaft assembly includes, but is not limited to the following components:

— swivel stem;

— top drive/power swivel main shaft;

— one or two IBOP valves;

— crossover or Intermediate sub;

— saver sub.

B.3 Causes of Misalignment

All of these components are assembled using rotary shouldered connections. Some top drives/power swivels incorporate an integral swivel. In these units, the swivel stem and the top drive main shaft are the same shaft. When drilling, the drill-string is made up directly to the top drive/power swivel, and therefore, the entire main shaft assembly is subjected to all tensile and torsional loads. However, when hoisting the drill-string or casing with elevators, most top drives/power swivel main shafts feature a collar that is located just above the lower connection of the top drive/power swivel main shaft that absorbs all of the tensile loads. In this mode of operation, none of the main shaft assembly components are under load except the top drive/power swivel main shaft itself. Therefore, drilling is the primary mode of operation that influences the fatigue life of top drive/power swivel main shaft assembly components.

Misalignment between the main shaft assembly and the wellbore can cause cyclic loading stresses to increase to much higher levels but this can be significantly reduced with proper alignment. Some of the major causes of misalignment are provided in the following:

a) the vertical axis of the derrick or mast is misaligned with the gravitational axis of the drill-string;

b) the plane of the traveling equipment guide rails (if fitted) is misaligned with the derrick and/or the drill-string;

c) the plane of the guide dolly structure is misaligned with the plane of the guide rails, and/or vertical axis of the derrick;

d) the guide dolly structure has been damaged, causing misalignment between it and the guide rails;

e) the axis of the top drive/power swivel main shaft is misaligned with the plane of the guide dolly structure;

f) there are more lines strung onto the sheaves on one side of the traveling block than the other, causing the traveling block to tilt when under load;

g) for top drives/power swivels used with traveling equipment that can be retracted or extended away from rotary center, a malfunction in the retraction system that prevents the traveling equipment from returning properly to rotary center will cause misalignment between the top drive/power swivel and the drill-string while drilling;

h) riser/conductor barrel may not be parallel and concentric with the mast/guide track/top drive main shaft.

NOTE More than one of these conditions can exist at the same time, which can make cause identification difficult.

B.4 Solutions for Misalignment

Identification and alleviation of one or more of the above conditions should be carried out by derrick/mast manufacturers and other specialists who have the equipment and expertise to identify the root cause of the misalignment, and know what actions need to be performed to correct it. Methods for checking alignment may include but are not limited to the use of transits, laser tools, piano wire, and measuring devices (see API 4G [2]).

Maximum misalignment tolerance recommendations should be provided by the top drive/power swivel equipment manufacturer as each manufacturer utilizes different types of guide systems that each are more or less tolerant to guide system alignment.

The initial signs of misalignment are often fatigue cracks that occur at greater frequencies in the root of the last-engaged threads of any box or pin connection in the main shaft assembly. Box connections are generally more susceptible to cyclic bending fatigue failure than pin connections. Therefore, stress relief features should be machined into top drive/power swivel connections wherever possible.

NOTE It may not be possible to employ these features on all connections such as those on IBOP valves and the lower swivel stem box connections.

The thread root of top drive/power swivel main shaft connections should also be cold-worked after all machining to increase fatigue life. In extreme cases, it may be necessary to employ the use of connections that feature a larger thread root radius to extend fatigue life.

Regardless of what connections are used or whatever stress-relief features are employed, visual and non-destructive examination (NDE) should be carried out to the connections of the top drive/power swivel main shaft assembly on a regular basis as recommended in API 8B and API 7-2, even though the size of the connections used in the main shaft assembly are much larger than those typically used for the drill-string that is connected to it.

Bibliography

[1] API RP 9B, *Application, Care, and Use of Wire Rope for Oil Field Service.*

[2] API RP 4G, *Operation, Inspection, Maintenance, and Repair of Drilling and Well Servicing Structures*

[3] ISO 13535, *Petroleum and natural gas industries—Drilling and production equipment—Hoisting equipment*

[4] API Spec 7-2, *Specification for Threading and Gauging of Rotary Shouldered Thread Connections*

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