“OPERATION, MAINTENANCE & INSPECTION OF HOISTING EQUIPMENT”

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COMMITTEE ON GUIDELINES FOR

“OPERATION, MAINTENANCE & INSPECTION OF HOISTING EQUIPMENT”

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Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain – upstream, midstream and downstream – Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry, Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits.

In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards – starting with research by in-house experts and iterating through seeking & validating inputs from all stake-holders – operators, designers, national level knowledge authorities and public at large – with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD – except in the Upstream Petroleum Sector – is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of international and national level Knowledge Organizations – both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate
FOREWORD

The Oil Industry in India is more than 100 years old. Because of various collaboration agreements, a variety of international codes, standards and practices have been in vogue. Standardisation in design philosophies and operation and maintenance practices at a national level was hardly in existence. This coupled with feedback from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state-of-the-art in designing, operating and maintaining oil and gas installations.

With this in view, the Ministry of Petroleum and Natural Gas in 1986 constituted a Safety Council assisted by the Oil Industry Safety Directorate (OISD) staffed from within the industry in formulating and implementing a series of self-regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safe operations. Accordingly, OISD constituted a number of functional committees of experts nominated from the industry to draw up standards and guidelines on various subjects.

The present standard was prepared by the Functional Committee on “Operation, Maintenance and Inspection of Hoisting Equipment”. The document is based on the accumulated knowledge and experience of industry members, the various national and international codes and practices.

This standard is meant to be used as supplement and not as a replacement for existing codes and practices.

It is hoped that provisions of this standard, if implemented objectively, may go a long way to improve the safety and reduce accidents in Oil and Gas Industry. Users are cautioned that no standard can be substitute for the judgment of responsible and experienced Engineers.

Suggestions are invited from the users after it is put into practice to improve the document further. Suggestions for amendments to this document should be addressed to

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This standard in no way supersedes the statutory requirements like Factories Act, OMR, CCE etc.
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The document is intended to supplement rather than replace the prevailing statutory requirements.
COMMITTEE
ON
"OPERATION, MAINTENANCE & INSPECTION OF HOISTING EQUIPMENT"

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OPERATIONS, MAINTENANCE & INSPECTION OF HOISTING EQUIPMENT

1.0 Introduction

Material handling is an important operation in oil industry. Due to complex and hazardous nature of job requirements, utmost care is required for material handling. The hoisting equipment are one of the most important material handling equipment. The regular maintenance and inspection of these equipment is essential for safe operation and to enhance their life.

2.0 Scope

The scope of this document is to provide guidelines for the operation, maintenance and inspection procedures that may be utilized to maintain serviceability and good health of hoisting equipment. The document covers correct operation and various aspects of maintenance and inspection of hoisting equipment (except cranes, covered in OISD Std.205).

These guidelines are to provide and assist in safe and reliable operations as a supplement to the manufacturer’s instructions which should be read, retained and followed.

3.0 Definitions

**Inspection:** It is the comparison of equipment conformity to predetermined standards, followed by a determination of action required.

**Maintenance:** Maintenance consists of actions including inspection, adjustments, cleaning, lubrication, and testing and expandable parts replacement necessary to maintain the serviceability of the equipment.

**Manufacturer:** A term denoting individuals or companies who make or process equipment or material.

**Owner:** An individual, legal entity or organization holding legal title to the equipment.

**Repair:** Actions performed on equipment that involves replacement and/or adjustment of parts other than expendable but exclude re-manufacturing operations.

**Testing:** Actions that are carried out on a piece of equipment to ensure that it can perform required function.

**Users:** A term denoting individuals or companies, who use equipment or materials or implement recommended practices.

**Accessories:** A secondary part /assembly of parts which contributes the overall function and usefulness of the machine.

**Crown Block:** A crown block is a sheaved pulley located at the top of the drilling/workover rig to provide a leverage point for wire line stringing. The sheaves of the pulley are mounted on roller bearings. The shaft assembly is bolted to the uppermost section of the rig frame. The drilling cable is rolled over the sheaves of the crown block alternately with the sheaves of the traveling block.

**Travelling Block:** A traveling block is a sheaved pulley arrangement that moves up and down as it hangs in the derrick and is used to pull drill pipe and casing as well as to hold the power swivel for drill pipe turning.

**Drilling Hooks:** Hooks are attached to the traveling blocks with a large shackles, and are used to various pulling functions of the rig. Small capacity hooks are used to handle tubing and sucker rods. Larger capacity hooks are designed to carry heavier loads of pipe ranging from 100 to 650 tons. Such hooks are equipped with a strong interior.

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spring and/or hydraulic snubber assembly to help absorb load shock developed by drilling operations.

**Draw-works:** A draw work consists of a large revolving drum around which the drilling line is wound, the catch up to which the cat heads are mounted and a series of shafts, clutches and chains and gear drives for changing speed and operation of directions forward or reverse.

**Catheads:** The Cat heads are installed on the cat shafts at both ends of draw works. One cat head is generally a simple drum type cat head used for light hoisting duties performed by rope and muscle power. However, the latest in use cat heads are generally air actuated mechanical devices. With modulated air valves to permit precise control in exerting pulls on donning or spinning lines.

**Air clutches of draw-works:** Air clutches are used in various positions in the draw works and drive groups to engage and disengage power transmission to the individual rig component. The air clutch is actuated by air pressure which closes quick release valves.

**Hydro-matic Brake:** The hydro-matic brake absorbs power by converting mechanical energy into heat within the brake fluid. The hydro-matic brake slows the input speed but does not bring it to a complete stop. The hydro-matic brake contains water within the working chamber which functions as an energy absorber.

**Elevators:** Elevators are clamps that grip a stand of drill pipe, casing, tubing and sucker rods so that the stand can be raised or lowered into the well. These are of two types, bottle neck type & collar lift type.

**Rotary Swivel:** It is a device joining two parts so that one or both can pivot freely. Bail goose neck, wash pipe, stem bearing are the main components of the swivel. It attached directly to kelly, rotates at the same time, and provide passage for a tremendous volume of drilling fluid under very high pressure.

**Power Swivel:** Power swivel is a device that moves with a travelling block and is designed to provide rotary power to the top of drilling string for drilling operation. It replaces the rotary swivel and includes rotary seal and bearing for supporting drill string weight.

**Spiders:** Spider is a set of clamps that grips a heavy string of stand of drill pipe, casing, tubing and sucker rods in such a way that these can be raised or lowered in to the well.

**Power Sub:** Power swivel is a device that moves with a travelling block and is designed to provide rotary power to the top of drilling string for drilling operation. It replaces the rotary swivel and includes rotary seal and bearing for supporting drill string weight.

**Safety clamps:** Safety clamps are used on drill collars above the slips to prevent the dropping of the string when the slips fail to hold.

**Drill String motion Compensator:**
This equipment is used on floater offshore rigs to compensate for the vertical movement (heave) of the vessel and thus keeps the drill string undisturbed and thus keeping weight on bit constant. Charging or discharging air in the hydraulic compensator system can easily vary the weight on bit. Compensator unit, interface vessel mounted with derrick, Compressor, Air pressure Vessel, control console, valves and piping.

**Riser Running Tool:** This is used for running the BOP stack, well head and casing etc.

**Guy-lines:** Guy-lines are wire ropes tied to the mast for its stability.

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Air winch: A mechanical device operated by compressed air is used to lift the drill pipe, drill collar and other light loads needed at derrick floor.

Chain Pulley: The device used to lift loads by applying effort on linked chain which passed over a pulley.

4.0 Equipment covered

Hoisting equipment covered are:
- Crown block
- Travelling blocks
- Draw-works
- Block to hook adapters
- Connectors and link adapters
- Elevators links
- Casing, tubing and drill pipe & drill collar elevators
- Rotary swivels
- Power swivels
- Power subs
- Drill string motion compensators
- Spiders when capable of being used as elevators
- Kelly spinners when capable of being used as hoisting equipment
- Safety clamps when capable of being used hoisting equipment
- Dead line tie down / wire line anchors
- Tubing and sucker rods hook
- Sucker rod elevators
- Gin Poles
- Guy lines
- Mast/ derrick
- Air winch
- Chain Pulley blocks and hooks

5.0 INSPECTION PROCEDURE

The inspection procedure for hoisting equipment should be developed based on the following factors:
- Application
- Loading and its usage
- Work environment

These factors for the purpose of equipment inspection may change from time to time as per the manufacturer’s guidelines, new technology, equipment history, product improvement and change in service conditions. However, in the broader terms the inspection of hoisting equipment should be carried out at the following stages:
1. At the time of commissioning of the equipment.
2. Routine inspection
3. At major repair

5.1 Inspection at the time Of Commissioning of the equipment

For a new hoisting equipment various inspections required to be carried out are:

i) Verification of manufacturer’s data and his test records/results.
ii) Inspection of equipment in view of fittings, workmanship etc.
iii) Checking conformity to the latest applicable standards.
iv) Main load bearing components shall be magnetic particle inspected after weld repairs and final heat treatment but before painting and assembly
v) Main load bearing components shall have tensile tests to ensure good brittle fracture

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vi) Manufacturer should provide a certificate that gives a serial No., Model No., rating and heat number.

vii) Manufacturer should provide certificate inspection records, mechanical properties, chemistry and weld repair records etc.

5.2 Routine inspection

5.2.1 Inspection Category and Frequency

Inspection should be carried out according to following four categories:

i) **Category I**
   This category includes observation of the equipment in case of indications of inadequate performance.

ii) **Category II**
   This includes inspection done under category I plus further inspection for corrosion, deformation, loose and missing components, deterioration, proper lubrication, visible cracks and adjustment.

iii) **Category III**
   This includes inspection done under category II plus further inspection, which should include NDT (Non-Destructive Technique) of exposed critical areas and may involve some disassembly to access specific components and identify wear that exceeds the manufacturer's allowable tolerances.

iv) **Category IV**
   This is the category III inspection plus further inspection where the equipment is disassembled to the extent necessary to conduct NDT of all primary load-carrying components as defined by the manufacturer.

5.2.2 Daily and Weekly Inspection (Category I &II)

Daily and Weekly visual inspection of the hoisting equipment in an operating condition should be made by the crew or supervisor:

Person inspecting the equipment on daily/weekly basis should look for cracks, loose fits or connections, elongation of the parts and signs of excessive wear or overloading. Any equipment found to show any of these discrepancies should be removed from the operation / service. He should check for missing components, improper lubrication and corrosion.

Tools be kept clean by hosing or brushing for daily/weekly visual inspection.

Field disassembly should not be done unless a clean dust free location is available.

5.2.3 Quarterly/Half yearly Inspection (Category –III)

Quarterly/Half yearly inspection be done by following methods:

Thorough on the job shut down inspection should be carried out on quarterly/half yearly basis in the field by the crew with the help of supervisor. All hoisting tools and their components should be inspected considering the good engineering practices and maintained in safe condition. No element in the hoisting tool system should be subjected to any load in excess of its design limitations.

5.2.4 Disassembly Inspection/Category-IV

Equipment should be taken to suitably equipped facility and all parts be checked for excessive wear and cracks both visually and by non-destructive techniques (NDT).

i) Cleaning: All foreign material such as dirt, paint, grease and oil should be removed from the surfaces of the equipment by hosing or brushing and soap solution.

ii) Disassembly: The equipment should be disassembled as much as necessary to permit NDT inspection of all load-bearing parts. Field disassembly should be done in a clean dust free location.

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(iii) Inspection Procedure: a trained competent operator should make the inspection. After removal of the defect in a particular part, the inspection again is done by an appropriate NDT method to ensure that the defect has been completely removed.

5.2.5 Inspection at major repair

At every major repair required due to break down or otherwise the complete disassembly and inspection are to be carried out as per the categories -IV Depending upon the requirement, inspection methods shall be used viz. Visual (VT), Liquid Penetrant Examination, Magnetic particles (MT), Ultrasonic (UT).

For periodic inspection category of various hoisting equipment used in drilling/work-over services, refer table given in annexure-1.

6.0 Equipment Maintenance and Inspection

6.1 Crown blocks:

(i) Every part of the crown block should be checked for cracks, distortion, fitting and lubrication of the pins & bearings. It should be inspected that adequate arrangement is made to prevent the sheaves from jumping out of the bearing.

(ii) Lubricate bearings, remove any dust and weather protect as required, check and secure all fasteners.

(iii) Bumper blocks should be inspected that it is properly fastened along their full length with both ends secured to mast and if it is wooden block then it should be enclosed with a protective screen to prevent wood fragments from falling to the work floor area.

(iv) The crown block assembly should be regularly reversed to even out wear on the fast line and deadline sheaves.

6.2 Travelling block & its components

(i) The travelling block and its components should be inspected for proper guard, looseness in pins, bearing fit cracks & wear in sheaves. Body & pins should be inspected for any change in gauge/size.

(ii) A suitable stop device shall be fitted to prevent travelling block hitting crown block and derrick floor. The device shall be tested at rig up or at least once a week thereafter when in use or when hoisting system is changed. Twin stop safety device/Crown-o-matic device shall also be inspected for accurate stoppage of traveling block at the adjusted points.

(iii) The hoisting line should not be removed from the hoisting drum until the traveling block is rested on the rig floor or held suspended by a separate wire rope or chain.

(iv) The service of the bearings should be done as per manufacturer’s guidelines. It is usually done after running/carrying the load of 630 tons at 100 RPM in case of block capacity of 480 tons and load of 760 tons at 75 RPM in case of block capacity of 550 tons.

6.2.1 Block to hook adopters:

Inspect for excessive wear, loose fitting and cracks in yokes & pins.

6.2.2 Connectors and link adapters:

Inspect the link for body wear, cracks and elongation, or reduction in the body sections. Pinholes and pins should be inspected for cracks. Link arms should be checked for excessive wear.

6.2.3 Drilling Hooks

Drilling Hooks to be inspected for its latch, wear and cracks, reduction of arm sections, and fittings of pin body cracks.

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6.3 DRAW WORKS

The guidelines for safe operation and inspection of draw-works:

(i) The equipment operator shall not leave the draw works brake without tying the brake down or securing it with a catch lock, unless the draw works is equipped with an automatic feed control.

(ii) A draw works used for well drilling shall be equipped with a device which actuates an emergency stop of the drum and engages the brake when the maximum wraps on the drum have been reached.

(iii) An emergency shutdown switch for a draw works engine or motor shall be located at the draw-works drum control console.

(iv) A visual inspection of the draw works and its working parts should be made at least once each day and records be maintained.

(v) Check the guard of the draw works for its placement and good condition.

(vi) Inspect the brakes system on the draw-works in line with manufacturer’s recommendations. Mechanical brakes requires periodic checks for wear of both brake blocks and brake flanges. Ensure that the designed flow rate and pressure of cooling water is maintained.

(vii) Tension should be applied by a catline tugger or other means when running the initial wraps on the draw-works.

(viii) When the hoisting line is placed on the hoisting drum, the end shall be securely fastened and there shall not be less than seven line wraps remaining on the drum at the lowest operating position of the travelling block.

6.3.1 CATHEADS

The guidelines for safe operation, maintenance and inspection of catheads should be followed:

(i) Cat head should be checked for grooves and rebuilt and turned when necessary to prevent fouling, cat head groove depth should not exceed ¼ inch.

(ii) A blunt smooth edged divider to separate the first wrap of a line on a cat head should be installed on all manually operated rope catheads and the clearance between the device and friction surface of the cathead should not exceed 1/2 inch.

(iii) Key seat and projecting key on a cat head should be covered with a smooth thimble or plate.

(iv) The fasteners for the guides and housing should be secured against loosening by safety wires or other equivalent means.

(v) Precautions should be taken to prevent entanglement of other lines with line in use on a cathead.

(vi) When a cathead is un-attended, a rope or line should not remain wrapped on or in contact with the cathead.

(vii) Only competent and authorised person should attend the draw-works control when a manually operated cathead is in use.

(viii) A guard shall be provided for protection of the operator at the draw-work controls when the line is in close proximity of the operator during operation of a catline, jerking or spinning line.

(ix) An automatic cathead and its mechanism should be maintained in safe working condition.

(x) A splice should not be allowed to contact the cathead friction surface, with the exception of the endless rope properly spliced.

(xi) A cat line shall not be used to raise or lower personnel.

6.3.2 Mechanical Brakes on Draw-works

The mechanical self energizing friction brake on the draw works is a critical item. Guidelines for its safe operation, maintenance and inspection are:

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(i) Check the brake equalizer for even and uniform braking on both ends at least once a week. If rough braking with jerks is noticed at any time, check brake band shoes, shoe screws and eyebolt adjustment on equalizer beam immediately.

(ii) Inspect the water jackets water lines and stuffing box for scaling. This should be done every 6-8 months depending upon the quality of water being used. Scaling may lead to various problems due to inadequate water flow. Inadequate cooling can lead to weld failure on jacket, cracking of hard surface on rim due to change in composition, failure of hose and pipe joints, thermal shocks on jackets.

(iii) The rims should be periodically inspected for wear. Inspection of rim is a must during change of brake shoes. In case, hard facing is suspected to be worn out or material has come off, immediate corrective measures should be taken.

(iv) While relining the brake band with new blocks, inspect the brake band for any cracks or fissures. In case any crack has developed replace with new brake band.

(v) When changing the blocks, ensure that complete set of blocks is changed. C-clamp may be used on the band for tightening the nuts ensuring that the nuts are tightened properly. The band should be free of rust, oil, grease and paint.

Storage and Preservation:

The brake rims require due attention:

a. Store the brake rim flat on its side with the bolt up flange on top for handling. This will avoid the risk of egg-shaping

b. Drain water from jacket on an idle rig to avoid rusting in warm conditions and cracking in freezing conditions.

c. Cover the rims with greased oil paper. This will prevent rusting. Before reactivating a rig, all traces of grease and rust (if any) should be removed to avoid build up on the blocks and leading to problems like slippage.

6.3.3 Hydromatic Brake

(i) Ensure that continuous flow rate as per manufacturer’s specification is maintained.

(ii) The temperature of water should not be allowed to rise above 85 Deg.C.

(iii) Inspect turbine blades for wear, pitting etc. upon disassembly. Check clearances are as per manufacturer’s specifications.

6.3.4 Chain Drives

(i) The chain drive should be periodically inspected for proper alignment and tension and lubrication. Mis-alignments of chain drive can cause uneven loading across the width of the chain.

(ii) To ensure proper alignment drive shafts must be parallel and leveled and the sprockets that old the chain must be properly aligned on the parallel shaft.

(iii) Improper tension might result in the chain adhering to the drive sprockets teeth, eventually snapping out of engagement. To prevent this, periodic adjustments should be made to properly adjust the chain tension.

(iv) Improper lubrication can result in chain fatigue and excessive wear due to overheating. Discoloration of the chain to red-oxide is a good indication of these conditions. The lubricating system should be checked for proper operation and contaminated oil shall be replaced with clean oil and filter.

(v) It should be ensured that the chain guard is in place before engaging the drive.

6.3.5 Air Clutches

Maintenance of the air clutch includes checking of:

(i) Air lines for restrictions or leaks

(ii) Operating valve for full opening

(iii) Air leakage at the quick release valve or at the diaphragm

Cold weather operation sometimes requires the introduction of ethylene glycol in
the air to avoid freezing of accumulated moisture within the air system.

6.4 Deadline anchor:

(i) A deadline anchor for a hoisting line should be so constructed, installed that its strengths equals or exceeds the working strength of the hoisting line.

(ii) Before new rope is slipped into the system, the clamp and brass inserts should be removed and inspected. The brass inserts should be replaced if worn or damaged.

(iii) The nuts should be tightened to the recommended torque by the manufacturer. The torque should be rechecked after the first one to two hours of operation.

6.5 Drilling Weight Indicator

The weight indicator shall be checked monthly for calibration by comparing its reading with the calculated drill string or tubing string weight, with adjustment made as necessary.

6.6 Casing line and sand lines

(i) All casing lines should be visually inspected at least once each day when in use and thoroughly inspected once each month and its record be maintained.

(ii) Wire rope used for hoisting purposes should be of strength to safely lift and otherwise handle anticipated loads under service. The maximum allowable working load should be based on a minimum safety factor of 3 in case of normal operation and safety factor 2 is allowed while setting casing, pulling on stuck pipe or while engaging in similar infrequent operations. For more details OISD STD - 187 may be referred.

(iii) The hoisting line under load shall not be allowed to come in contact with any part of the derrick or mast. Kick-back rollers provided for the purpose should be inspected daily for their wear and free movement.

(iv) Work done by the casing line should be calculated in accordance with OISD Std. 187 and its record be maintained. Casing line slip and cut procedures shall be followed in line with OISD Std. 187. A ton-mile indicator may be installed to record the work done by the casing line.

6.7 Casing, tubing and drill pipe & drill collar elevators

Inspect the elevator latches, latch locks, pins and springs for wear & cracks. Shoulder and elevator bore be inspected for proper gauge, wear of pins & holes. Hinge pins, latch lug surfaces and link contact should be inspected for proper lubrication. Grease back surface of slips. For details OISD STD -190 may be referred.

Maintenance: Elevators require regular care and inspection to ensure their use for long period of time. The elevator hinge pin, hinge and latch mechanism, coat link arm wear surfaces and latch lug should be lubricated for ease of operation. Worn or damaged parts, if found be replaced to avoid the malfunctioning & inadvertent release of the load. Loose fasteners if found be tightened.

Elevators bored for 18\degree shoulder (bottle neck) pipe should not be used for collar pipe and vice-versa.

6.8 Elevators links :

Periodic checks should be made of worn diameters particularly when higher weight levels are involved. Any hook with link showing wear of half inch should be promptly repaired. Wear should never exceed ¼ inch when properly built up to recommended dimension.
6.9 Swivel & its components

(i) The swivel is inspected for wear, cracks and fittings in pins, wash pipe & body and also for looseness of pins and bolts and section reduction and cracks in bail. Wash pipe be inspected for metal packing rings, leaks, adjustment & lubrication. Oil seals, bail pins, wash pipe packing inspection must be done daily when in operation.

(ii) Rotary swivel shall be hydraulically pressure tested before commissioning to one and a half times maximum working pressure of the assembly but not less than 10,000 Psi.

(iii) Goose neck connection of the swivel should be provided with suitable lug for tying safety chain. The safety chain should be inspected regularly.

(iv) Greasing and lubrication of oil seals, bail pins, wash pipe packing must be done as manufacturer's recommendation.

6.10 Power Swivel

The power swivel should be inspected as per the manufacturer's guidelines.

6.11 Spiders when capable of being used as Elevators

Look for cracks and general wear in bowl taper. Check for looseness and proper operation of latch. Gripping dies, spring should be inspected for wear and proper lubrication.

6.12 Power sub

It is a device, which moves with the T/B and is designed to provide rotary power to the top of drilling string for drilling operations. It attaches to the rotary swivel but does not include a rotary seal or being for supporting the drilling weight.

6.13 Tubing & sucker rod hooks

These may be inspected for wear, bail distortion, fit for pins, lever and latch operation, and free movement of swivel. The scars and cracks also are inspected.

6.14 Sucker rod elevators

These are inspected for wear, cracks and reduction of section of bail and trunnions. Looseness & operation of latches and levers also be inspected. During inspection of elevator, it should be checked that elevator seat is not worn out or egg shaped. If the center line of the sucker rod, when seated in the elevator, does not coincide with the center line of the elevator axle, the sucker rod will bend when the elevator picks up the load of the rod string.

6.15 Safety clamps when capable of being used as hoisting equipment.

These should be examined for cracks, missing cotter keys, galled or stripped threads, rounded off nuts or wrenches, dull teeth, broken slip springs and slips that do not move up or down easily.

6.16 Drill String Motion Compensators

The Air Pressure Valves and relief valves, compressors, piston rods, lock bar of the equipment be inspected for proper functioning. Fluid sample analysis, condition of deceleration valves also be checked.

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6.17 Riser Running Tool Components when capable of being used as Hoisting Equipment

The moving parts should be thoroughly checked for grease, visual wear and damage. Thread connection should be checked in each use. NDT of these equipment be carried to avoid the failure during the operations. The tools with moving parts should be preferably stored in oil bath for trouble free and longer life.

6.18 Mast/ derrick

Every part of mast should be inspected for its straightness and no member of mast be corroded. Mast shall be leveled and properly positioned before raising, lowering the structure or tightening guy lines. Foundation should be capable of safely distributing the gross weight of the derrick under the maximum anticipated hook load. Before imposing any load on derrick or mast, all required load guys should be properly tightened. An unguarded opening large enough to permit a person to fall through should not exist between the beams or main support of the crown blocks. For further details OISD standard 202 may be referred.

6.19 Gin Poles

A gin pole should be properly attached to the well head or X-mas tree with a chain or a load binder in a manner that prevents movement when the load is being handled. A chain and a ratchet binder used to attach the gin pole to the well head or X-mas tree should be of proper size and strength to support the anticipated load to be handled. When the gin pole is being used to lift the lubricator or any other object, the load should be pulled from as near a vertical position as practicable.

6.19.1 Gin poles for conventional Derricks

The Gin pole at the crown of every derrick should not have fewer than two uprights and a cross beam. The top tackle block should be suspended from the cross beam as near the centre thereof as is practicable. The clearance between the crown platform and the cross beam should not be less than 8 feet. A gin pole should be designed and constructed so as to sustain the maximum compression load imposed thereon with a minimum safety factor of 3.

6.20 Counter Balance

On a rotary drilling rig, every counterbalance above the rig floor when not fully encased or running in permanent guides shall be held to the frame of the derrick with a separate safety line made of wire rope of a diameter of not less than 5/8" of an inch, or such other diameter as may be approved by the competent person, installed in such a manner as to prevent the counterbalance from coming within 8 feet of the floor.

6.21 Guylines

(i) A guyline should be maintained in a good condition and should be of strength including auxiliary devices such as chains, boomers and clamps capable of withstanding loads for the anticipated service conditions. A guyline should have safety factor of 3 (to be checked).

(ii) Each guyline should be removed from service and replaced if in any length of 10 diameters the total number of visible broken wires exceeds 10% of the total number of wires in the line or if the guyline shows other signs of excessive wears, corrosion or defect.
6.22 Air winch

The competent person should inspect following to ensure safe working of the winch.

(i) The load being lifted with the winch is within its lifting capacity.
(ii) The air-motor and its operating lever are in perfect working condition as prescribed by the manufacturer.
(iii) The foundation is strong enough and the winch is properly secured with all foundation bolts tightened.
(iv) The winch is so constructed that the brake is applied when control handle is not held in operating position.
(v) The brake is in good working condition.
(vi) The condition of wire rope should be as per the provisions of OISD Std. 187 and its reeving should be done properly.
(vii) The wire line does not get entangled or rub against anything while load is lifted.

6.23 CHAIN HOIST

a. Operating Instructions

Before lifting inspect carefully the hooks, the load chain, the brake device and lubrication of the block.

For safe operation:

(i) Don’t lift load exceeding the rated capacity of the chain blocks.
(ii) Don’t use the block chain as a sling.
(iii) Don’t use when the chain is kinking.
(iv) To avoid accidents working or passing under a lifting load is strictly forbidden.
(v) In case of the hand chain fails to move do not use undue force. Stop operation and proceed inspection of the chain block.
(vi) Only use to lift vertically, do not use to drag loads

b. Maintenance

(i) After operations clean the chain block from dirt and keep in a dry place from rust and corrosion.
(ii) Clean the chain block annually by purging the parts in kerosene and apply grease to them. It is advisable that the cleaning work should be done by skilled hands.
(iii) O-Marks on the two disk gears should be aligned.
(iv) Stick the rollers of both left and right bearings to the inner race of the bearings of the chain sprocket shaft journal, and then put them in to the outer race of the bearings on the side plates.

(v) After cleaning and repair the chain block should be subjected to no-load and heavy-load tests, if it works normally, put it into operation.

c. Pre-Use Inspection

The operator should perform a pre-use inspection, if any deficiencies are found the equipment should be taken out of service and the supervisor notified.

(i) Visually inspect all load chains for gross damage that may be a hazard.
(ii) Hoist is properly secured.
(iii) The load does not exceed the load limit on the warning label.
(iv) Check that motions are smooth and regular with no hesitations, vibrations, binding, unusual noise or other irregularity.
(v) Chain is not kinked or damaged.

d. Annual Inspection

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The annual inspection may be performed with the hoist in its normal location and do not require the hoist to be dismantled. Covers and other items normally supplied to allow inspection of components should be opened or removed for these inspections.

6.23.1 Inspection of Items

(i) Check the material of following & co-relate with mill certificates:
   - Load chain – grade 80 alloy steel conforming to IS-6216
   - Hand chain – grade 30 steel conforming to IS-3832

The following dimensions to be checked:

a) Load chain – diameter, pitch, length & width of link chain as per section 3 of IS-6216.
   - Length of chain per section 4.8 of IS-3832.

b) Hand chain: diameter (nominal size) pitch, outside width of link & length of chain per section 4.10 of IS-3832

(ii) Operating mechanism checked for mal-adjustment and listened to for unusual sound that may indicate problems.

(iii) Tightness of bolts, nuts and rivets.

(iv) Excessive wear, corrosion, cracks or distorted parts in the following:
   - Load blocks
   - Suspension housings
   - Hand chain wheels
   - Chain attachments
   - Clevises
   - Yokes
   - Suspension bolts
   - Shafts
   - Gears
   - Bearings
   - Pins
   - Rollers
   - Locking and clamping devices

(v) Full engagement of pawl & ratchet

(vi) Check that on ‘No Load’ top hook swivels freely

(vii) Check that “Effort” required to raise the full safe working load is as per section 7 of IS-3832.

(viii) Damage and excessive wear on hook retaining nuts or collars and pins and welds or rivets used to secure the retaining members.

(ix) Excessive wear or damage on load sprockets, hand chain wheel, and drums or sheaves shall be checked for damage or excessive wear.

(x) Evidence of worn, glazed, or oil contaminated friction discs, worn pawls, cams or ratchets and corroded, stretched or broken pawl springs in braking mechanism

(xi) Evidence of damaged to supporting structure or trolley

(xii) End connection of load chains shall be checked for evidence of wear, corrosion, cracks, damage or distortion.

(xiii) Welded link hoist chain

(xiv) Hooks

(xv) Hook-latches

6.23.2 Welded Chain Inspection

(i) The hoist should be tested under load in lifting and lowering directions and the operation of the chain and sprockets shall be observed. The chain should feed smoothly into and away from the sprockets

(ii) If the chain binds, jumps or is noisy, it shall first be checked to ensure that it is clean and properly lubricated. If the trouble persists, the chain and mating parts shall be inspected for wear, distortion or other damage.

(iii) The chain shall be examined visually for gouges, nicks, weld spatter, corrosion, and distorted links.

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(iv) The chain shall then be slackened and the adjacent links moved to one side to inspect for wear at the contact points.
(v) The chain should be measured according to the hoist manufacturers’ instructions. If instructions are not available, the process shall continue as follows.
- An unworn, un-stretched length of the chain shall be selected (eg., at the slack end)
- The chain shall be suspended vertically under tension and, using a caliper type gauge, the outside length of any convenient number of links shall be measured (12 to 24” overall)
- The same number of links in the used sections shall be measured and the % increase in length shall be calculated.

6.23.3 Hook Inspection

Ensure that the material of the hook is – Fully killed forged & fully heat treated grade-S Alloy steel, conforming to IS-8610 and dimensions of the Hook are as per section 4 of IS-8610
Check for:
(i) Cracks, nicks, or Gouges.
(ii) Latch engagements, damaged or malfunctioning latch (if provided)
(iii) Hook attachment and securing means.
(iv) Deformation. Any bending or twisting exceeding 10 degrees from the plane of the unbent hook.
(v) Throat opening. Any distortion causing an increase in throat opening exceeding 15%.
(vi) Wear. Any wear exceeding 10% of the original sectional dimension of the hook or its load pin.

7.0 PROCEDURE REVIEW

The inspection procedure should be reviewed from time to time with the new inspection techniques, change in technology, environment, person handling and type of the operation & work being carried out and also in view of the procedures consistent with widely accepted industry practices.

8.0 DOCUMENTATION

The following document be maintained for the good performance of the equipment:

i) Records
   The good record keeping system consisting of inspection records, information provided by the manufacturer, maintenance records, repair records, re-manufacture records shall necessarily be maintained by the owner/user.

ii) Identification
    Unit serial number or some identification marks provided by the manufacturer should be maintained on the equipment and should be recorded in the equipment register/records.

iii) History
    The data indicating the changes in the status which could affect equipment serviceability or maintenance should be recorded in the equipment register/records.

iv) Records identification
    The date, name and signature of the responsible person involved in the carrying out the inspection be recorded in the equipment records/register.

9.0 RESULTS

The following parameters are developed as the inspection results for the safety of the man and the equipment.

i) Acceptance criteria
   The acceptance criteria should be established based on experience and manufacturer’s
recommendations. The worn out equipment/component which do not meet acceptance criteria, should not be accepted for operation unless an analysis is made in accordance with the applicable equipment specification at reduced load conditions.

ii) **Rejection of the equipment**
Rejected equipment should be marked and removed from the operation until the deficiencies are corrected.

10.0 **REFERENCES**

API-RP-8B : Recommended practice for procedures for inspections, maintenance repair and re-manufacture of hoisting equipment.

API-8A : Specifications for drilling and production hoisting equipment.

IS-3177 : Code of practice for EOT cranes and Gantry Cranes

EIL Spec. 6-48-0002: Standard spec. for EOT crane

ONGC/TBG-Mech. 020: Standard specification for chain pulley blocks

Maintenance Engineering Hand book : Lindley R. Higgin

OISD STD. 190,187, 202

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Table: **PERIODIC INSPECTION CATEGORIES AND FREQUENCIES**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Equipment</th>
<th>Daily</th>
<th>Weekly</th>
<th>Semi-annually</th>
<th>Annually</th>
<th>Other frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Crown blocks hoisting sheaves and bearing</td>
<td></td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Travelling blocks, hook block, block to hook adapter</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Twin stop safety device (Crownomatic &amp; floor-o-matic device)</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (3 years)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Connectors and link adapters</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Sucker rod hooks</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (2-years)</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Elevator links</td>
<td>I</td>
<td>III</td>
<td>IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Casing, tubing, drill pipe &amp; drill collar elevators</td>
<td>II</td>
<td></td>
<td>III</td>
<td>IV (2 years)</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Sucker rod elevators</td>
<td>II</td>
<td></td>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Swivel bail adapters</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Rotary swivels</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Power swivels</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Power subs</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Air winch</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Mast/ derrick</td>
<td>I</td>
<td></td>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Spider capable of being used as elevators</td>
<td>II</td>
<td></td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Dead line tie down / wire line anchors</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Drill string motion compensators</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Kelly spinners capable of being used as hoisting equipment</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV (5-years)</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Kelly bushing and master bushing</td>
<td>II</td>
<td></td>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Safety clamps when capable of being used as hoisting equipment</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** The above frequencies apply to equipment in use during the period specified. However, the frequency be planned based on experience, manufacturer’s recommendation and consideration of one or more factors such as -Environment, Load cycle, Testing, Repairs, Regulatory requirements, Operating time.

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