

PETRONAS TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

STANDARD

LIFTING

PTS 60.2103

OCTOBER 2011



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This PTS 60.2103 - **Lifting (October 2010, Revision 0)** has been developed to provide standards and guidelines to ensure that all hoisting and rigging operations are performed safely and in conformance with all applicable standards, as well as to minimize the risk of injury to personnel and damage to equipment and property

This PTS also includes PETRONAS Lessons Learnt and Best Practice for the subject matter **Lifting**.

The custodian of this PTS is: Manager - HSE MS, Standards & Regulations, Group HSE Division.

Please direct any questions regarding this PTS to the above-mentioned.

Document Approval

	Name	Designation	Date	Signature
Prepared	Ahmad Nadzri Mustapha	Manager, Reliability Management, PCSB PMO	27/10/11	
Technical Approved	Morris Kho Kee Wee	Custodian, Safety Management Operations, Group HSE Division	16/11/11	
Verified	Maureen Song Chai Kee	General Manager, Group HSE Strategy and Performance, Group HSE Division	30/11/11	
Approved	Mohd Tarmizi Bin Munir	Head, Group HSE Division	2/12/11	

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PREFACE

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They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' OPU in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardisation.

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ACKNOWLEDGEMENT

No.	IWG Members	OPU
1	Ahmad Nadzri B Mustapha (Team Leader)	(PMO/PCSB)
2	Hanafi B Talib	(PMO/PCSB)
3	M Nasir B Osman	(PMO/PCSB)
4	Ibrahim B Ismail	(PMO/PCSB)
5	Ahmad Syahidi B Che Zainal	(SKO/PCSB)
6	Tandel V R	(SKO/PCSB)
7	K Samunathan	(SBO/PCSB)
8	M Jamizal B Zainol	(MD/PCSB)
9	Busari Jabar	(GHSED)
10	Zaidi B Mat Dom	(POD/PGB)
11	Michael Jihem Sitang	(PLM/MLNG)
12	M Nizam B Omar	(MCI/PPMSB)
13	W M Razainul Amin B W Zakaria	(MTN/MTBE)
14	A Hakim B A Rahman	(MAINT/PMLSB)
15	Anjuna Lee Foong Yee	(R&T/PETH)
16	Zaini B Minin	(R&T/PETH)
17	Ramle B Awang	(R&T/PETH)
18	M K Shrivastava	(R&T/PETH)

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1. INTRODUCTION

Heavy material handling requiring the use of cranes or hoists is a potentially hazardous activity. To assure the safety of such operations, stringent controls for the use of such equipment, including below-the-hook components should be exercised, and the procurement, maintenance and inspection of all such equipment should be strictly controlled.

This publication is intended to provide guidelines with which the management of PETRONAS OPU/HCU can assess its practices and procedures to assure that all hoisting and rigging operations are performed safely and in conformance with all applicable standards, as well as to minimize the risk of injury to personnel and damage to equipment and property.

This document should always be used in conjunction with local statutory regulations. Should any significant deviations be made from the requirements of this PTS document, users are required to inform Management of the OPU of the nature and justification for the deviations.

1.1. Scope

This PTS specifies appropriate standards, procedures and guidelines to operation, inspection and maintenance for various types of cranes, lifting appliances and lifting tackles.

1.2. Definition

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project, or operation or maintenance of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier/Vendor** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorized to act for, and on behalf of, the Principal.

The word “**shall**” indicates a requirement.

The word “**should**” indicates a recommendation.

Please see Appendix I for other terms and definitions.

1.3. Cross-reference

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in Section 7.

2. DISTRIBUTION , INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorized by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS or managed by a Group company, and to Contractors and Manufacturers/Suppliers nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities, supply/marketing installations and project/construction sites. If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS, the Contractor shall determine by careful scrutiny which of the requirements are more stringent and which combination of requirements will be acceptable with regards safety, environmental, economic and legal aspects.

In all cases the Contractor shall inform the Principal of any deviation from the requirements of this PTS which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

3. ROLES AND RESPONSIBILITIES

3.1. PETRONAS OPU/HCU

- a) Lifting operations are generally carried out by Contractors. The Contractor has prime responsibility for the safe lifting operations. However, the PETRONAS OPU/HCU remains accountable responsible for safety on site and also for the safe execution of projects.
- b) In addition to selecting a competent Contractor, OPU/HCU shall
 - ensure that the established OPU/HCU's standards and procedures are available, understood and agreed by the Contractor.
 - verify that the Contractor provides proper training in safe operation of lifting equipment and appliances for his personnel.
 - verify that the Contractor provides adequate supervision of the work in hand.
 - be responsible to undertake similar roles and responsibilities as the contractor as per item 3.2 below for lifting equipment or appliances owned by the OPU and operated by its own personnel.

3.2. The Contractor

The Contractor shall:

- Provide qualified lifting engineer to certify crane assembly and erection at site and ensure compliance with national or local regulatory body.
- ensure that lifting devices and lifting fixtures used for the work are properly documented and inspected, maintained safely to ensure integrity is not affected or jeopardized during applications (e.g. due to improper use or modifications).
- ensure that all its employees adhere to the recognized standard or code of practice with respect to the lifting operations and maintenance of the equipment

- provide proper training for its personnel in safe operations of lifting equipment and appliances
- provide adequate safety clothing and equipment such as gloves, overalls, helmets, safety shoes and harnesses, lifelines, safety nets and life jackets (if working above water) and ensure the proper use of the safety equipment.
- carry out regular quality control checks on lifting equipment and appliances.
- exercise adequate supervision of lifting work in hand.

3.3. The Responsibilities of Various Parties

The responsibilities of various parties applicable for typical lifting activities are generally summarized below:

a) Supervisors (OPU or contractor)

Supervisors shall ensure that personnel know how to safely operate cranes and hoists and how to move objects safely. Supervisors must enforce the use of safe lifting techniques, and ensure lifting equipment in good mechanical and operating condition.

b) Employee/Users

Employee/users are required to observe all established safety regulations relating to safe lifting and handling techniques. The user should ensure at all times that lifting equipment and appliances are safely used and not modified without authorization.

c) Lifting Engineer / Technical or Area Authorities

Appointed OPU's personnel from technical discipline shall review and approve appropriate engineering layout, lifting fixtures and configurations as laid out in the Lifting Plan.

d) Area Owner/Project Owner

Area owner/project owner is accountable for defining and requesting any move/lift; determining which activities are considered as Critical Lifting; writing lifting procedures where required; providing technical information on relevant characteristics of the apparatus, including special lifting fixtures when required; providing suggestions on rigging and moving; and assigning resources for planning and coordination of all aspects of the job being performed.

e) Crane Operator

Crane operator is responsible for correct and safe operation of the crane under his or her directs control accordance to PETRONAS and host country guideline. The crane operator shall ensure crane is safe to be used by performing inspection before and after lifting operation and also perform front line maintenance.

f) Rigger

Rigger is responsible to attach and detach the load to and from crane load lifting attachment in safe manner and for using correct lifting tackle and accessories.

g) Signalman

Signalman is responsible to relay information to crane operator for safe movement or crane and load. The signalman shall stop the lifting operation if he found the condition is not safe to do lifting.

h) Inspector

Inspector shall inspect and verify the crane safe to be used in accordance to relevant PETRONAS guidelines or host country regulation.

4. GENERAL REQUIREMENTS

4.1. Lifting Operations

4.1.1. General

- a) All use, maintenance, storage, checks, inspection and examination of lifting equipment shall comply with the manufacturer's instructions.
- b) Lifting operation shall be carried out using right equipment i.e. crane or hoist suitable for the job.
- c) Mobile cranes (except crawler crane) shall not be used onboard marine vessel or barge.
- d) Only personnel who have been trained and/or certified competent (as required by applicable laws and regulations) shall be authorized to operate cranes. (see Section 4.4 - Training and Competencies for details on training requirements).

4.1.2. Permit to Work (PTW) and Job Safety Analysis(JSA)

- a) All lifting operations shall be controlled through use of PTW and relevant lifting certificate and checklist completed and approved. In addition to Lifting Certificate, Lifting Plan shall be prepared for critical lifts as listed in item 4.1.3 below
- b) During the execution of a lifting operation, if there is a change in operational conditions or in the assumptions on which the risk mapping was based, the operation shall cease and the need for a new risk assessment and implementation of any corrective safety measures shall be considered.

4.1.3. Lifting Plan

- a) Lifting Plan shall be prepared for critical lifting operations using cranes or other lifting appliances or equipment in order to manage the risks. These operations include, but are not limited to:
 - Lifting more than 20 tons of load.
 - Lifting over live or critical/sensitive process equipment or facility.
 - Lifting load of weight more than 80% of rated capacity of the lifting equipment at the specified working radius and boom angle as per crane load chart.

- Personnel transport using lifting appliance.
 - Lift of special loads such as structures, mobile cranes, boiler and vessel.
 - Lifting operation using helicopter.
 - Coordinated lift whereby the weight exceeds the maximum lifting capacity of one of the lifting appliances e.g. using of multiple cranes.
 - Lifting operation at location less than the specified Safety Distance from live overhead power line (refer to Appendix XX: Safety Distance Calculation)
 - Lifting operations for testing purposes to ensure integrity or functionality of the lifting equipment after installation, structural repair or modification of the equipment including functional or proof load tests
 - Subsea operations using offshore crane.
 - Other lifting operation which are deemed as critical or high risk and determined in the OPU's Hazards and Effect Register e.g. blind lift, lifting through hatches.
- b) Lifting operation shall be planned in order to ensure safe execution and that all predictable risks are taken into consideration.
- c) The planning shall be carried out by personnel who have the relevant competence deem acceptable by PETRONAS OPU's.
- d) For repeated or routine operations, such planning is only necessary for the first time, provided that an operating procedure is in place or documented in another way. Periodic revisions shall be carried out to ensure that no critical factors have changed.
- e) Lifting plan shall be documented and, as a minimum, ensure that
- all personnel involved are familiar with the task, i.e. what is to be lifted, weight of the load, what lifting equipment to use, the travel path, and the roles of the persons involved in the lifting operation.
 - competent and sufficient personnel are present at all phases of the lifting operation, the travel path is clarified and any obstacles are removed before lifting commences,
 - method of communication is clarified,
 - the lifting operation can be executed safely in relation to simultaneous operations,
 - lifting appliances and lifting gear are suitable and will be used in accordance with the manufacturer's instructions for use,
 - the landing area can accommodate the load in terms of size and weight,
 - use of tag line is considered,

- personnel involved have sufficient competence and knowledge of the regulations and standards that govern the operation that is to be executed,
- lifting or technical authorities is involved in tandem lifts where the weight can exceed the lifting capacity of one of the lifting appliances
- work area shall be barricaded,
- Load calculation shall be included in Lifting Plan.

NOTE: Example of Lift Plan format or shown in Appendix XXI.

4.1.4. Pre-Use Inspection

- a) Each lifting equipment and machinery shall be inspected by a qualified personnel before use, during any given work shift. The inspection can be documented on a tag attached to the crane controls, or it may be documented in a log that is kept with the key that unlocks the crane controls.
- b) Details on pre-use inspections for various types of lifting equipment and machinery are described in Section 6.

4.1.5. Communication

- a) At all times there shall be adequate communication between all personnel who are involved in the lifting operation.
- b) When performing lifting operations in very noisy areas, radio with head set should be used.
- c) In case of unclear or failing communication, immediately stop the lifting operation until safe communication has been restored.
- d) Radio equipment appropriate for the relevant lifting operation shall be used. Radio check shall be carried out prior to the start of the lifting operation.
- e) When directing the load, instructions shall be clear and unambiguous.
- f) The lifting appliance operator can repeat the signal man's instructions (confirmatory communication) to avoid any misunderstandings during lifting operations.
- g) Where appropriate, a communication method can be chosen whereby the signal man gives a continuous signal to continue the movement. The lifting appliance operator shall stop immediately if he does not receive the signal.
- h) The method of communication to be used shall be agreed as part of the pre-job talk or JSA.
- i) Communication shall be in a common language that is understandable by both the lifting appliance operator and signal man. All personnel who are involved shall be competent in the language chosen.
- j) If visual signals are used, the hand signals shown in Appendix XIX shall be used.

4.1.6. Rigging and Slings

- a) The crane operator is responsible for verifying that the load is properly rigged.
 - Use engineered attachment points and standard hardware (swivel lift rings, shackles, and nylon slings) wherever possible.
 - Verify that all slings and hardware are rated for more than the expected load, and are appropriate for the intended type of load and direction.
 - Verify that all slings and special lifting hardware have valid inspection tags.
- b) Signal Man and Rigger
 - Lifting operations with cranes shall be carried out with a minimum of three roles involved: the lifting appliance operator, signal man and rigger.
 - For all other permanent lifting appliances (traveling cranes, wire line winches, personnel and work winches, etc.) a risk analysis defining the minimum number of staff required to perform lifting operations as and when required.
 - The signal man and rigger shall not change roles during the performance of a lifting operation. If the lifting appliance operator has a good visual overview of the area, the slinger can, with clearance from the lifting appliance operator, handle the load when it is under control and below hip height (1.3m).
 - The signal man and rigger shall stand in a safe area at all times when the crane and/or lifting wire is moving. The slinger can manually guide the empty hook to and from the load or load carrier.
 - If the lifting appliance operator has a good visual overview of the area, the slinger can, with clearance from the lifting appliance operator, handle/maneuver the load when it is under control and below shoulder height.
 - If the lifting appliance operator has a good visual overview of the area, the signal man can carry out the slinger's duties. In such circumstances, the signal man can, with clearance from the lifting appliance operator, handle/maneuver the load when it is under control and below shoulder height, and manually guide the empty hook to and from the load or load carrier.
- c) Blind Lifts
 - In connection with blind lifts, there shall always be at least two persons (signal man and rigger) who have visual contact with the load and each other, and have radio contact with the lifting appliance operator. Any closed circuit television that monitors the work area is considered to be an aid, and not a replacement for either of these persons.
 - If load has to be pushed or pulled into position manually, a signal man shall be present close to the load such that he can direct the lifting appliance safely and thereby address the safety of other involved persons.
 - Where possible, the signal man should place himself in a position where he can give the stop signal manually in the event of radio failure.

d) Lifting through hatches and in shafts

- For lifting operations through hatches and in shafts, the requirements for blind lifts apply,
- Lifting through several levels shall be covered by OPU/HCU standard and procedures including JSA. In particular, the risk of the load or load carrier snagging on hatch frames should be assessed.
- For crane operations in shafts, the lifting appliance operator shall ensure that the lifting appliance brake function is active and that any function for automatic overload protection is disconnected during the operation.

e) Use of tag line

- Lifting appliance operator shall assess and approve the use of tag line.
- The end of the rope shall be secured against fraying, but knots shall not be used at the free end of the rope.
- For internal movement of load, tag line can be used.
- Tag line should be used to keep control of a load, not to gain control over a load.
- If several tag lines are necessary, personnel who are not deck operators can be involved in the operation. JSA shall then be carried out, and the personnel shall have undergone the necessary training related to the use of tag lines.
- Obtain assistance from professional rigging crew for loads that require special rigging. Be particularly careful with potentially unstable loads, including choker lifts of long loads and loads with a high center of gravity (e.g., lifting pallet loads with slings).

4.1.7. Other Safety Requirements

- a) Minimum PPE requirements as per OPU/HCU's policy and standards shall be used by personnel involved in lifting operation.
- b) All personnel operating a crane or hoist, participating in the lift or within 15 feet of the vertical plane of the load, where the under carriage of the bridge is more than 12 feet from the ground, must wear approved hard hats.
- c) Sturdy work gloves must be worn when handling wire rope or loads with rough or sharp edges or splinters.
- d) Barriers shall be installed at appropriate location where lifting operations take place to prevent personnel from walking or standing under suspended load.
- e) Any electric powered crane that is not attended by a qualified operator for an entire shift and during off hours must be secured by locked controls, or equivalent means such as preventing access to the crane by locking the doors, or locking up radio/pendant controls. Only authorized user of the secured crane may have control of the locking mechanism.

- f) Crane under maintenance shall not be used for lifting operation and proper signage to be displayed.

4.2. Standards & Requirements on Lifting Tackles & Accessories

4.2.1. Sling

- a) Appropriate and approve sling shall be used.
- b) The load shall be attached to the hook by means of slings or other suitable lifting gear. Protective material shall be placed between the slings and any sharp edges, and a check shall be carried out to ensure that the bend diameter complies with the manufacturer's instructions for use.
- c) If several slings are used in the same eye or hook they shall not lay on top of each other.
- d) When slings or chains are used, consideration shall be given to the number of legs, the angle and other factors that alter the capacity of the sling.
- e) The sling shall be tensioned with care, and not jerked. Care shall be taken to ensure that the load is distributed evenly between sling legs

4.2.2. Chain

Special care shall be exercised when using chain. The pre-use check shall focus in particular on corrosion and flexibility of each link.

4.2.3. Shackles

- a) When choosing a shackle, the overall load and working angles must be considered carefully.
- b) If shackle is used to connect two slings to the hook of a lifting machine, it shall be a Bow type shackle assembled with the slings in the shackle body and the hook engaged with shackle pin. The include angle between the slings shall not exceed 120 degree.
- c) When shackles are used in a lifting lug, the shackle's Safe Working Limit (SWL) shall be equal or greater than the lifting lug's Working Load Limit (WLL).
- d) The load on the shackle must be centered on the shackle pin to avoid lop side loading on the shackle base
- e) For critical lifting, only shackles with double locking shall be used, for example nut plus split pin or screwed connection with split pin. Other types of pin shall not be used. For securing static loads, other types of shackle can be used.
- f) Shackles without rotating bolt should not be used in permanently installed lifting arrangement due to the danger of transferring rotating forces to the shackle bolt.
- g) If shackle without rotating bolt is used in lifting arrangement, the bolt shall be properly secured to withstand any rotating forces transferred to the shackle bolt

4.2.4. Eye bolts and eye nut

- a) Eye bolts and eye nuts shall always be screwed in to the point where the entire collar is in contact with the surface.
- b) Pre-use check shall include a check of the threads in the material in which the eyebolt will be mounted, and that the thread dimension and type are the same

4.2.5. Wire Rope Termination

- a) Wire rope clamp
 - If Wire rope clamps need to be used as termination, it shall be of a type with two gripping surfaces. U-bolt clamps shall not be used on lifting equipment.
 - When using wire rope clamps, the minimum breaking load of the wire rope shall be reduced in accordance with manufacturer's instructions for use, and the correct number of clamps shall be used.
 - Wire rope sling with clamp termination shall not be used for lifting
- b) Zinc (spelter) and Swaged Socket
 - Manufacturer instruction and recommendation shall be followed to ensure 100% efficiency of termination
 - When inspecting existing socket connection, examine the rope closely for corrosion at the socket base. This corroded wire is very susceptible to fatigue

4.2.6. Beam Clamps and Beam Trolley

- a) If trolleys are used, end stops on beam shall be installed.
- b) Trolleys without automatic brake shall always be secured against unintentional movement during and after use
- c) Beam clamps shall be installed as described in the manufacturer's instructions for use, and not be subjected to load beyond the stated load angles

4.2.7. Turnbuckle

If turnbuckles are used in the lifting arrangement, they shall be inspected and approved for lifting.

4.2.8. Lifting Nipples and Lifting Cap

- a) Lifting nipples and lifting caps shall be certified and approved for lifting.
- b) Before use, a check shall always be carried out to ensure that the thread section on the pipe and on the lifting nipple or lifting cap are undamaged, that the lifting equipment is correctly installed, and that the thread dimension and type are the same.
- c) When moving load with lifting nipple or lifting cap, the area below the travel path shall be barricaded

4.2.9. Single and Multi-sheave Block

- a) When securing snatch block to the load bearing structure, the operator shall ensure that all split pins, locking and safety pins are in place and in good condition.
- b) The user shall ensure that the load bearing structure is strong enough to withstand the resultant force (load plus wire tension and any friction forces) and that the snatch block is correctly positioned such that the wire rope does not rub against the side plates.
- c) For complex arrangements, a lifting/technical authorities shall verify the correct set-up and calculations of resultant forces

4.2.10. Load Carrier

- a) Load carrier shall be designed, constructed, inspected and maintained to applicable codes and standards acceptable by PETRONAS i.e. BS EN12079 Offshore containers. Design, construction, testing, inspection and marking or DNV2.7-1
- b) Before use, the slinger shall check that the load carrier and attached lifting set are suitable and that the load is satisfactorily secured.
- c) The check should include:
 - load carrier has been controlled and approved,
 - all load is secured in such a way that it cannot move around,
 - load does not stick out over the sides of the load carrier,
 - multi-leg sling on open load carriers, tanks, special containers and modules are secured against snagging the load etc. Net or canvas can be used as covering, or the legs of the slings can be secured with cable ties,
 - all load is positioned such that it is easy and safe for the receiver to handle the material when unloading the load carrier,
 - equipment is always placed on pallets when loading containers,
 - safety net is used to prevent load from falling out of load carriers with doors,
 - heavy and/or unstable items are secured by means of tensioning arrangement,
 - there are no loose parts on the load that could fall off during the lift,
 - when lifting using cranes or hoists, multi-leg chain slings are not crossed when attached to load,
 - all load are registered on a manifest,
 - type of dangerous goods is stated on the manifest,
 - required safety data sheets (SDS), declarations etc. always accompany dangerous goods,
 - containers are sealed with a seal having a unique number,
 - tags on load carriers show the correct destination and are signed

- d) Load carriers on marine support craft shall not be stacked on top of each other, either on the installation or on the vessel. However, if hooking on can be done from deck level, an exception can be made for empty garbage containers which, in accordance with the instructions for use, can be stacked into each other. Stacking shall be limited to a maximum of three empty garbage containers. In connection with this stacking, particular attention shall be given to increased windbreak, and to ensure prevention of damage to the slings.
- e) Load and personnel shall not be lifted in a single lift operation.
- f) When placing load in load carrier, the load shall be set down on pallets/timber and secured when required. The weight shall be distributed evenly in the load carrier insofar as possible. Heavy loads should be placed at the bottom of containers.
- g) Lifting set for offshore load carrier (sling assembly and shackles) should not be removed except for inspection and maintenance, or if load carrier installed for a longer period on an installation

4.2.11. Load Carrier for Gas Bottles

Gas bottles shall be transported with fitted protection cap in load carrier designed for the purpose.

4.2.12. Big Bags/Jumbo Bag

- a) Flexible bulk container used as standard container for transporting of dry material such as sand, plastic granule or other product using lifting appliance.
- b) Big bags for repeated use shall be documented as lifting gear. Big bags for single use to transport product shall have a type certificate in accordance with European Flexible Intermediate Bulk Container Association (EFIBCA). "Single use" means transport product in big bag from the manufacturer to the loading point.
- c) Big bags shall only be used in connection with lifting of load to/from load carrier

4.2.13. The following Equipment Should Not Be Used:

- a) Plate clips
- b) Magnetic yoke
- c) Vacuum yoke
- d) Barrel lifter except for handling barrels into/out of barrel baskets

4.3. Integrity Management

- 4.3.1. Lifting equipment shall not be modified for purposes other than those stated without the consent of the manufacturer and/or applicable authorities
- 4.3.2. Detailed requirements on inspection and testing of lifting equipment are described in Section 6. This includes the requirements for:
 - a) Pre-use Inspection
 - b) Periodic Inspection (Weekly, Monthly, Quarterly or Annually)
 - c) Load Testing

4.3.3. Lifting appliances shall not be used if safety systems or parts of safety systems are not functioning or have been isolated. Examples of safety systems are

- a) Limit switches
- b) Crane overload protection
- c) Safe Load Indicator
- d) Anti-2-block system
- e) Wind speed indicator
- f) Boom angle indicator system
- g) Hook safety latch and pin
- h) Spark arrester
- i) Over speed shut off

4.3.4. Servicing and repair of equipment.

- a) Structural modifications of lifting equipment shall only be carried out by competent persons.
- b) When lifting appliances such as slings, hooks and shackles have been modified structurally, they should be load tested, certified, labelled/tagged and/or colour-coded

4.3.5. Maintenance Frequency and Record of Equipment

All inspections, testing and maintenance of lifting equipment and machinery shall be documented. As a minimum the following shall be documented:

- Pre use checks performed by the Crane Operator (Operator).
- All maintenance activities
- Change out of critical items
- Test certificates
- Load test and results
- Any approved modifications
- Any deviations supported by a MOC with the necessary approval

All records shall be retained for seven years or such a time when a critical item with certificate is expired.

4.3.6. Storage of loose lifting appliances

- a) All installations shall have dedicated area(s) where loose lifting appliance not in use shall be stored. Loose lifting equipment shall be protected against the weather and other harmful conditions during storage. Sizeable lifting gear such as lifting beams, pendants, internal load carriers and similar shall insofar as practically possible, be protected against harmful conditions during storage.
- b) An updated index should be kept of the issue and return of lifting equipment used in connection with setting up of temporary lifting appliances.
- c) The user shall inspect loose lifting equipment for the correct marking, possible overload, wear and damage, before and after use.
- d) The user is responsible for returning loose lifting equipment to the storage area after use.

- e) Defect and damaged loose lifting equipment shall be marked and set aside at a designated place clearly identified for this purpose

4.3.7. Design and Maintenance of Lifting Tackles and Accessories

a) Design of Lifting Tackles and Accessories

- Design, fabrication, and testing of lifting fixtures that are self-fabricated shall be carried out by a qualified engineer. The actual physical testing shall be performed in accordance with the approved test procedures which include, amongst others, the calculation of lifting fixture stresses and deflections.
- The design stress for lifting fixtures or lifting attachment points must not exceed one-fifth the ultimate strength of the material at its operating temperature.
- If welded fabrication is used, the design stress must take into consideration any weakening effects of welding. Design and fabrication in conformance with the latest standards of the American Welding Society (AWS) or equivalent are required. All welds in lifting fixtures must be certified welds, performed by certified welders, and inspected and certified by certified weld inspectors.
- Makeshift lifting fixtures shall be subjected to load test to twice the maximum rated load and followed by a non-destructive examination.

b) Inspection and Testing of Lifting Tackle & Accessories

Slings, shackles, lifting eyes, and other **Below-the-Hook** devices are most vulnerable to damage from wear and abuse and require inspection and testing.

- Load test tag/certificate, inspection stickers, or colour code shall be current, where applicable.
- All makeshift lifting tackles, accessories or fixtures designed and internally fabricated by the OPU shall be proof-tested to twice their Safe Working Load (SWL) before being placed in service. A Non-Destructive Examination (NDE) is required after the proof test. The rated capacity must be marked on the lifting fixture so that it is clearly visible to the equipment operator.
- For commercial lifting fixtures without certified load ratings, relevant engineering documentation or certificates shall be made available to determine the safe load capacity, and to furnish guidance for load testing.
- Active lifting devices and fixtures must be examined using NDE at least once every four years (or upon request), using magnetic particle detection or other appropriate methods and the examination records must be maintained. Inactive lifting devices and fixtures must be clearly marked "STOP DO NOT USE," and must be load tested and certified prior to renewed use.

4.3.8. Identification & Color Coding of Lifting Appliance

a) Every item of lifting equipment, portable and fixed shall be clearly marked with:

- Colour code
- Identification Number / Tag Number of the item
- Safe Working Load (SWL)
- Next inspection date

b) The colour code in use shall be prominently displayed on the facility and in the rigging loft on an indicator board as per applicable host country regulations.

Note: The colour code strip will slide onto the board so that it can easily be changed periodically as necessary.

c) The following are colours code shall be used:

- GREEN (Jan till June)
- YELLOW (July till December)

d) Any Lifting appliance not bearing the valid colour code SHALL NOT be used. An item found with the wrong colour shall be removed from the facility for inspection and re-certification.

e) Lifting appliances that found damage or not fit to use shall be destroyed e.g. cut

4.4. Training and Competency

4.4.1. General

- a) All parties involved in lifting operations shall receive a basic training in the relevant code of practice and safety regulations. The training shall cover with safety procedures and technical aspects at various levels.
- b) The PETRONAS OPU/HCU is accountable for ensuring that in-house lifting supervisors are properly trained and qualified, and that Users have a basic understanding of lifting safety.
- c) Training for lifting supervisors shall address relevant lifting standards and legislation, safety inspections and safe lifting operations with a basic introduction of structural mechanics.
- d) The OPU/HCU shall also ensure that a Contractor is made fully aware of the activities being carried out on site and shall be given full notice of potential hazards through Contractor's induction training.
- e) The Contractor is responsible for providing technical and practical training required for lifting equipment operators, riggers and signalers. It is essential that qualified and competent personnel (as may be required by statutory laws and regulations) are employed to operate and maintain lifting equipment and appliances

4.4.2. Competency Requirement

a) Crane Operator

- Crane operator shall undergo Crane Operator course at training centre recognized by national and/or local regulatory bodies.

Note: Where local regulation does not exist, training can be conducted by any Crane manufacturer holding an API 2C Monogram License and who are providing such training and certification for Trainers / Assessors. As minimum, training program shall meet API RP 2D requirements.

- All crane operators shall be registered with the national and/or local regulatory bodies before they are allowed to operate tower and mobile cranes.

Note: In Malaysia; to enforce this directive, the DOSH will use provision 26(1) of the Factories and Machinery (Notification, Certificate of Fitness and Inspection) Regulations 1970 to stipulate that all the said cranes must be operated by certificated operators.

- Tower crane (Menara)
- Mobile crane (Bergerak)
- Derrick crane (Derik)
- Authorization by OPU management is required to operate the crane.
- Crane operator shall be reassessed every 3 years.
- Crane operator of age 40 years old and below shall undergo full medical check-up minimum every 2 years. Crane operator of age above 40 years shall undergo full medical check-up annually by qualified OSH medical practitioner/PETRONAS panel OSH doctor as per PTS 60.1501.06 Fitness to Work.
- Mobile Crane Operator shall obtain valid driving license from the national and/or regulatory bodies. Note: for Malaysia; Class H driving license.

b) Crane Inspector

- Crane inspector shall undergo Crane inspector course recognized by national and/or local regulatory bodies.

Note: Where local regulation does not exist, training can be conducted by any Crane manufacturer holding an API 2C Monogram License and who are providing such training and certification for Trainers / Assessors. As minimum, training program shall meet API RP 2D requirements.

- Crane inspection training program shall be based on OSHA and ASME standard or equivalent. Topic to be included:
 - Relevant manufacturer standard, federal, state and all local requirement
 - Inspector responsibilities
 - Equipment design and consideration
 - Equipment usage/ environmental consideration

- Accidents consideration due to faulty equipment
 - Inspection procedure
 - Wire rope inspection
 - Deficiencies reporting
 - Documentation required and report
- Crane Inspector must obtain certification/qualification from
 - any crane manufacturer holding an API 2C Monogram License and who are providing such training and certification for Trainers / Assessors OR
 - institution recognized by national and/or local regulatory bodies
 - Authorization by OPU management is required
 - Crane inspector shall be reassessed every 3 years
- c) Rigger
- Rigger must attend rigging and slinging training organized by institution recognized by national and/or local regulatory bodies e.g CIDB/NIOSH for Malaysian operator.
 - Refresher course shall be attended every 2 years.
- d) Forklift Operator
- Forklift Operator shall attend training organized by institution recognized by national and/or local regulatory bodies.
 - Operator shall attend refresher course every 2 years if the frequency of operating Forklift is less than 50 hours for the past 2 years. Authorization by OPU management is required for driving forklift.
 - Forklift Operator shall obtain valid driving license from the national and/or regulatory bodies if travelling on the road.
- Note:** For Malaysia; Class H driving license.
- e) Survival Craft Inspector
- Survival craft inspector shall attend training as recommended by respective survival craft OEM. Survival Craft Inspector shall be reassessed every 3 years.
 - Inspector shall attend training recognized by national and/or local regulatory bodies e.g. IMO
- f) Lift/Elevator Inspector
- Lift/elevator inspector shall attend training at training centre recognized by national and/or local regulatory bodies. Lift/elevator inspector shall be reassessed every 3 years.
- g) Others lifting appliances
- Operator shall be trained and assessed by experienced operator on the specific equipment

4.5. Audit and Monitoring

OPU/HCU should have a system in operation for regular audits and inspections in order to monitor whether:

- The Contractor adheres to the agreed standard or code of practice with respect to lifting equipment and appliances and their operations.
- The Contractor employs competent personnel.

5. OPERATING STANDARDS PRACTICES

5.1. Offshore Pedestal Cranes

5.1.1. The qualified Crane Operator (herein referred as the operator) is responsible for safe operation of the crane. The following are guidelines for good operating practices:

- a) The operator has the authority to stop work and refuse to handle loads or continue lifting operations in an unsafe condition.
- b) During bad weather with lightning or strong wind (56 km/hr and above), or poor visibility to see the signal person due to darkness, fog, rain, etc., crane operations can be restricted at the Operator's discretion and agreed by OPU/HCU representative.
- c) The operator shall verify the following prior starting the crane
 - Pre-use inspection has been completed
 - All controls are in the "off" or "neutral" position
 - Area is clear from all personnel
- d) Prior lifting the load, exposed brakes shall be warmed and rusted surfaces on the drums cleaned by raising and lowering the boom and the load lines under slight pressure.
- e) Operator shall never start any movement or rotation unless the load is clearly seen or the signal man / rigger has given the appropriate signal
- f) The operator shall respond to only signals from the appointed signal man / rigger except the emergency stop signal from whoever give the signal,
- g) Before leaving the control station for prolong period, the operator shall ensure the followings
 - Land any attached load
 - Boom shall be parked at the boom rest
 - Disengaging the master clutch, where applicable
 - Set all locking devices,
 - Put control levers in the OFF or neutral position
 - Stop the engine / prime mover
 - Assure that the crane will not interfere with normal helicopter flight operations.
- h) At the end of the shift, the Operator shall ensure information on lifting operations and usage is recorded in crane log book

5.1.2. Load Handling

The following guidelines shall be adhere by the operator with respect to load handling

- a) Be aware of the weight of load to be lifted.
- b) All lifting gears have been certified and colour coded, suitable capacity and gear is correctly attached and positioned to prevent uneven lifting or slippage of the load.
- c) The signal man/ rigger has correctly positioned the hook over the centre of the lifting point; this shall prevent any "load drift" when it is start to move up.
- d) Do not start lifting the loads until all personnel are clear from the lifting area
- e) Observe and monitor closely the safe load indicator for a possible overload situation.
- f) Be aware of any activities/obstructions within the crane radius when moving loads across the deck.
- g) Avoid the movement of loads over the personnel below.
- h) Tag line/s of sufficient length must be attached to control the load.
- i) Possible, erect barriers around the lifting zone to prevent personnel from entering the lifting area.
- j) When carrying out any "blind" lifts, monitor the safe load indicator for any loss or increase in the weight of the load; this could indicate that the load has snagged.
- k) Always keep the load within the specified radius of the crane.
- l) When hoisting loads off a moving supply vessel deck packed with cargo, be alert for snagging or wrongly manifested cargo weights.
- m) There is a clear view of the embarkation areas, load path and landing areas when it is necessary to transfer personnel to or from a vessel.
- n) Stop all crane operations during helicopter landings, unless dispensation has been given to carry out special tasks.
- o) Aviation lights remain switched ON whenever the boom is in the air and the A-frames or masts extended above the helicopter deck.
- p) No less than five (5) full wraps of rope shall remain on the drum in any operating condition

5.2. Mobile Crane/Crawler

5.2.1. The following API and ASME standards, practices and specifications apply to the design, construction, installation, operation, inspection and maintenance of lifting equipment covered in this section

- ASME B30.5 : Onshore Mobile Cranes
- API-9A : Specification for Wire Rope
- API-RP 2D (sections as applicable)
- Local regulations

Note: Some of the guidelines as specified for operations and maintenance of Pedestal Cranes is applicable for Mobile cranes, whichever is more stringent

5.2.2. Mobile Cranes used in OPU/HCU facilities shall meet the standards operation as follow:

- a) The Crane operator should park the crane properly with the outrigger extended fully regardless of size and weight of the load. Ensure that the wheels are off the ground and never attempt to extend the boom unless all outriggers are extended and down on the hard surface with the crane level.
- b) The Crane Operator must be guided solely by the load chart/rating plate concerning boom length, boom radius and load to determine maximum capacity. The operator is responsible to ensure that the rated capacity is not exceeded regardless of which quadrant the crane is operating in.
- c) The Crane Operator shall respond to signals only from the appointed Signal man, but shall obey signal for an emergency stop at anytime from anyone at the working site.
- d) The riggers shall ensure that all the loose objects are removed from the load/machine to be lifted or, when this is not possible, he shall ensure that the loose objects are properly lashed /secured.
- e) Tag line/s of sufficient length must be attached to control the load.
- f) When lifting a heavy load, the crane operator should lift it a few inches off the ground and hold to check load balance and the crane's lift brakes. If it is in order, the lift shall then proceed.
- g) The crane operator/signal man shall warn the people in the area of the lifting activities when he swings the crane and always stay within the rated capacity. Loads shall not be allowed to exceed rated load capacity and working radius.
- h) No free fall of load is permitted
- i) The operator must ensure that the hoist drum has at least 5 full wraps of wire rope remaining on the drum during the time when the boom is fully extended and the lifting hook is on the ground level
- j) For long or bulky loads, at least 2 tag lines to be attached to the load to assist in the control of the lifting or lowering and positioning.

- k) Make sure that slewing, derricking (boom up & down), lifting and landing areas are clear of people, vehicles and obstructions during all crane operations.
- l) Do not swing a suspended load in quick motion; slewing with a load suspended must be carried out as gently as possible such that the load does not swing out of control when the slewing stops. Special attention to be given to loads partially filled with liquid.
- m) Never allow personnel to ride/stay on the load.
- n) The operator shall safely lower the load and then immediately stop operating the crane if he observes any defects or unsafe conditions during operation that could affect safety operation or on hearing the plant emergency alarm.
- o) The operator must never leave the control station of his machine while the load is suspended except in cases of emergency
- p) Before leaving the control station for prolonged period, the operator shall ensure the followings
 - Lower the load to the ground;
 - Lower off long boom
 - Engage the following:
 - Swing brake
 - Boom hoist pawl (if any)
 - Disengage master clutch
 - Shut-off engine
- q) On completion the crane booms must be fully retracted and lowered to a safe height, The outriggers must be fully retracted and the area are clear before moving out the crane.
- r) For night lifting activities, adequate lighting at lifting area is required. Radio communication shall be used between crane operator and signal man for lifting instruction

5.3. Overhead and Gantry Crane

Overhead and gantry cranes must be operated as per the manufacturer's operating instructions and further guided by the operating procedures and precautions detailed in ASME B30.17: Overhead and Gantry Cranes. This section provides a summary of key basic operating guidelines and precautions.

Due to the nature of operation, design and load motion characteristics of these cranes, the following operational procedures shall be observed:

- a) When handling load of rated capacity, the operator shall test the hoist brake by raising the load a few inches and apply the brake; any slippage or downward motion is unacceptable.
- b) Side pulls are not permitted,
- c) No sudden acceleration or deceleration of the moving load,

- d) If crane is of variable speed type, always start with the slowest speed,
- e) Change directions only when the crane motor has been stop.
- f) Operators shall be competent in the operations of Gantry cranes or as authorized by the Area Authority.
- g) Prior to first use of any hoist during each shift or day, the operator shall perform the Frequent, or Pre-Use Inspection and notify the Area Authority of any hazardous defects immediately,
- h) The hook shall be positioned directly over the load so as to minimize swinging when start lifting.
- i) Ensure the rope is seated in the drum grooves and in the sheaves (i.e. check for the signs of slack rope conditions),
- j) The load shall be moved smoothly, slowly, and never contact any obstructions.
- k) The operator shall not lift, lower, or travel the crane whilst anyone is near the load or hook.
- l) The load shall never be lowered below the point where five (5) wraps of rope remain on each anchorage of the hoisting drum and shall include those with lower limit device.
- m) The operator shall not leave the controls unattended, if the load is suspended over an area accessible to personnel.
- n) The operator shall not use the limit switches as a mean to stop vertical and horizontal movement.
- o) Hand signals poster (as in Appendix XIX) shall be displayed clearly at the work location.
- p) The load block shall be lifted above head level for storage when the crane is not in use

5.4. Tower Crane

- 5.4.1. The qualified Crane Operator (herein referred as the operator) is responsible for safe operation of the crane. The following are guidelines for good operating practices:
 - a) The operator has the authority to stop work and refuse to handle loads or continue lifting operations in an unsafe condition.
 - b) During bad weather with lightning or strong wind (48 km/hr and above), or poor visibility to see the signal person due to darkness, fog, rain, etc., crane operations can be restricted at the Operator's discretion and agreed by OPU/HCU representative
 - c) Every tower shall be provided with device for measuring wind velocity. Tower crane shall not be operated with wind speed at any time is greater than 48 km/hr.
 - d) Tower crane shall not be raised to a new operating level when the wind speed exceeds 32 km/hr.