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AMIRAL PROJECT

STEELSTRUCTURAL ERECTION PROCEDURE

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1 PURPOSE

This procedure and guidance information has been produced to ensure that prior to commencing any steel erection activities in AMIRAL PKG 4 – Utilities, Flare and Interconnecting and systems, a written Work Method Statement (WMS) and Job Safety Analysis (JSA) are submitted for approval prior to start of the specific work activity. Also, that steel erection work is carried out and strictly supervised in accordance with the approved Work Method Statement (WMS), Job Safety Analysis (JSA), AMIRAL Construction Safety Manual (CSM) and Saudi Aramco General Instruction (GI).

2 SCOPE

This procedure and guidance will be used by members of the PKG#4 Project Management Team, Designers, Supervision and Steel Erection Subcontractors when planning, supervising and monitoring Steel Erection.

This procedure and guidance will assist members of the Project Management Team in the subsequent approval of the Steel Erection Subcontractors written method statement and provide further assistance in the development of a Project Risk Assessment for steel erection.

3 TERMS AND DEFINITIONS

3.1 WORK METHOD STATEMENT

- An outline of a task or series of tasks identified in a sequential manner.

3.2 JOB SAFETY ANALYSIS

- Job Safety Analysis (JSA) is appropriate for any task where the hazards and control measures need to be formally assessed.

4 RESPONSIBILITIES

4.1 PROJECT MANAGER

- to ensure that all steel erection has been suitably designed and that erection is safely carried out in accordance with the approved work method statement, job safety analysis and other relevant safety regulations.
- To approve and submit where necessary to the client for approval, the steel erection work method statement developed by the contract.

4.2 SECTION MANAGER / SUPERVISOR

-To provide full assistance to Safety Manager in development of Job Safety Analysis (JSA) for steel erection works in areas under their control.

-Is responsible for overseeing the installation of steel erection works.

-Request equipment to keep execution safe and easier

-Request fall protection and prevention system

4.3 SAFETY MANAGER

- To carry out Job Safety Analysis for hazard identification and control during steel erection in conjunction with Construction/Section Managers.
- To advise the Contractor Project Manager and other members of the PMT-Project Management Team on the suitability of the Contractor's Work Method Statement.
- Provide training to Construction/Section Managers and other members of supervision on the key safety items featured in the steel erection Work Method Statement to ensure they can confidently monitor Safety practices during steel erection work in areas under their control.
- To monitor the Safety activities of the Contractor and Subcontractors carrying out the steel erection.

4.4 SAFETY SUPERVISOR / OFFICER

- Responsible to check and monitor the site and ensure that steel erection is carried out in a safe manner in accordance with the approved Work Method Statement (WMS), Job Safety Analysis (JSA), Saudi Aramco Construction Safety Manual (CSM) and Saudi Aramco General Instruction (GI).

4.5 RIGGER

- Saudi Aramco approved
- Oversee and can ONLY execute rigging works and for the load weight limit and type of lift to be rigged/slung without supervision.
- Rigger III - Can rig loads up to 10 tons
- Rigger II - Can rig loads up to 40 tons, originate Critical Lift Plans, and
- rig/supervise crane suspended personnel platform (man basket) operations.
- Rigger I - Can rig all loads and approve Critical Lift Plans for critical lifts
- Responsible for inspecting lifting gears prior to use and ensure required document are available and valid.

4.6 CRANE OPERATOR

- Who is certified as being qualified to operate a specific model and capacity of crane as per Saudi Aramco Certification requirements; or a specific type or class as per the approved certification authority's requirements; may also receive additional certifications for crane attachments, tandem lifts, pick and carry operations, and personnel platforms (man baskets)
- Making sure crane are fully inspected prior to use
- Making sure certifications are valid
- The crane operator shall have the final decision on any crane lift that affects the safety of his crane.

4.7 Steel Erector

- Undergo CTR Safety orientation and other trainings related to their job
- Obtain HIP-Hazard identification plan training
- Authorized person to work as steel erector, working with steel beams, girders, columns, and other components.

Erection tools list:

- Torque Wrench, several capacities
- Total Station
- Impact Wrench
- Pneumatic
- Pencil Grinder Brush
- Hydraulic Jack
- Rope, Wire Steel, Galvanized, several sizes
- Shackles, Screw Pin Type Bow
- Galvanized, several sizes
- Web sling Polyester Lifting, Vertical, Double Ply, several capacities
- Lever Hoist, Hooks With 360 Deg Swivel Automatic, several capacities
- Wire Rope Winch (Tirfore), Hooks With 360 Deg Swivel, 3several capacities
- Spanner, Combination, several sizes
- Wrench, Adjustable
- Measuring Tape, Steel
- Spanner, Single End Ring Slogging, Normal, several sizes
- Erection pin
- Chain blocks-3ton.

4.8 Bolt Tightening Details:

- Level and plumbness of individual members of the steel structures shall be checked and shall be accepted within the specified tolerances prior to bolt tightening work.
- All bolts, nuts and washers shall be properly identified and marked with the material grade and manufacturer's logo. All bolts holes shall be standard holes with a diameter 1/16 inch(1 mm) larger than the nominal bolt diameter, unless otherwise specified on the design drawing or noted in the following subsection

- It shall be checked the conditions, such as faying surfaces and adjacent, bolt holes,

Load Transfer	Application	Joint Type	Faying Surface Preparation	Install per Section	Inspect per Section	Arbitrate per Section
Shear only	Resistance to shear load by shear/bearing	ST	No	8.5.2		
	Resistance to shear by shear/bearing. Bolt pretension is required, but for reasons ther than slip resistance	PT	No	8.5.3 or 8.5.4		
	Shear-load resistance by friction on faying surface is required	SC	Yes	8.5.3 or 8.5.4		
Combined shear and tension	Resistance to shear load by shear/bearing. Tension load is static only	ST	No	8.5.2		
	Resistance to shear by shear/bearing. Bolt pretension is required, but for reasons ther than slip resistance	PT	No	8.5.3 or 8.5.4		
	Shear-load resistance by friction on faying surface is required	SC	Yes	8.5.3 or 8.5.4		
Tension only	Static loading only	ST	No	8.5.2		
	All other condition of tension-only loading	PT	No	8.5.3 or 8.5.4		

burrs and other contaminations, of bolting splicing area before bolting work.

- Bolts, nuts and washers shall be properly aligned to holes to insert the bolts undue damage to the threads of the joint. A minimum of 5% extra quantities of each bolt size and length, including nuts and washers shall be furnished by the fabricator for the field erection.

- Faying surfaces and surfaces adjacent to the bolt head and nut for snug-tightened or pretensioned joints shall be free of dirt and other foreign material.

- The application and requirement of the joint types are summized as below table

ST : Snug-Tightened joint: a condition where *faying surfaces** in a bolted joint assembly are in firm contact after a few impacts of an impact wrench or with the full effort of a worker using a spud wrench

* *Faying surfaces* are the contacting faces placed in firm contact at a connection joint

PT: Pretension joint: a joint that transmit shear or tensile load, where the bolt assembly is fully tightened to which the tension in the bolt will be equal to a

minimum 70 percent of the specified tensile strength

Snug-tightening Method :

- Prior to initial snug tightening all connections and their components shall be checked against the IFC Drawings and Specifications
- Prior to the start of work, it shall be ensured that all fastener components to be used, all connected piles and all bolt holes are met the requirement
- All bolt holes are aligned and permit insertion of the bolts without damage to the threads
- Bolts shall be placed in all holes with washers positioned as required and nuts threaded to complete the assembly.
- Compacting the joint shall be progresss systematically from the most the most rigid part of the joint
- The faying surfaces are in firm contact (snug-tight condition) after a few impacts of an impact wrench or with the full effort of a worker using an ordinary spud wrench
- The minimum bolt pretension for pretensioned and slip-critical joints is as follows

Nominal Bolt Diameter (Inch)	Specification Minimum Bolt Pretension Tm, kips	
	ASTM A325 and F1852 Bolts	ASTM A490 Bolts
1/2	12	15
5/8	19	24
3/4	28	35
7/8	39	49
1	51	64
1-1/8	56	80
1-1/4	71	102
1-3/8	85	121
1-1/2	103	148

5 INSTRUCTIONS

5.1 GENERAL

Steel erection is a high-risk activity during which many fatal or serious accidents occur. The principal causes relate to falls from heights, instability of a partially erected structure during erection and materials falling from height.

Steel erection must be suitably planned with agreed safe work methods and systems of work establishing safe erection procedures; these must be implemented through effective Safety Management Control.

Site-specific erection plans shall be developed and shall include, but not be limited to:

- Coordination of steel erection activities with other applicable parties, such as emergency responders.
- Material deliveries, material staging/storage and construction activities
- Description of crane and derrick selection and placement procedures, which shall include:
- Site preparation.
- Path of overhead lifts.
- Critical lifts, including rigging and equipment.
- Description of steel erection activities and procedures, including the following:
- Stability considerations requiring temporary bracing or guying.
- Erection bridging terminus points.
- Notifications regarding repair, replacement or modification of anchor bolts (anchor rods).
- Columns and beams (including joists and purlins).
- Connections.
- Decking.
- Routes of travel up and around the structure.
- Ornamental and miscellaneous steel.
- Description of fall protection procedures, including use of prefabricated anchorage (tie-off) points.
- Description of procedures for prevention of falling objects.
- Hazard Identification Plan (HIP), including special procedures required for hazardous or non-routine tasks.
- Minimum training/certification requirements for steel erection personnel (see Section 5.13).

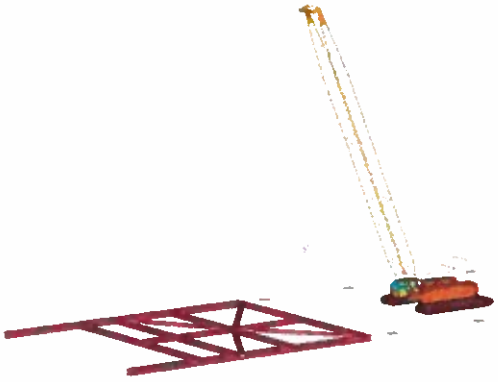
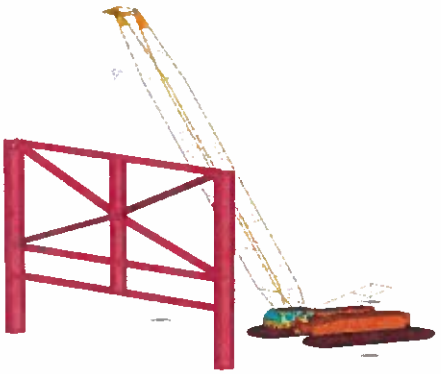
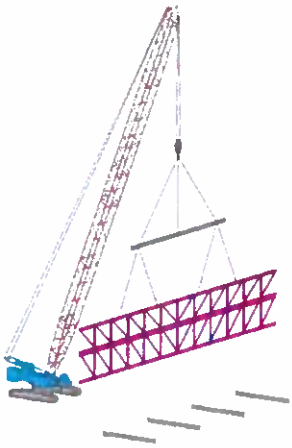
- List of steel erection personnel and the training/certification they have each received, including the designated competent person(s) who will be in charge of the steel erection.
- Description of rescue or emergency response procedures.
- Erection plans shall be signed and dated by the appropriate personnel (e.g., the steel fabrication shop's detailer and/or structural design engineer).
- Appropriate approval shall be obtained from the SA Proponent Organization (SAPO) prior to commencing steel erection work.
- Site planning meetings and site inspections shall be conducted between steel erectors and the SAPO, including the project engineer, to ensure that all hazards have been identified and addressed. These hazards and their respective mitigation measures shall be incorporated in the HIP included with the site-specific erection plans.
- In case of site emergency involving high elevation rescue, Emergency Response Plan (MIP6-PM-5010-006) shall be referred to.

5.2 STEEL STRUCTURE ERECTION STAGES:

The typical erection sequence of assembled structures and single structure shall be as follows.

- Preparation of lifting operation.
- Lifting the structural steel and traveling it on the location of foundation to be installed.
- Columns shall be anchored by a minimum of four anchor bolts.
- The structure shall be plumbed, levelled and braced before any final bolting
- Fixing the base plate of the structures, which is lifted over the foundation, into anchor bolt on the concrete foundation.
- Installation of support cables using ratchet sets rated to assure vertical stability and prevent "upturn" until cross members are connected. Support cables shall be connected to civil foundation and fixed using chain or lever block for alignment of structures.
- Cross beam shall be installed "piece by piece" method.
- The spread balance beam shall be used for the lifting of the long span member to prevent distortion or bending of the structures.

Typical Sketch of Structural Steel Erection

	
[Preparation of lifting operation]	[Erection on the foundation]
	
[Installation of support cable]	[Spread balance beam for long span member]

- Bolt holes shall be aligned to permit free insertion of the bolts and tightened by snug-tightening method using ordinary spud wrench. The faying surfaces shall be firm contacted after snug-tightening

- Softeners (cut lifting belts) must be used for structural members while holding with sling to prevent damage of members.
- Guying or bracing shall be used and installed properly as per the site-specific erection plan or as determined by the project structural engineer.
- All joint surface, including adjacent to the bolt heads, nut and washer, shall be free of burrs, dirt and other foreign materials that would prevent solid seating of part.
- Structure installed shall be plumbed, levelled and braced before any final bolt tightening. Levelling plates, nuts / washers, loose baseplates and bearing plates shall be set in for correct alignment and elevation.
- The erector shall maintain the job site in a clean and safe condition at all time and shall properly dispose of, off the premises, all crating waste materials, and other refuse that has accumulated as a result of the erector's activities.
- Contractor erector shall install sufficient and adequate temporary bracings, guy cables or supports necessary to counter loads while erecting steel.

Erection tolerance is as follows

- Columns:

Distance between axis of two successive columns: ±3 mm
The angular variation of the working line from a plumb line shall be equal to or less than 1/500 of distance between working points
Variation in elevation relative to established grade is equal to or less than plus or minus 1/8" (3mm)
Deviation "e" of a column between level of successive floor(h): e<0.002h

- Floors:

Actual level with regard of theoretical level

Without equipment: ±5 mm

With equipment: ±3 mm

Difference of level between two beams of the same floor

Without equipment: ±5 mm

With equipment: ±2.5 mm

Distance between two adjacent beans: ±5 mm

- Any damage caused during erection shall be reported and corrective measures shall be taken as per specification. Major damage shall be replaced immediately.

5.3 WORK METHOD STATEMENT

- The method and sequence of erection.(specific Steel erection method of statement)
- Methods of overcoming temporary instability.
- Names and positions of persons with specific responsibilities.
- Site hazards and other restrictions
- Cranes, material handling and storage.
- Work place accesses and egress including prevention of falls.
- Interface with other contractors.
- Protection of persons below.
- Provision and use of PPE.
- Emergency procedures featuring in particular rescue from heights. Rescue methodology is also seen and applied.
- Safety training for all persons involved in the erection including training in the contents of the Work Method Statement.

For complete detail of steel erection activities and procedure based on Contractor's scope of work please refer to the separate attachment [Method Statement for Steel Structure Erection Work (Temporary Facilities Area)]

5.4 SITE HAZARDS AND OTHER RESTRICTIONS

- Site hazards and other restrictions likely to impair safe erection should be identified during each stage of the development of the Work Method Statement
- These shall include but not limited to:
- Overhead and underground services (electric, gas, water etc.).
- Restricted site access limiting the size and weight of material, plant and cranes.
- Restricted space for erection, maneuvering, storage and pre-assembly fabrication.
- Location of other buildings/structures, roads, railways etc. which may affect the planed method of erection and crane operations.
- Possible hazards from toxic gases, chemicals, fluids dusts etc.from existing or nearby site activities

- Preparation of Erection
- Before erection check the foundation, anchor bolts dimension and civil clearance
- Set the sim plate top of foundation as per approved drawing elevation.
- Fabricated materials or components shall not be laid directly on muddy or corrosive ground during storage.
- The minimum number of bolts in a framed beam connection shall be 2no's.
- The bottom face of the structural steel base plate shall be checked visually for cleanliness.
- The concrete surface of the foundation shall be thoroughly chipped and then be cleaned completely with air, etc.
- The inspection reports of foundation and anchor bolt shall be reviewed for acceptance of location,
- Elevation and concrete tests prior to erection of structural steel.

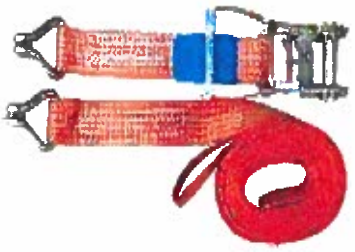
5.5 STRUCTURAL STABILITY

- Structural stability shall be maintained at all times during the steel erection process.
- The steel erector shall, at all times, be responsible for the adequacy and installation of any temporary bracing or guy cables required to counteract loadings imposed during erection. This responsibility shall also extend to temporary bracing required to ensure safe and stable conditions of partially completed structural assemblies.
- Plumbing-up equipment shall be installed in conjunction with the steel erection process to ensure the stability of the structure.
- Plumbing-up equipment shall only be removed with prior approval from the designated competent person in charge at the site.

5.6 TRANSPORTATION, OFFLOADING AND STAGING

- TANSPORTATION During transportation of structural steel materials (I beams, H beams, etc.) shall comply with Saudi Aramco requirement:
- Cargo securements shall be in accordance with Saudi Aramco SMG 06-008-2019 Land Transport Cargo Securement.
- The amount of tension produced by a truck winch or hand ratchet depends on the length of the handle and how large the diameter of the webbing spool becomes during tightening

- Hand ratchets, shown in below, that operate by pulling the handle downwards will normally produce much more tension than truck winches.



- Structural steel materials shall be transported on vehicles or trailers with headboards that can prevent the load from moving forward in the event of a sudden stop of the vehicle.
- The load must not be over/above the headboard during transportation.
- Vehicles or trailers shall have a minimum of four side-stakes/stanchions on each side to prevent sideways movement of the load.
- No load is allowed to travel without the side stanchions / stakes without the minimum
- Tie-down web lashings shall be sufficiently tensioned to provide adequate downward restraint and prevent sideways, frontal or rearward movement.
- All general cargo shall have the load secured ensuring it will not dislodge, cause the vehicle to become unstable, or fall out during unloading operations.
- The appropriate cargo securing equipment shall be selected based on the type and configuration of the load being transported.
- The Project shall implement a Trailer and Load Safety Inspection Checklist (Refer to Attachment 1) for all heavy equipment and bulk cargo movements

5.7 OFFLOADING

During offloading of structural steel materials (I beams, H beams, etc.), the following shall be followed:

- Offloading of structural steel materials from trailer truck, crane operator, forklift operator, rigger must be certified under G.I. 7.025 Heavy Equipment Operator and Rigger Testing Certification.

- The securement of the load shall only be removed when the vehicle is parked at designated offloading location.
- The total load shall not exceed the rated capacity of the hoisting and rigging equipment as per AMIRAL Construction Safety Manual (CSM) III-8, Slings and Rigging Hardware.
- Tag lines shall be used to control loads, it shall be fully gripped by all fingers.
- Softener shall be implemented during offloading and handling of steel materials.

5.8 REPAIR OF DAMAGED COATING PROCEDURE

- Defective area shall be ground to a rough metal surface using sand paper or grinding machine.
- Coating repair of structural steels, such as cleaning, mixing ratio, color and other, etc. will be performed in accordance with the manufacturer's recommendation. Coating will be applied by brush or roller
- Touch up shall be done in accordance with manufacturer's recommendation after smooth sand papering and cleaning.

5.9 STAGING FOR STRUCTURAL STEEL MATERIALS

- Assign separate areas for storing structural steel of different classes, sizes and lengths.
- Due care shall be taken in handling structural steel and sub-assemblies to avoid damage.
- Particular care shall be taken in the selection of slings and lifting arrangement as per GI 7.029 – Rigging Hardware Requirements
- Store it above ground level upon platforms, skids or any other suitable supports to avoid distortion of sections.
- Having a safe distance from overhead services and structures.

5.10 CRANE OPERATION

During crane operations, the following specific factors should be considered and coordinated:

- Cranes shall be levelled in accordance with manufacturer's specifications and shall be located on a properly compacted foundation prior to performing any lift. All cranes shall

be provided with a fixed bull's-eye level and/or a carpenter's level to verify the crane is levelled.

- Crane lifts shall not be performed in wind speeds exceeding 32 km/h (20 mph) (17.4 knots) (9 m/sec), unless otherwise specified by the crane manufacturer.
- Crane operators shall be Saudi Aramco Certified and shall be responsible for crane operations under their direct control.
- A competent person shall be assigned to supervise and monitor the presence of hazard that may occur during the lifting activity. Manual (CSM) III-7 – Crane and Lifting Equipment.
- Crane operation activities shall be in accordance with AMIRAL Construction Safety
- Hoisting and rigging during steel erection shall be in accordance with GIs 7.025, 7.027, 7.028, 7.029, 7.030 and AMIRAL Construction Safety Manual (CSM) III-7 – Crane and Lifting Equipment.
- Only Saudi Aramco Certified riggers shall rig loads to be lifted, including transport trucks and boom trucks. The rigger shall have responsibility for coordinating activities of all personnel involved with the lift as per Saudi Aramco Construction Safety Manual (CSM) III-8, Slings and Rigging Hardware.
- The total load shall not exceed the rated capacity of the hoisting and rigging equipment as per AMIRAL Construction Safety Manual (CSM) III-8, Slings and Rigging Hardware.
- Tag lines shall be used to control suspended loads, unless their use may cause a greater hazard. Tag lines shall not be tied around the hand/wrist. They shall be fully gripped by all fingers.

- Cranes and heavy equipment shall be kept away from the edge of the excavation a distance of 2 m (6.5 ft) or the depth of the excavation.

5.11 MANLIFT OPERATION

- "Manlift" in this section refers to elevating work platforms, mobile elevating work platforms, scissor lifts, telescopic and/or articulating boom manlifts, spider lifts, or any other type of aerial work platform whether self-propelled or manually powered.
- anlift operators shall be certified on the equipment they will operate
- as per GI 7.025.
- Manlift operator shall has PAL – Power Access licensed

- Manlift operator shall possess certification from IPAF
- Personnel inside a manlift, whether operator or passenger, shall wear full body harnesses and lanyards attached to the anchor point within the basket of the manlift
- Manlifts shall not be operated in wind speeds exceeding 32 km/h (20mph), unless otherwise specified by the manlift manufacturer
- Tools shall be in a tool pouch, toolbox, or otherwise secured in the manlift basket. Materials shall not protrude beyond the handrails of the manlift nor shall the handrail be used to support materials of any kind.
- A standby man, who is a certified manlift operator (per GI 7.025), shall be available on the ground to operate the lower manlift controls in case of an emergency.
- All telescopic and/or articulating boom manlifts shall be equipped with an anti-entrapment device such as a physical barrier and/or pressure CSM III-2 Mechanical and Heavy Equipment July 2020 Page 13 of 17 sensing device.
- Personnel shall not leave the basket controls unattended when in an elevated position. A manlift may not be used to access an elevated CSM III-2 Mechanical and Heavy Equipment July 2020 Page 14 of 17 work platform or surface unless the following requirements are met:
- Fall arrest procedures and equipment are approved by the SAPO
- and properly utilized.
- All workers are secured at all times to the basket and/or structureby the use of proper fall arrest equipment.
- A full-body harness with a double lanyard is used.
- One lanyard is attached at all times when transitioning from the
- basket to the working point and back.
- The second lanyard is attached before the first lanyard is released
- when moving outside of the basket.
- The standby man (referenced in Section 2.13.5.A) shall be
- physically present at the specific work location at all times when
- workers are working in this manner.

5.12 INSPECTION AND MAINTENANCE

- HEAVY EQUIPMENT

- Periodic inspection and maintenance shall be conducted to all equipment should be determined in accordance with supplier or manufacturer's recommendation.
- A record of inspections and maintenance must be kept for each item of plant and equipment. This includes scheduled maintenance, breakdown maintenance and replacement of parts (e.g. blades and belts) outside the scheduled maintenance program.
- Prior to starting to operate any plant and equipment, a pre-start check shall be carried out daily by the operators on their respective plant and equipment they are operating
- Filled daily pre-start checklist shall be kept and retained with the equipment on the operator's cabin throughout the duration of his work and made available in any inspection made on site
- Any defects or abnormalities found or observed during the daily pre-start check shall be noted and notified to coordinator for arrangement or scheduling of further checks or repair of defects

- RIGGING HARDWARE

- Ensure a certified rigger as per the requirements of GI 7.025 inspects all slings, fittings, and shackles before each use.
- Inspect slings and other rigging hardware per applicable standards every 6 months using a certified rigger.
- Inspection of slings and rigging hardware shall be of two (2) types:
  - Frequent inspection - Visual examination by a Saudi Aramco certified rigger (See GI 7.028) prior to use. Records are not required.
  - Periodic inspection - Detailed visual inspection by a Saudi Aramco certified rigger performed within a maximum of six (6) month intervals. The inspection is recorded in the Sling Inspection Log (SA 9657), listing any deficiencies found. Records shall be maintained by the USER.
- Maintain a job-site log sheet of slings that identifies the sling and periodic inspection results. Record defective slings in the log and remove them promptly from the job site. (Refer to G.I. 7029 Form SA 9657)

- All rigging hardware shall be inspected in accordance with ASME B30.20 standards and GI 7.029.
- Sling inspection logs and rigging hardware shall be an assessment items in safety inspections conducted by users.
- Rigging hardware that does not comply with AMIRAL requirements shall be immediately removed from service and shall be destroyed to prevent further use.

5.13 FALL PREVENTION

- The risks involved in working at height can be reduced by assembling all possible items at ground level and erecting them in position as semi-fabricated assembly
- Steel erection personnel performing activities on walking/working surfaces with unprotected sides or edges more than 1.8 m (6 ft.) above a lower level shall be protected by a guardrail system, safety net system, personal fall arrest system, etc
- .Fall protection equipment, including full-body harness with suspension trauma strap, shall be inspected daily to ensure that it has not been damaged and is in good condition.
- Suitable means of anchorage for safety harness must be provided. Anchorage points must be capable of supporting at least 2,268 kg (5,000 lbs.) per person attached
- Anchorage point shall be high enough (preferably above shoulder height) to prevent personnel from free falling more than 1.8 m (6 ft.) or striking any lower level during a fall.
- Safety nets as secondary fall preventions shall be installed under the walking/working surface in which workers are working. Safety nets shall be capable of absorbing an impact when personnel fall occurs.
- Fall protection shall be in accordance with the requirements in AMIRAL Construction Manual (CSM) II-5, Fall Protection
- Rescue capabilities shall be immediately available for personnel involved in a fall. Suspension trauma safety straps (foot stirrups) shall be provided with each full-body harness to ensure that personnel involved in a fall can stand up in their harness to prevent loss of circulation until they can be rescued.

5.14 CONTROL DECKING ZONE (CDZ)

- Steel erection personnel performing activities on walking/working surfaces with unprotected sides or edges more than 1.8 m (6 ft) above a lower level shall be protected by a guardrail system, safety net system, personal fall arrest system, etc
- Personnel working in a controlled decking zone (CDZ) at elevations of 1.8 m (6 ft) or greater shall be protected from fall hazards.
- CDZs may be established in areas of the structure 4.5-9.5 m (15-30 ft) above a lower level where metal decking is initially being installed and where it forms the leading edge of a work area
- Be erected not less than 1.8 m (6 ft) and no more than 27.4 m (90 ft) from the leading edge.

5.15 ACCESS AND EGRESS

- There are a variety of temporary access methods that may be used during steel erection. The type of equipment to be used should be carefully planned and detailed in the work method statement
- Mobile Elevated Working Platforms (MEWPs) provide rapid access between points for making connections they require firm bases and operators must be fully trained in the use of such equipment.
- When there is no means of access to the elevated workplace, a man basket may be used for making connections on open structures, in particular beams to columns.
- Usage of man basket shall be fulfilled per GI 7.027 Crane suspended personnel platform
- Material must not be carried in the man basket and the maximum load must be clearly marked inside and outside the man basket. Tagline must be attached to the man basket to control its movement.
- All permanent walkways and ladders should be erected as soon as possible to enable them to be used instead of temporary access. When the access routes have been agreed established and clearly defined then any gratings or boards should be removed only under a permit to work system.

5.16 RESCUE & EMERGENCY RESPONSE

- Rescuer / Rescue Team

- Rescuer should be properly trained and competent in the use of rescue equipment.Rescue-training records kept up to date including any re-assessment. Provide sufficient number of trained personnel available on site.

- Emergency Contact Number

- In the event of an emergency such as; fall from height, the WAH supervisor should immediately alert the rescue team and first aid assistance. Emergency Contact Number shall be updated and posted on site.

- Communication

- Ensure that communication system to be used between the suspended personnel and supervisor / rescue team such as direct voice communication, Whistle, Mobile Phone and Two-way Radios / Headsets are readily available.

- Equipment

- Ensure that rescue equipment for suspended personnel is available on site within 5 minutes to minimize the suspension trauma. The use of MEWP such as; scissor lift, man lift and other applicable rescue equipment (see figure 1 & 2) shall be utilized to rescue suspended personnel

Figure 1: Rescue Equipment

MANLIFT

SCISSOR LIFT

Figure 2: Rescue Tools

(1)

(2)

(3)

- #1 Suspension Trauma Strap or Foot Stirrups
- #2 Retractable Rescue Winch
- #3 Pulleys, Rope, Rescue Pole, Pigtail Rope Control Handle, Carabineers, Cross-Arm Anchor, Tool Lanyard, Kit Bag and Pole Bag

- Traffic Control and Accident Scene Control
- Contractor ERT personnel shall isolate the area to control overcrowding. All working personnel shall proceed to the nearest assembly point.
-

5.17 INTERFACE WITH OTHER CONTRACTORS

- The steel erection area should be defined as a restricted area and protected with suitable barriers and informative signage to prohibit entry of unauthorized personnel.
- All informative signage to be written in a language that is understandable to all members of the workforce and supported with internationally known pictorial hazard and warning signs.
- All site personnel to be fully informed of the reasons for the restricted area and warned about the consequences should they not obey the 'keep out' warnings.

5.18 PROTECTION OF PERSONS WORKING BELOW

- All loose material, nuts, bolts, washers, tools etc. must be lifted, lowered and carried in a suitable material container
- Loose materials must not be left unattended during steel erection work
- The Work Method Statement should where possible avoid the requirement for persons to work directly below overhead operations. Where this is not practicable protection must be provided to prevent materials from falling (i.e. safety protection debris nets or other suitable methods).
- Barricade must be provided below overhead steel erection operation to restrict other person to work and informative warning signs must be posted.

5.19 PROVISION AND USE OF PPE

- All mandatory PPEs shall be used.
- The primary means of achieving safety when working at height is to provide adequate access arrangements and temporary working platforms including hand rails, toe boards, edge protection, safety nets etc. to prevent persons from falling.
- Full body harness should only be used by all workers working at height.

5.20 SAFETY TRAINING FOR STEEL ERECTION

- **All personnel involved in the steel erection should be trained and assessed as competent in erecting steel structure, training include but not limited to;**

- Hazard identification and awareness
- The correct use of Personal Protective Equipement (PPE) including Full Body Harness equipped with Suspension Trauma Strap
- The contents of the Work Method Statement.
- The location of Emergency Telephone Number.
- The location of First aid and medical services.
- Emergency rescue procedures.

- **Fall protection training shall be provided for personnel exposed to fall hazards. The training shall include, but not be limited to, the following topics:**

- Fall hazard recognition and mitigation measures.
- Use, operation and inspection of temporary guardrail systems (including perimeter safety cable systems), personal fall arrest systems, safety net systems and other fall protection to be used.
- Procedures for erecting, maintaining, disassembling and inspecting temporary guardrail systems.
- Procedures to prevent falls through holes and openings in walking/working surfaces and walls

Figure 3: Trainings

Specific Training	Steel Erector Supv.	Steel Erector	Crane Operator	Rigger	Manlift Operator	Forklift Operator
HDEC Safety Orientation	✓	✓	✓	✓	✓	✓
Working at Height	✓	✓	✓	✓	✓	✓
Heat Stress	✓	✓	✓	✓	✓	✓
Fall Protection (Steel Erection)	✓	✓	✓	✓	✓	✓
Hand and Power Tools	✓	✓	✓	✓	✓	✓
Crane Lifting and Rigging	✓	✓	✓	✓	✓	✓
Human Machine Interface	✓	✓	✓	✓	✓	✓

All steel structure personnel shall be competent to position and fit-up structural framework in any construction sites. (Refer to Attachment 3 – List of Designated Competent Person and Steel Erection Personnel and Attachment 4 – Certificate of Designated Competent Person and Steel Erection Personnel.

6 REFERENCES

- Saudi Aramco Construction Manual (CSM) II-5, Fall Protection.
- Saudi Aramco Construction Safety Manual (CSM) II-7 – Steel Erection
- Saudi Aramco Construction Safety Manual (CSM) III-7 – Crane and Lifting Equipment
- Saudi Aramco Construction Safety Manual (CSM) III-8, Slings and Rigging Hardware
- Saudi Aramco General Instruction, GI 7.025 – Heavy Equipment Operator and Rigger Testing and Certification
- Saudi Aramco General Instruction, GI 7.027 – Crane Suspended Personnel Platform (Man basket Operation)
- Saudi Aramco General Instruction, GI 7.028 – Crane Lifts: Types and Procedures
- Saudi Aramco General Instruction, GI 7.029 – Rigging Hardware Requirements
- Saudi Aramco General Instruction, GI 7.030 – Inspection and Testing Requirements for Elevating/Lifting Equipment
- Saudi Aramco Safety Management Guide 06-008-2019 – Land Transport Cargo Securement

7 ATTACHMENTS

Attachment 1 – Trailer and Load Safety Inspection Checklist (English)

Attachment 2 – Trailer and Load Safety Inspection Checklist (Arabic)

Attachment 3 – Full Body Harness and Lanyard Inspection Checklist

Attachment 4 – List of Designated Competent Person and Steel Erection Personnel

Attachment 5 – Fall protection plan

Attachment 6 – Manlift Operator certification card

Attachment 7 – Crane Operator Certification card

Attachment 8 – Rigger Certification card

Attachment 1 – Trailer and Load Safety Inspection Checklist (English)

Trailer and Load Safety Inspection Checklist

Project Name:				**Date:**			
Contractor Name:				**Subcontractor Name:**			
Driver Name:				**Driver ID No.:**			
Vehicle/Equipment Type:				**Plate No.** (if a plate no is available):			
Before Loading				**Focus Area**			
Trailer Body and Ramp	**Yes**	**No**	**N/A**	**Load Restraining Equipment**	**Yes**	**No**	**N/A**
Coupling				Webbing strap with Hand Ratchet in good condition			
Hydraulics				Cargo Lashing Chain 3rd party certified			
Low bed ramp				Turnbuckle 3rd party certified			
Low bed ramp safety device				Load does not exceed the height of the head board			
Low bed securing chains				(if NO "Do Not Allow the Delivery")			
Overhead board				**During Travel**	**Yes**	**No**	**N/A**
Side stanchions/stakes				Load safe and secure			
Trailer lights				Trailer in good condition as per before loading checklist			
				Before Offloading			
Brake test				**Receiving Supervisor / Driver**	**Yes**	**No**	**N/A**
Load restraining equipment in good order				Load shifted (stored energy)			
Driver clear of ramp laydown zone				Load restraining equipment in good order			
Trailer Rims and Tires	**Yes**	**No**	**N/A**	Area prepared and adequate for offloading			
All wheel nuts secured				Correct type equipment for offloading available			
Tires - right air pressure				**Receiving Supervisor (Name & Signature)**			
Tread depth (minimum 1.6 mm)							
Tread pattern matches							
Lumps, bulges, tears, ply exposure							
Overall tire condition - No deep cuts							
Trailer Electrical	**Yes**	**No**	**N/A**	Driver has route map for specific delivery			
PWAS				Load height meets required vertical clearance as per route map			
Brake and reverse lights working				Load inspected and secured before travelling			
Turn signals working				Vehicle and trailer maintenance log available			
Revolving light				Operator is aware of no go zone while preparing trailer for loading/offloading			
Backup alarm working				All inspectors trained on load safety requirements			
Emergency Equipment	**Yes**	**No**	**N/A**	Driver has right tools and PPE to do the work at site			
Jack and accessories				No flammable materials are allowed inside the truck head cabin			
Fire extinguisher				Do not leave engine running unattended			
First aid kit							
Hazard warning triangle							
Certification / Training	**Yes**	**No**	**N/A**				
SAG License							
Driver trained (trailer and load safety procedure)							

Driver (Name & Signature) **Supervisor (Name & Signature)** **Rigger (Name & Signature)** **Safety Officer (Name & Signature)**

*If any of the boxes is marked "NO", the loading or delivery **MUST NOT** commence.

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Attachment 2 – Trailer and Load Safety Inspection Checklist (Arabic)

HYUNDAI ENGINEERING & CONSTRUCTION

قائمة فحص سلامة الحمولة والمقطورة

أرامكو السعودية saudi aramco

التاريخ: | إسم المشروع:

إسم المقاول الفرعي: | إسم شركة المقاولات:

رقم هوية/ إقامة السائق: | إسم السائق:

رقم اللوحة. (إذا كان رقم اللوحة متوفر): | نوع المركبة:

أثناء التنقل

غير متوفر	لا	نعم	تصريح الدخول/ نقطة الضبط الأمني/ المرافقة
			الحمولة آمنة وسليمة
			المقطورة كانت في وضع جيد وقت فحصها

نقطة الفحص الأمني (الإسم والتوقيع)

قبل الإنزال

غير متوفر	لا	نعم	مشرف الإستلام/ السائق
			الحمولة على وشك السقوط
			معدات تثبيت الحمولة في وضع جيد
			المنطقة مهيئة وجاهزة لإنزال الحمولة
			معدات الإنزال المناسبة إلى نوع الحمولة متوفرة

مشرف الإستلام (الإسم والتوقيع)

نقاط التدقيق

غير متوفر	لا	نعم	معدات تثبيت الحمولة
			حزام التثبيت مع القفل العائق في حالة جيدة
			سلسلة تطويق الشحنة (معتمدة من طرف ثالث)
			أولب شد معدني (معتمدة من طرف ثالث)
			المنصة العلوية أكثر إرتفاع من الحمولة * الجواب (لا) لاتسمح بالتوصيل

السائق يحمل خريطة لمكان التوصيل المحدد.
إرتفاع الحمولة مناسب لظروف الطريق الذي تم تحديده على الخريطة.
تم فحص الحمولة والتحقق من سلامتها قبل الرحلة.
توفر سجل الصيانة للقاطرة والمقطورة.
المشغل على دراية بالمناطق الخطرة أثناء التجهز لعملة التحميل والإنزال.
جميع المفتشين مدربين على التحقق من مقاييس الشحن الآمن.
السائق يحمل معدات الحماية الشخصية وعدة الصيانة المناسبة لإجراء الصيانة في حالة الطوارئ.
لا يسمح بالمواد سريعة الإشتعال داخل قمرة القيادة.
لا تترك محرك القاطرة يعمل من دون مراقبة.

قبل التحميل

غير متوفر	لا	نعم	سطح المقطورة ومنحدر التحميل
			الوصلات
			هيدروليك
			منصة تحميل منخفضة
			جهاز أمان منصة التحميل المنخفضة
			سلسلة تأمين المنصة السفلية
			المنصة العلوية
			الدعامات الجانبية / الأوتاد
			أنوار المقطورة
			إختبار المكابح
			معدات تثبيت الحمولة في وضع جيد
			السائق بعيد عن منطقة فتح المنصة

غير متوفر	لا	نعم	ضغوط وعجلات المقطورة
			تم التحقق من جميع صامولات العجلات
			ظغط الهواء مناسب في جميع العجلات
			عمق النقش على العجة (1.6 مل الحد الأدنى)
			جميع نقوش الإطارات متطابقة
			إنتفاخات وتمزقات وتآكل في الإطارات
			الوضع العام للإطار – لاتوجد شقوق عميقة

غير متوفر	لا	نعم	كهربائيات المقطورة
			نظام إنذار تحذير الإقتراب
			أنوار المكابح وأنوار الرجوع
			أنوار إشارات الإنعطاف
			الأنوار التحذيرية
			صافرة الرجوع للوراء تعمل

غير متوفر	لا	نعم	معدات الطوارئ
			عدة تبديل الإطارات
			طفاية حريق
			عدة إسعافات أولية
			مثلث التحذير العاكس

غير متوفر	لا	نعم	الشهادة والتدريب
			يحمل رخصة قيادة سعودية مصنّفة من أرامكو
			تم تدريب السائق (على عملية القطر والشحن بشكل آمن)

ضابط السلامة (الإسم والتوقيع) | المسؤول عن التجهيز (الإسم والتوقيع) | المشرف (الإسم والتوقيع) | السائق (الإسم والتوقيع)

* إذا كان الجواب في أي خانة (لا) يجب عدم إكمال عملية الشحن أو التوصيل

Rev 6 (Nov 27, 2023)

Attachment 3 – Full Body Harness and Lanyard Inspection Checklist

HYUNDAI ENGINEERING & CONSTRUCTION

AMIRAL PROJECT PKG # 4

amiral

Full Body Harnesss and Lanyard Inspection Checklist

COMPANY								SECTION							COLOR CODE						MONTH				
No.	FBH Serial No	D-Ring Incl Back Pad		Shoulder Strap (Body)		Chest Strap with Adjuster		Leg Strap with Adjuster		Suspension Trauma Strap		ANSI Z359.1 Marking		LANYARD Serial No.	Shock Absorber		Lanyard (Double)		Snap Hook (Self Locking)		Carabiner (Self Locking)		ANSI Z359.1 Marking		REMARKS
		GOOD	BAD	GOOD	BAD	GOOD	BAD	GOOD	BAD	GOOD	BAD	GOOD	BAD		GOOD	BAD	GOOD	BAD	GOOD	BAD	GOOD	BAD	GOOD	BAD	
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									

INSPECTED BY:		I.D. No.		Signature:	

Attachment 4 – List of Designated Competent Person and Steel Erection Personnel

STEEL STRUCTURE MANPOWER LIST AS OF July 29, 2024

S/N	NAME	POSITION	CERTIFICATE/BADGE NO
1	WINSTON	PM	2559209933
2	SURESH KUMAR	SUPERVISOR	2336399924
3	MUHAMMAD JAHID	FOREMAN	2442930919
4	SHAMNAD	COORDINATOR	2537564391
5	ADITHYAN	DRIVER	2541295271
6	IHTIAHAM UL HAQ	DRIVER	2394124164
7	MD MILON	MANLIFT OPTR.	OP/2546784
8	MD ATABUDDIN	MANLIFT OPTR.	OP/2450901
9	MD MOHSHIN	MANLIFT OPTR.	OP/2534650
10	SUJON BISHWA	MANLIFT OPTR.	OP/2561097
11	MASUM SIKDER	MANLIFT OPTR.	OP/2367816
12	MD ZUBAIR	MANLIFT OPTR.	OP/2565371
13	SHABBR SHA	MANLIFT OPTR.	OP/2482638
14	RAYHAN ALAM	MANLIFT OPTR.	OP/2513003
15	MD HABIBUR	MANLIFT OPTR.	OP/2208567
16	SHIPON SHEIKH	MANLIFT OPTR.	OP/2546805
17	MD SOHAIB	MANLIFT OPTR.	OP/2569688
18	MD SAIFUL ISLAM	MANLIFT OPTR.	OP/2546778
19	MD MAMUN HOWELDER	MANLIFT OPTR.	OP/2482616

Attachment 5 – Fall Protection plan

HYUNDAI ENGINEERING & CONSTRUCTION	AMIRAL Project - PKG # 4 Contract No:	aramco

FALL PROTECTION PLAN

Section 1 – Basic Information							
Date							
Specific Activity							
Exact working location							
Section 2 – Means of Access							
Stair / Ladder		Scaffolding Access		Elevating platform (Manlift)		Others: (Please Specify)	
Section 3 – Personnel							
Training		(Please Specify):					
Section 4 – Fall Protection Method (including Protection of Falling Object)							
Fall arrest		Fall restraints		Guardrail System and/or covering of openings		Safety nets/canopy	
Affected area below barricaded with signage		Restraining rope and/or pouch for materials and tools		Others: (Please Specify)			
Section 5 – Anchorage point							
Lifeline		Connectors		Acceptable permanent structure		Others: (Please Specify)	
Section 6 – Fall Protection Equipment							
Full body Harness & Shock-absorbing Double – Leg Lanyard (ANSI Z359.1)		Suspension Trauma Strap		Self-retracting lanyard		Others: (Please Specify)	
Section 7 – Rescue and Emergency Equipment							
Rescue Rope and Carabiner		Stretcher		Manlift or Scissor Lift		Crane	
Ladder		Others: (Please Specify)					
Section 8 - Emergency Response Procedure							
1 Call the Emergency Hotline Number (013-3523-661)							
2 Secure the area or Clear the area							
3 Rescue Methodology (see specific rescue details at the back):							
Self-Rescue		Assistant Rescue		Equipment Rescue: Manlift		Crane	Manual Rescue
4 Emergency Response Team (ERT) handover to Medical Team							
5 Load the injured person to the ambulance (if necessary)							
6 Transport the injured person to the Site Medical Clinic (if Necessary)							

Section 9 – Fall Protection Plan Authorization					
Signatories	Name	Position	Badge #	Signature	Date
Prepared by Site Supervisor					
Approved by Contractor/Subcontractor Construction Manager					
Verified by Subcontractor HSE					
Verified by HDEC HSE					

HYUNDAI ENGINEERING & CONSTRUCTION	AMIRAL Project - PKG # 4 Contract No:	aramco

IMPORTANT: Rescue of suspended employee due to fall must be performed quickly as possible to avoid suspension trauma. The impact will be reduced if the employee can be able to stand in the suspension trauma strap.

RESCUE METHODOLOGY

1. **SELF RESCUE** – A suspended employee that can be possibly reached any structure for self-rescue or provided by Ladder.
   - Keep verbal communication with the employee
   - Employee will climb back up to the nearest structure / platform
   - Emergency Response Team (ERT) will assist the employee
   - Employee will return to the elevated floor level or climb down to the ground

2. **ASSISTANT RESCUE** – Suspended employee which require fall protection equipment such as rope or winch to hoist up / down to the nearest safe working platform.
   - Keep verbal communication with the employee
   - Maintain verbal communication during the rescue
   - Instruct to utilized the suspension trauma strap
   - Emergency Response Team (ERT) will arrange the rescue rope / winch and installed in the firm structure
   - Connect the rope or winch hook from the D-ring of the employee's full body harness. (Ensure that there is positive connection / secure connection between the rope and D ring)
   - Emergency Response Team (ERT) will raise or lower down the employee to the nearest safe working platform or directly on the ground

3. **EQUIPMENT RESCUE** – Use of available equipment to lower down the Injured Person

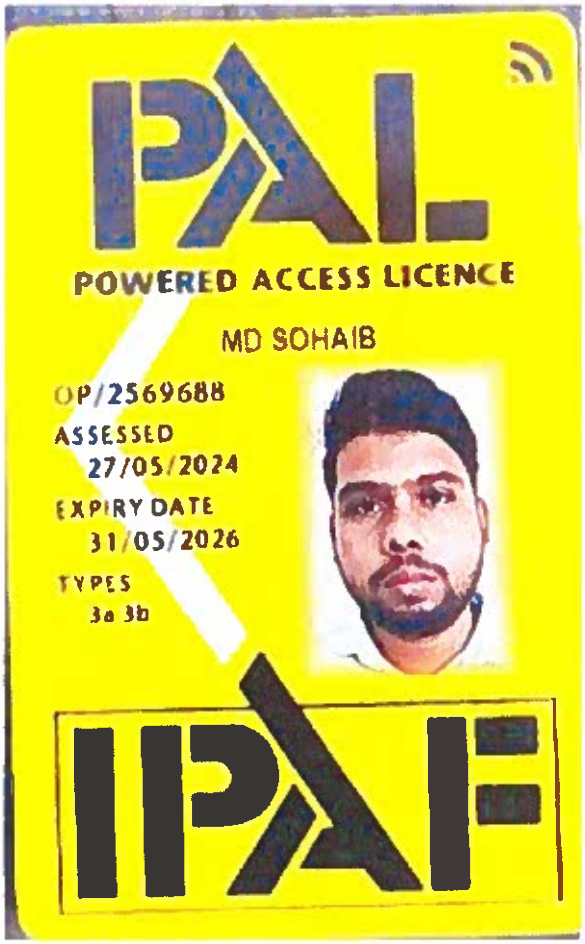
   3.1 USE OF MANLIFT
   - Emergency Response Team (ERT) will bring the rescue stretcher at the elevated area
   - Emergency Response Team (ERT) will load the injured person to the rescue stretcher
   - Secure the injured person in the rescue stretcher
   - Load the stretcher to the man lift basket and secure by rope
   - Maneuver the man lift to bring down the injured person

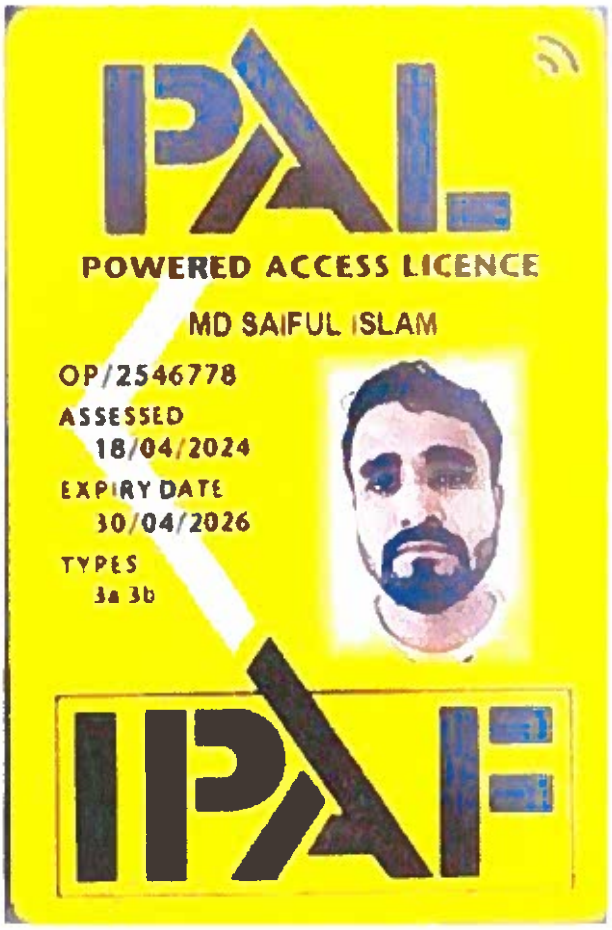
   3.2 USE OF CRANE
   - Emergency Response Team (ERT) will bring the rescue stretcher at the elevated area
   - Emergency Response Team (ERT) will load the injured person to the rescue stretcher
   - Secure the injured person in the rescue stretcher
   - Attached the sling to the rescue stretcher lifting eye
   - Provide tag lines to the stretcher to control the rigging rescue operation
   - Rig down the rescue stretcher to the safe location

4. **MANUAL RESCUE** – Rescue at elevated area with available staircase
   - Emergency Response Team (ERT) will bring the rescue stretcher at the elevated area
   - Emergency Response Team (ERT) will load the injured person to the rescue stretcher
   - Secure the injured person in the rescue stretcher
   - Lift manually the rescue stretcher with the injured person
   - Bring down the rescue stretcher with injured person using the stair case

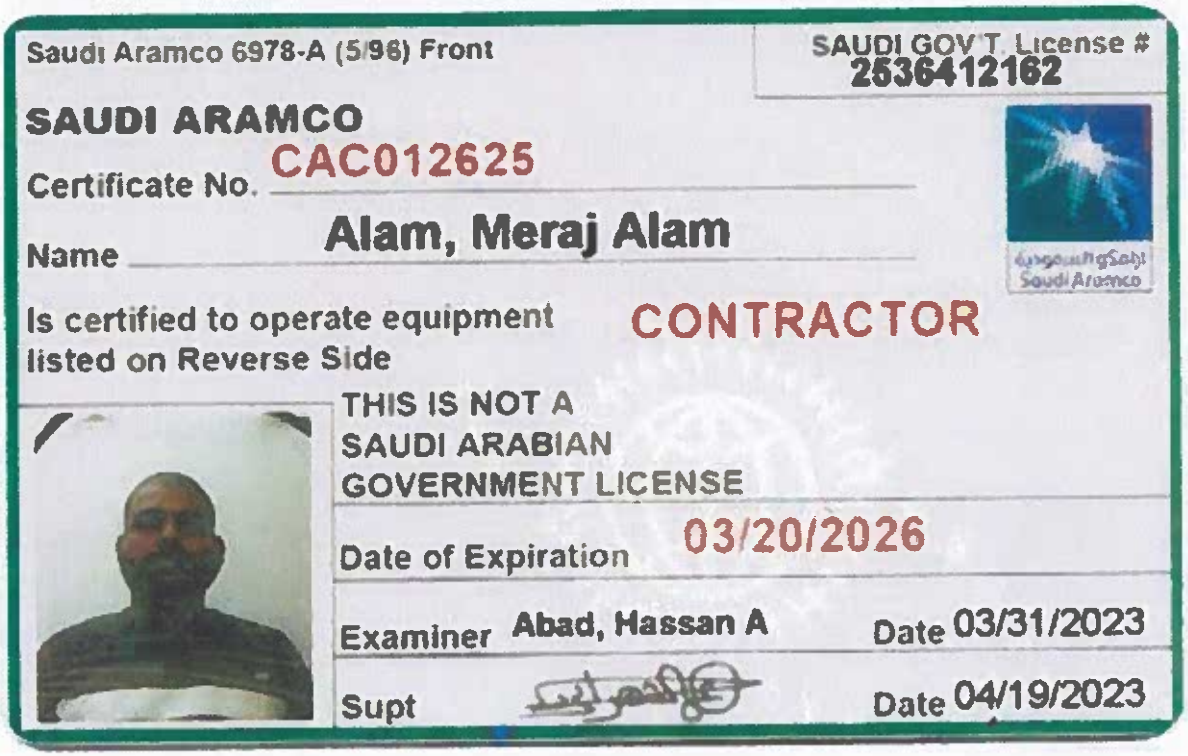
Note: The Emergency Response Team (ERT) will handle and manage the rescue methodology applicable on site condition

Attachment 6 – Manlift Operator certification card





Attachment 7 – Crane Operator Certification card



Attachment 8 – Rigger Certification card


Saudi Aramco - Ind Training Dept

شركة الزيت العربيه السعودية (أرامكو السعودية)

SAUDI ARABIAN OIL COMPANY (SAUDI ARAMCO)

نشهد بان الموظف المدون إسمه قد أكمل بنجاح البرنامج الخاص باعتماد مثبتي الأحمال على المستوى

Having successfully completed the Rigger Certification Test on level

Rigger III Certification No. CAR012962 رقم الشهادة

Badge No. 2509124604 Name: Bhoomaiah, Praveen

وأنه معتمد للقيام بالمهام الموكلة إليه وفقا للمستوى الذي إجتازه

is certified to perform the task in accordance with the level passed

DATE ISSUED 04/18/2022

VALID UNTIL 04/18/2025

JOB SKILLS TRAINER

Carr, Neil Andrew

TRAINING DIVISION HEAD

ALI A. SHAHRANI