SECTION 4: SPECIFICATIONS

SPECIFICATIONS FOR QUICK RELEASE HOOK

1. INTRODUCTION

1.1 General

Pakistan LNG Terminals Limited (PLTL) has appointed Pakistan Gasport Limited (Client); a subsidiary of the Pakistan based Associated Group (AG), for the development of a Liquefied Natural Gas (LNG) regasification (regas) import facility near to Port Qasim southeast of Karachi, Pakistan.

The objective of the Pakistan Gasport LNG Project is to establish an easy supply of high-pressure natural gas (NG) to Sui Southern Gas Company (SSGC) gas net at the connection point. The supply will be provided through a Floating Storage and Re-gasification Unit (FSRU) docked at a jetty with unloading facilities.

1.2 Scope of Specifications

This document contains the technical specifications which covers the quick release hooks and remote release systems for the Project.

Quick Release Hook (QRH) units shall be installed in the location, orientation and arrangement to be established in the detailed drawings.

Each QRH assembly shall be a complete unit designed and built to hold the mooring ropes and to release the mooring lines quickly. Each unit shall be equipped with an integrally mounted, electrically driven capstan having a safe working load capacity with 3 tonne.

1.3 Definitions

DRAWINGS - the Drawings referred to the construction drawings prepared by the Contractor and approved by the CLIENT.

CLIENT – means Pakistan Gasport Limited (PGPL), and CLIENT appointed CRP for the Project.

PROJECT – means Pakistan Gasport LNG.

CONTRACTOR – means the entity awarded a CONTRACT by CLIENT to perform engineering services for the CLIENT.

VENDOR – means any and all persons, firms, partnerships, manufacturers, suppliers, companies, body entities or a combination thereof including sub-vendors and sub-suppliers from whom the supply of goods for the PLANT, as specified in the Material Requisition, is obtained by the CONTRACTOR through a Purchase Order.

1.4 Standards and References

The following Standards and Codes of Practice are referenced within this specification. All materials, workmanship and testing shall conform to the requirements of the latest editions of the following standards and codes of practice except as explicitly vary by this specification in

case of a conflict more conservative approach shall prevail:

› ASTM A572.

› ASTM A148.

› ASTM A29 4140.

› ASTM E1444-05.

› AWS D1.1.

› OCIMF Mooring equipment guidelines.

› High strength steel bolts with associated nuts and washers for structural engineering – refer Steel Work Specification.

› AS 1939: Degrees of protection provided by enclosures for electrical equipment (IP Code).

› ISO 12944: Coatings.

› AS 2729: Rolling bearings - Dynamic load ratings and rating life.

› ISO 8504-2: Preparation of steel substrates before application of paints and related products – Surface preparation methods Part 2: Abrasive blast-cleaning.

› ISO 8504-3: Preparation of steel substrates before application of paints and related products – Surface preparation methods Part 3: Hand and power-tool cleaning.

› ISO 2808: Paints and varnishes – Determination of film thickness.

› ISO 4624: Paints and varnishes - Pull-off test for adhesion.

› BS EN: 60079 Explosive atmospheres.

› AS 4291: Mechanical properties of fasteners.

› ISO 9001: Quality management systems – Requirements.

› BS6349.4: Maritime Structures Part 4: Code of Practice for Design of Fendering and Mooring Systems.

1.4.1 Project Documents

The Project documents to be read in conjunction with this document are as follows:

› XPE, THCC (2016), Design Basis Report Marine Civil, FPK16027DD-0000-OT01-SPC-01.

› XPE, THCC (2016), Specification for Marinework Concrete, FPK16027DD-0000-MS01-SPE-03.

› XPE, THCC (2016), Specification for Cathodic Protection System of Steel Piles, FPK16027DD-0000-MS01-SPE-05.

› XPE, THCC (2016), Specification for Quick Release Hook, FPK16027DD-0000-MS01-SPE-07.

› XPE, THCC (2016), Specification for pilling Work, FPK16027DD-0000-MS01-SPE-09.

› XPE, THCC (2016), Specification for Quay Furniture, FPK16027DD-0000-MS01-SPE-10.

› XPE, THCC (2016), Specification for Corrosion Protection Coating of Steel Tubular Piles, FPK16027DD-0000-MS01-SPE-11.

› COWI (2016), Design Basis – Civil Marine, A082981-PR-001.

› COWI (2016), Design Basis – Electromechanical, A082981-PR-002.

› COWI (2016), Steel Work Specification, A082981-PR-001.

› COWI (2016), Concrete Specification, A082981-PR-002.

› COWI (2016), Piling Work Specification, A082981-PR-003.

› COWI (2016), Dredging Work Specification, A082981-PR-004.

› COWI (2016), Quay Furniture Specification, A082981-PR-005.

› COWI (2016), Quick Release Hooks and Remote Release Specification, A082981-PR-006.

2 General Design Requirements

2.1 Design Documentation

The CONTRACTOR/VENDOR shall ensure that the mooring equipment has been designed in accordance with relevant standards and can safely carry the safe working loads given in this Specification.

The CONTRACTOR/VENDOR shall supply full details and the DRAWINGS of the proposed mooring hooks, capstans, motor bearing arrangement and electrical requirements. The CONTRACTOR/VENDOR shall supply calculations in support of the design.

Manufacture of the QRH system or any component thereof, shall not commence until all engineering deliverables have received the CLIENT's approval.

2.2 Immersion of Mooring System

All mooring hook units will be located outside the normal splash zone. However, in storm surge and storm wave conditions the hooks may be splashed. The CONTRACTOR/VENDOR shall design for these conditions.

2.3 Inspection and Test Plan

The VENDOR shall produce and implement an Inspection and Test Plan (ITP) covering all engineering, and examination and testing activities.

The ITP shall be submitted to the CLIENT for approval before any work is started.

The CLIENT requirements for involvement in engineering document review, and inspection and testing activities shall be marked on the ITP.

The CLIENT reserves the right to witness test by means of their inspectors and to inspect all materials and/or equipment at any time in the CONTRACTOR's and/or VENDOR's workshop.

3 Design Requirements of Quick Release Hooks

3.1 Operating Requirements of Quick Release Hooks

3.1.1 Operation of Hooks

Manually operated hooks shall be provided. The mooring rope shall be released manually by detachable hand-lever located on the hook, using one hand, with maximum force of less than 150 N under any amount of load, from zero tension to maximum safe working load.

The manual release levers shall be operated from the back of the unit.

The levers shall be provided with a safety locking device to prevent accidental or unauthorised release of a hook.

A local release control shall also be provided.

Each hook of the unit shall be capable of being individually released independent of the other hooks in the unit.

The hooks shall not jam or stick.

The quick release mooring system shall be controlled and monitored from jetty control room, and tension monitoring shall be available in FSRU through fiber optical.

The QRH assemblies will be located within an explosion prone zone at the berths and shall be suitable for the hazardous area and environment as determined by the CONTRACTOR.

All QRH assemblies, including the capstans, shall be electrically insulated from the dolphin structure. This isolation shall provide an electrical resistance of more than 1 mega ohm.

3.2 Technical Requirements of Quick Release Hooks

3.2.1 Material

The hook frame shall be manufactured from plate steel to ASTM A572 Grade 50 or approved equivalent, or cast to ASTM A148 Grade 115/95 or equivalent.

The hook and pivot block will be of alloy steel casting to ASTM A148 Grade 115/95 or approved equivalent and pivot shafts to ASTM A193 Grade B7 or equivalent.

Galvanizing of hardware shall comply with ASTM A153 or equivalent. Painting shall be in accordance with the Manufacturer's standard coating system subject to approved in writing by the Principal. The film thicknesses and surface preparation shall be in accordance with Section 3.3.1 as a minimum.

3.2.2 Anchorage to Dolphin Structures

The QRH units shall be anchored into the concrete superstructures of the berthing and mooring dolphins by means of anchor bolts as per the supplier’s requirements.

The CONTRACTOR/VENDOR shall undertake the design of connections. The CONTRACTOR/VENDOR shall undertake an analysis of all connections, loads, and stresses. This analysis shall be carried out by an independent third party employed by the CONTRACTOR/VENDOR and records of this analysis shall be provided to the Principal's Representative.

The full length of bolts and fixings shall be coated with Enviropeel prior to fitting into cast-in ferrules. All bolts shall be supplied complete with washers and nuts where required.

The CONTRACTOR/VENDOR shall provide design calculations verifying the capacity of all fixings (including anchor bolts) to withstand design loads.

3.3 Design Requirements for Load Monitoring

Each mooring hook shall be provided with a Load Cell monitor. The monitored load shall be transmitted to the control room and shall be displayed on a control screen. Design and installation of Load Cells and monitoring system are to be provided by the CONTRACTOR/VENDOR. Operational and maintenance manuals shall be provided.

3.3.1 Design Requirements for Coatings

All external steelwork surfaces and welds are to be suitably prepared and coated with approved protective systems. The surface preparation and the application of corrosion protection must comply with the following Standards:

› ISO 8504-2 Preparation of steel substrates before application of paints and related products – Surface preparation methods Part 2: Abrasive blast-cleaning.

› ISO 8504-3 Preparation of steel substrates before application of paints and related products – Surface preparation methods Part 3: Hand and power-tool cleaning.

› ISO 2808 Paints and varnishes – Determination of film thickness.

› ISO 4624 Paints and varnishes - Pull-off test for adhesion.

Coating to be applied in accordance with the Manufacturer's standard coating system will be accepted where this offers equivalent protection. As a minimum it shall meet the following:

› Surface Preparation: Class 2.5 Blast (1):

› 1st Coat: 75µm DFT epoxy zinc-rich primer.

› 2nd Coat: 125µm DFT two-part epoxy, containing MIO.

› 3rd Coat: 75µm re-coatable two-part polyurethane.

4 Design Requirements of Powered Capstan

4.1 Operating Requirements of Powered Capstan

4.1.1 Capacity

The running line pull load of each capstan shall be 3 tonne. Start-up pull capacity is twice the line pull.

The line speed shall be 25 m/min.

Minimum drum diameter shall be 250 mm.

4.1.2 Capstan Motor

All motors and motor frames shall be designed, constructed and tested in accordance with the latest amendments of AS 1359 - Rotating Electrical Machines - General Requirements, and with all relevant SAA Specifications.

The preference for Motors brands is Toshiba, Siemens or ABB.

The CONTRACTOR shall select motors with regard to torque requirement of the load, the speed torque characteristics of the motors and the torque reduction due to the voltage drop caused by the starting current.

All motors shall be suitable insulated to limit motor temperature rise. All insulating materials shall be non-hygroscopic and the complete motor shall be tropic proofed. High voltage motor insulation shall be capable of withstanding voltage spikes.

It shall be possible to disconnect and remove all motors with a minimum of disruption to motor cabling.

All bearings shall be designed for an L_{10} life of 50,000 hours with an a_2, a_3 life adjustment factor not greater than 1.0 in accordance with AS 2729 – Rolling bearings - Dynamic load ratings and rating life.

Rotor cages shall be designed to withstand the starting duty specified and minimise vibration.

All motors must be suitable for the appropriate hazardous area zone as determined by the CONTRACTOR.

4.2 Technical Requirements of Powered Capstan

4.2.1 Type of Capstan Drum

The Capstan shall be the vertical drum type.

4.2.2 Capstan Motors

Motors of the same output shall be identical (for spares standardisation). All motors shall be able to receive cables from the right and left hand side. This feature may be achieved by

either providing the cable termination box(s) on the top of the motor or by providing a symmetrical motor frame.

All motors shall be totally enclosed (TENV) and suitable for hazardous environments. All motor enclosures shall be rated minimum IP 65 and shall be vermin proof.

All motors shall be provided with a means of lifting comprising a lifting bolt set in a tapped hole. The tapped holes for the lifting bolts shall not pass completely through the motor frame.

The electricity-operated motor shall be equipped with a foot switch. The capstan shall pull the eye of the mooring line directly over the mooring hook. The capstan shall also be equipped with a brake or other approved mechanical mechanism designed to hold 150% of the running pull to stop capstan spinning in the opposite direction once the foot pedal is released.

All motors shall be supplied complete with fault rated terminal boxes, which are completely sealed off from the motor winding space. Motor windings shall be brought out to adequately sized fixed terminals. Connections from terminals to the motor winding shall not use natural rubber as an insulation.

All motor bearings (ball and roller) shall be fitted with labyrinth seals to prevent the ingress of abrasive dust and moisture.

All motors must be suitable for hazardous area zone 1.

5 Electrical/Instrumentation

5.1 Electrical Ratings

The quick release system and powered capstans shall be supplied as a package complete with all electrical control equipment and motor starters. All electrical equipment shall be rated for the applicable hazard zone as determined by the CONTRACTOR.

5.1.1 Power Supply

The power supply to the capstans shall be 440 V AC, 3 phase, 60 Hertz.

5.1.2 Control Power Supply

The control power supply for all equipment shall generally be 220 V AC, single phase, 60 Hertz.

5.2 Electrical Equipment Identification

Each piece of electrical equipment shall be provided with an engraved stainless steel nameplate identifying the service. Nameplates shall be in black lettering except for safety or warning nameplates, which shall be in red lettering. Nameplates shall be mounted adjacent to or on the operating mechanism with corrosion-resistant 316 stainless steel screws. The fixing of the nameplate shall not void the equipment IP rating.

All power, control and instrument cables and wiring shall be identified at each end with wire markers corresponding to the designations on wiring diagrams.

All field devices shall be provided with stainless steel wired tags.

5.3 Capstan Motors

The motors for the capstans shall be rated at 440V AC, 3 phase, 60 Hertz. Power to each motor shall be supplied from a combination starter. The motors and combination starters shall be supplied as part of the capstan assemblies. The motors shall be suitable for hazardous environments zone 1, T3 temperature rated and TENV (totally enclosed non-ventilated) Control Devices.

Electrical equipment shall be protected within an IP 65 rated enclosure.

The local combination starters shall be equipped with forward/reverse selector switches for determining the direction of operation. A single footswitch shall be provided for each capstan assembly to initiate capstan operation.

The footswitches can be provided at a reduced control voltage for added safety protection and must be provided with safety guards. Footswitches shall be protected with an IP rating of 66.

Each combination starter shall be provided with an emergency stop pushbutton on the starter door that is hardwired into the control circuitry for immediate stoppage when pushed.

Capstan brakes or other approved mechanical mechanisms shall be provided that are internally connected and automatically actuated when power is removed.

5.4 Wire and Cable

5.4.1 Wiring

All wire and cable conductors shall be copper and stranded. No wire smaller than 2.5 mm^2 shall be used, except in control circuits where 1.5 mm^2 shall be used.

Inside the combination starters, all wiring shall be double insulated PVC-V105, polyethylene or ethylene-propylene insulation. Wiring crossing hinges or doors shall be adequately protected to prevent chafing or straining when the door is opened.

5.4.2 Terminations

Internal equipment wiring shall be point to point with no splicing or T connections and shall be neatly trunked and supported such that there is no strain on the terminations.

Adequately sized 440 V power connection terminals or lugs shall be provided for the incoming cable (up to 25mm^2 conductors).

5.4.3 Terminal boxes

Terminal boxes shall be capable of receiving multi-core cables or single core cables. Terminal box covers shall be supplied complete with captive securing screws such that water leaking along the thread cannot enter the terminal box. Gaskets shall be securely fixed to either the terminal box cover or base. All terminal boxes shall be rated IP 66 as a minimum and generously sized to accommodate incoming cables and terminations.

5.4.4 Grounding

Exposed, non-current carrying metal parts of electrical equipment shall be solidly bonded to equipment enclosures and provisions made to bond the enclosure to ground with the ground wires from incoming cables.

Grounding connections shall be readily accessible such that the integrity of the grounding connections can be readily observed.

6 Inspection

A certificate of tests shall be furnished to the CLIENT for each Quick Release Hook for the following:

› Proof load test to specified requirement.

› Release test at the SWL of 150 tonnes.

› Certification of the materials.

› A Calibration Certificate for the MLM pin.

An Inspection and Test Plan shall be reviewed and approved before the CONTRACTOR proceeds with construction of the equipment to be supplied.

All electrical equipment shall be pre-assembled, electrically interconnected to the control equipment inclusive of all cabling and glands, and factory tested to ensure control and performance characteristics are obtained.

7 Factory Acceptance Tests

A Factory Acceptance Test (FAT) on all equipment shall be carried out.

The CONTRACTOR shall provide a timetable for the tests 1 month prior to undertaking the FAT.

Acceptable success/failure criteria will be established by the CONTRACTOR in consultation with the CLIENT, of which the CLIENT will have the final say.

The FAT will include as a minimum:

- Proof load testing of at least 1 hook unit, with the load monitored by the supplied load cell and control room equipment, as well as by independently calibrated load monitoring equipment.
- Local and remote release test of all hooks under SWL.
- MLM test with the supplied control unit of all hooks, while all hook units are powered and operating.
- Remote Release tests location specific remote release equipment and control room equipment, while all hook units are powered and operating.
- Manual release of all hooks under SWL.
- Resetting of all hooks.
- Vertical and horizontal operating range of hooks.

8 Packing, Transport, Storage and Handling

8.1 Packing and Transport

The individual components that make up the quick release system shall be adequately packed for transport and lifting. Where applicable, particular care shall be taken to prevent damage due to mishandling or the ingress of dust or water while in transit. Care shall be taken to prevent damage to any protective coating used.

Bolts, nuts and washers shall be delivered to site in suitable bags or containers, which shall be clearly labelled identifying the size and quantity. Bolts shall be appropriately stored and protected. Sufficient bolts, nuts and washers shall be sent to site to enable the erection to continue without delay.

8.2 Site Storage

Material delivered to the site shall be stored in an orderly manner on wooden blocks or similar above the ground prior to erection. Where required, material shall be stored so as to prevent the ingress of dust or water.

8.3 Handling

All components must be lifted and handled such as to avoid both structural and surface coating damage.

Chains and wire ropes shall not be used in direct contact with any steelwork for lifting and handling. Chains and wire ropes shall be lagged or padded if required.

Damaged items shall be rectified by a method approved by the CLIENT and shall be carried out in accordance with Contract Specifications.

9 Installation and Commissioning

Mooring hooks, capstans and remote release systems shall be installed in accordance with this Specification, the Specifications, the manufacturer's recommendations and all design documentation supplied to and approved by the CLIENT.

9.1 Personnel and Workmanship

Personnel experienced in this work shall carry out the installation of the mooring hooks, capstans and remote release systems. The work shall be carried out under the direction of an experienced specialist. The workmanship shall follow international best practice throughout.

9.2 System Commissioning

Mooring hooks, capstans and remote release systems shall be commissioned in accordance with the commissioning procedure supplied to the CLIENT.

The testing and commissioning of the system shall be carried out by an experienced specialist. The workmanship shall follow international best practice throughout.

A commissioning report with the results of all testing shall be provided to the CLIENT within 2 weeks of completion of the commissioning.

9.3 Site Acceptance Test

A Site Acceptance Test (SAT) on all equipment shall be carried out. Acceptable success/failure criteria will be established by the CONTRACTOR in consultation with the CLIENT, of which the CLIENT will have the final say. It is required that all tests pass with 100% success.

The SAT will include tests similar to that in the FAT.

10 Technical Documentation

10.1 Data and Certification Required

The CONTRACTOR shall provide sufficient technical data, calculations and certification that the quick release hooks and capstans have been designed in accordance with relevant standards and can safely withstand the applied design loads provided in this Specification.

The CONTRACTOR shall provide all technical documentation detailed elsewhere in this Specification, DRAWINGS, or in other Contract documentation.

All information to be provided in electronic format suitable for printing.

10.2 Drawings

The CONTRACTOR shall submit detailed, certified, mechanical and electrical DRAWINGS for all items supplied under this Specification and certified information specifying the design requirements for related equipment, cable or materials to be provided by others.

10.3 Identification

The CONTRACTOR shall note all documents with the specification number for identification purposes.

11 Submittals

11.1 Manuals

The following manuals shall be submitted to the CLIENT in electronic format in accordance with Project Specifications:

› Factory acceptance test report.

› Installation manual.

› Maintenance and operations manual.

› Wiring termination and schematic diagrams.

› Commissioning report.

› Site acceptance test report.

11.2 Spare Parts

A list of recommended spare parts shall be submitted to the CLIENT.

11.3 Other Items

The following items shall be indicated at time of Preliminary Design submission:

› General arrangement of the units

› Detailed information on the configuration and size of attachment hardware

› Recommended list and cost of spare parts

› Mooring hook and capstan maintenance requirements.