

Heavy Lifting Works

Scope of Work

FIDIC RED BOOK



CONDITIONS OF CONTRACT
FOR CONSTRUCTION
(FOR BUILDING AND
ENGINEERING WORKS)
DESIGNED BY THE EMPLOYER

SPECIFICATION SECTION

1. HEAVY LIFTING WORKS

1.1 General

This section covers the planning, provision, execution, monitoring and completion of all heavy lifting activities as shown on the Drawings and as specified herein.

1.2 Scope

The Heavy Lifting Works comprise but are not limited to:

- Lift planning and method statements
- Engineering and lifting calculations
- Supply and selection of lifting equipment
- Mobilization and demobilization of cranes and equipment
- Preparation of lifting area and access
- Rigging, slinging and lifting accessories
- Execution of lifts and load control
- Taglines and load guiding
- Interface with other trades and operations
- Inspection, testing and certification
- Documentation and reporting

1.3 Standards

All materials and workmanship shall conform to the applicable Codes, Standards and Specifications as specified herein.

FIDIC RED BOOK - SPECIFICATION

SCOPE OF WORK

CONTRACT NO. [...]

FOR

HEAVY LIFTING WORKS

[...] PROJECT

AT

[INSERT CITY]

IN

[INSERT COUNTRY]

TABLE OF CONTENTS

ARTICLE 1 – INTRODUCTION	3
ARTICLE 2 – SCOPE OF WORK – GENERAL	3
ARTICLE 3 – DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS	3
ARTICLE 4 – DESCRIPTION OF WORK.....	3
ARTICLE 5 – AS-BUILT DRAWINGS	18
ARTICLE 6 – HSE & SECURITY	18
ARTICLE 7 – CONTRACTOR SERVICES.....	18
ARTICLE 8 – SURVEY AND SETTING OUT	32
ARTICLE 9 – COMPLETION & TURNOVER COORDINATION	32
ATTACHMENT 1 – DETAILED SCOPE OF WORK REQUIREMENTS	
ATTACHMENT 2 – RESPONSIBILITY MATRIX – MECHANICAL CONTRACTOR AND CONTRACTOR	
ATTACHMENT 3 – LIST OF EQUIPMENT TO BE INSTALLED BY CONTRACTOR	
ATTACHMENT 4 –REACTOR ERECTION SEQUENCE	

ARTICLE 1 – INTRODUCTION

- 1.1 The Scope of Work described herein includes all the Heavy Lifting Works work required for the unloading, transportation and installation of PLANT of the [...] Project.

ARTICLE 2 – SCOPE OF WORK - GENERAL

Except as otherwise expressly provided herein CONTRACTOR shall supply all labour, supervision, permanent, temporary and consumable MATERIALS, computer equipment and software, temporary facilities, services, testing devices, and each and every item of expense necessary for the performance and completion of the:

Heavy Lifting Works

ARTICLE 3 – DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

- 3.1 All WORK shall be performed in accordance with the requirements of the CONTRACT and in particular the SPECIFICATION.
- 3.2 General directive concerning drawings, specifications and other documents.
- 3.2.1 ENGINEER will provide CONTRACTOR with one (1) copy of the drawings, specifications and other documents referenced in DRAWINGS section of the Contract.
- 3.2.2 CONTRACTOR is responsible for obtaining and confirms it is in possession of complete copies of the applicable national and international codes and standards which are not specifically listed nor physically included in the CONTRACT package. The most recent edition published as of the effective date of this CONTRACT shall apply unless expressly stated to the contrary elsewhere in this CONTRACT.
- 3.2.3 CONTRACTOR shall where applicable, in interpreting the drawings, specifications and other documents, be bound by the figures marked therein and not by scaled measurements.
- 3.2.4 Works and supplies which by their nature form part of the CONTRACT or are necessary for proper completion of the WORK but are neither expressly mentioned in the drawings, specifications and other documents nor expressly excluded shall be for the account of CONTRACTOR.

ARTICLE 4 – DESCRIPTION OF WORK

Without restricting the generality of Articles 2.0 and 3.0 above or the extent of the WORK required therein, the WORK shall specifically include, but not be limited to, the following:

4.1 General Activities

- 4.1.1 The following general activities shall form part of the CONTRACTOR's Scope of Work:
- Provide records of field and/or shop inspection, tests alignment and calibrations performed.
 - Advise ENGINEER when any government authority inspection or test of field installation is required. Liaise as required for any/all external authority approvals relating to CONTRACTOR's work.
 - CONTRACTOR shall provide all scaffolding and proprietary means of access necessary to execute the WORKS and shall co-ordinate with ENGINEER with regard to the planning, erection and removal of scaffolding for multi use in pipe racks, elevated and tall equipment. CONTRACTOR shall also provide all means of access to the work including ladders, scaffolding, hydraulic hoist boost or any other means acceptable to the ENGINEER and in accordance with safety regulations. CONTRACTOR shall furnish on a weekly basis during the execution of the project a schedule showing linear meters of scaffold board and tube, numbers and types of fittings and numbers and lengths of ladders that are in use and those which are readily available at the jobsite.

- d) Administrative reporting requirements, including provision of all labour force and construction equipment reports and submission for ENGINEER's review of the procedures for time-keeping and control of his workforce.
- e) Protect ENGINEER's benchmarks and monuments from damage by CONTRACTOR.
- f) To supply, setting and removal of temporary warning sign boards.
- g) Ensure the arrival of tools and equipment at the SITE to meet construction schedule requirements and SITE laydown availability.
- h) Submission in good time to ENGINEER for its approval of all required or necessary procedures as described in the CONTRACT or as required by good practice.
- i) Maintain records of all changes in the field and provide drawings marked up to indicate such changes.
- j) Ensure that only appropriately trained and competent technicians carry out the work.
- k) Perform daily clean-up and housekeeping of all work areas, warehouses, offices, storage locations and at and around all other temporary facilities and to dispose of all waste.
- l) Segregate all waste produced by CONTRACTOR and his SUBCONTRACTOR's and dispose of by proper means, including the removal from the SITE.

4.2 Rigging and Lifting Requirements

- 4.2.1 Rigging is generally considered to be an activity of "greater risk" within the construction industry. With proper knowledge, planning and care, the process of lifting can produce expected result. The hardware, the environment, the planning and the personnel are all part of the lifting process.
- 4.2.2 The CONTRACTOR must provide all construction equipment and tools required for the safe, proper and timely performance of the WORK, whether or not expressly mentioned in the CONTRACT, unless expressly stated otherwise by the COMPANY. CONTRACTOR shall provide adequate construction equipment to perform the WORK and in an effective manner and maintain the construction schedule.
- 4.2.3 ENGINEER may request the CONTRACTOR to provide additional equipment, if in the ENGINEER'S opinion the equipment is necessary to maintain the construction schedule. All equipment costs associated with maintaining the schedule shall be the responsibility of the CONTRACTOR.
- 4.2.4 No CONSTRUCTION EQUIPMENT will be withdrawn from SITE without formal written approval of COMPANY
- 4.2.5 CONTRACTOR shall inspect all equipment upon arrival at the SITE prior to the use thereof. Copies of inspection reports shall be submitted to ENGINEER for review prior to initial use at the SITE. The equipment that does not meet required safety standards will not be allowed access to SITE.
- 4.2.6 Inspection of CONSTRUCTION EQUIPMENT by CONTRACTOR should take place prior to shipping item to the SITE to ensure that it meets requirements. If CONTRACTOR does not undertake such pre-shipping inspection and during the inspection that is to be carried out on arrival at the SITE defects or deficiencies are found which require corrective action and which results in delay(s) therefrom, CONTRACTOR shall take such action as is necessary or required to remediate such delay(s). The inspections shall be performed by qualified and experienced personnel only.

- 4.2.7 ENGINEER shall have the right and option to inspect CONTRACTOR's CONSTRUCTION EQUIPMENT and all other equipment and vehicles at any time when entering, while on or when exiting the SITE. Any vehicle that in ENGINEER's sole opinion is not conforming to law, regulations, or is unsafe or otherwise unfit for the purpose intended, shall be immediately removed from the SITE at CONTRACTOR'S cost. Such inspections by ENGINEER do not relieve CONTRACTOR from making its own inspections and maintaining the equipment as required by this CONTRACT and the law.
- 4.2.8 Any such equipment which is rejected as not conforming to the foregoing shall be promptly removed from the SITE by CONTRACTOR and replaced with equipment acceptable to ENGINEER without additional cost to ENGINEER and without delay in completion of the WORK.
- 4.2.9 CONTRACTOR shall be responsible for a spill preventive control procedure. This procedure shall include specific activities CONTRACTOR will undertake to minimize the likelihood of contamination resulting from spillage. These activities include items such as drip pans under oil drums and other transfer points, dikes around fuel storage tanks, fuel transfer procedures requiring all transfers to be controlled via pumping through hoses, readily available spill clean-up material such as absorbent material. Promptly clean up of spilled material must be executed.
- 4.2.10 CONTRACTOR shall immediately notify ENGINEER of any environmental spill or incidents and submit a written report within twenty-four (24) hours of each occurrence
- 4.2.11 CONTRACTOR shall avoid the use of over-weight and over-wide loads for equipment and materials. When, for shape or size reasons, the load cannot meet this recommendation, proper road signs as well as signposts for heavy, large and wide loads shall be used. In the routes on national or departmental roads, escort vehicles shall be provided. In the same manner, proper schedules shall be chosen for the transportation of these types of loads, considering the non-rush hours as well as the hours with less presence of pedestrians in populated zones.
- 4.2.12 CONTRACTOR shall evaluate the maximum permissible weight for heavy loads in the road to be used. In case of surpassing the load limits, the Ministry or other regulatory body in charge of the road shall be contacted in order to obtain the proper permits and coordinate any permit requirements.
- 4.2.13 CONTRACTOR vehicles, machinery and equipment shall have back-up alarms for alerting the personnel of vehicle, machinery and equipment movement. This excludes crawler cranes, which must have a flagman available at all times when the equipment is in motion.
- 4.2.14 CONTRACTOR shall ensure the use of mufflers in all the exhausts of vehicles, machinery and equipment, including CONSTRUCTION EQUIPMENT.
- 4.2.15 CONTRACTOR shall maintain a sufficient supply of spare parts and other accessories to ensure timely maintenance of all its CONSTRUCTION EQUIPMENT and other vehicles and equipment. The proposed spare parts inventory shall be considered as the minimum inventory which CONTRACTOR shall have on hand at all times at or near the SITE.
- 4.2.16 The CONTRACTOR shall submit a CONSTRUCTION EQUIPMENT schedule to the ENGINEER no later than 4 weeks after the EFFECTIVE DATE. This schedule shall be updated and submitted to the ENGINEER on a monthly basis to show actual mobilisation, on SITE and demobilization dates of the CONSTRUCTION EQUIPMENT. This schedule shall include all CONSTRUCTION EQUIPMENT including those used by SUBCONTRACTORS.
- 4.2.17 Safe work methods and good rigging practices are the foundation of a successful rigging operation. Written procedures alone are not enough to make a successful lift, it requires all members of the rigging team – engineering, construction, subcontractors, etc. – to have a commitment and passion for safety. Safe work methods are the result of this practice.
- 4.2.18 The guidelines set out in this Section 4.2 address the major components that go into making a successful lift. These key components consist of well planned and clearly explained procedures, properly trained personnel, and adequately sized and well-maintained equipment.

- 4.2.19 ENGINEER business philosophy is to be in conformance with domestic and foreign governing regulations. Within that framework, all crane operations and rigging gear design is to comply with OSHA 1926 and ASME B30 series regulations. The ENGINEER design basis of all rigging attachments is the AISC allowable stress design method using a 50% impact factor. The more restrictive requirements govern.

4.3 Personnel

- 4.3.1 The responsibility for safe lifting operations falls on all who are involved with the lift-whether they have minimum involvement or make major contributions. The key is proper planning and execution of the work by everyone. To achieve successful results, it is necessary that all parties work together to share information and communicate data with each other. To that end, the general responsibilities of various positions are noted and outlined below. The following list of positions is not exhaustive, but representative of the necessary sharing and communicating that is required for a successful lift.

CONTRACTOR Construction Manager

- Determine level of rigging supervision to be provided
- Approve and sign-off for lifts falling into major and critical lift classifications
- Ensure that all cranes and operators provided by the CONTRACTOR and third-party sources are in compliance with ENGINEER standards and requirements and all domestic or foreign laws and regulations.
- Ensure that a preventative maintenance and inspection program for cranes and rigging gear is in place

CONTRACTOR Rigging Superintendent

- Approve and sign-off for lifts falling into major and critical lift classifications.
- Ensure that crane and rigging equipment inspections and certification are current before equipment is put into operation on the site.
- Ensure that all cranes are maintained according to manufacture's recommendations.
- Review with rigging supervision and operator known obstructions and interferences including power lines and underground pipe per rigging plan addressing these issues
- Evaluate the lift to see what lift classification applies and determine the proper level of documentation and approval
- Verify that lift plans have been reviewed and approved by the appropriate personnel
- Verify that the SITE has been prepared for the crane soil loading
- Make sure that adequate space is available for crane assembly and rigging operations
- Provide all required materials for the lift, such as crane mats, etc.
- Validate weight and centre of gravity (CG) for the lift
- Advise rigging supervision and crane operator of the lift weight and CG
- Prepare an emergency plan in conjunction with ENGINEER requirements, and advise all involved with the lift
- Review weather conditions at the beginning of the lift to determine if the lift can proceed safely
- Ensure that all rigging operations are conducted in a safe manner in accordance the requirements of the CONTRACT and all governing codes and regulations

CONTRACTOR Rigging General Foreman

- Approve and sign-off for all lifts
- Coordinate pre-lift meetings and determine who is to attend
- Assign competent rigging personnel to each crane
- Assign a competent flagman for the lift. Provide for radio communications if necessary
- Confirm that the load is properly rigged for the lift

CONTRACTOR Rigging Foreman

- Approve and sign-off for all lifts.
- Coordinate pre-lift meetings and determine who is to attend
- Assign competent rigging personnel to each crane
- Assign a competent flagman for the lift. Provide for radio communications of necessary
- Confirm that the load is properly rigged for the lift

CONTRACTOR Operator

- Acknowledge that the lift criteria in the rigging plan has satisfactorily been met for all lifts.
- Operate the crane in a safe manner in accordance to manufacturer's recommendations
- Make sure that the crane has been assembled in accordance to manufacturer's specifications
- Confirm the weight of the load and the rigging
- Perform daily inspection of crane in accordance to manufacturers' and ENGINEER recommendation
- Be able to read and fully understand the crane load chart(s)
- Check SITE to confirm it is adequately prepared for the lift
- Check the SITE for existing obstructions, both overhead and underground. Check with supervision, especially for underground obstructions (pipelines, sewers, etc.) that may not be readily evident
- Inform supervision of any concerns for safety, obstructions, etc. before or during the lift
- Meet operator qualifications.

CONTRACTOR Riggers

- Have an overall understanding of the lift
- Know their individual responsibilities during the lift

4.3.2 CONTRACTOR shall employ an experienced, competent and responsible Heavy Lift and Transport Engineer, previously approved by the ENGINEER prior to mobilization. This person shall be responsible for preparation and approval of all rigging and transportation studies. This person shall be a registered professional engineer

4.3.3 If CONTRACTOR requires to utilise a SUBCONTRACTOR for any part of parts of the WORK, then CONTRACTOR's SUBCONTRACTOR shall provide such information as is required of CONTRACTOR, for example:

- Required documentation of inspection on cranes
- In the case of the provision of personnel, their responsibilities are the same as those described above

4.3.4 All crane operators are required to take both a written test and a practical test before being issued a CONTRACTOR's operator's card. Both exams are given by a CONTRACTOR designated competent person and are conducted in conjunction with the CONTRACTOR's safety manager. The written test is to cover basic crane operation as well as modules for different types of cranes. The practical examination is to be given on the specific piece of equipment to be operated. The card that the operator receives from the CONTRACTOR will list the specific equipment and model that the operator is qualified to operate. No CONTRACTOR employee is to operate cranes on the SITE without being issued a card that is specific for that machine.

4.4 **Equipment**

4.4.1 Crane selection is accomplished through the lift planning process. This process involves not only the physical capability of the crane to lift and set the load, but also the constraints that may restrict crane location relative to the final vessel location. Every crane shall be fitted with a load-radius table available in the cab, a load indicator, a safe load indicator and alarm, (all in English plus a language understood by the operator) and crane hooks with safety catches.

- 4.4.2 Many times it is not possible to place the lift crane in the ideal position due to constraints. Consideration must be given to both the possible crane and vessel transport system locations. A crane's lattice boom length can sometimes be a critical factor in tight quarters. Tail swing clearance constraints, if any, must be addressed. Obstructions that the boom must clear, other than the vessel itself, in the process of setting the equipment must be considered.
- 4.4.3 In selecting the crane for a lift, the physical size and weight of the item to be lifted must be known, as well as the height the item must be lifted to reach the setting position. In the preliminary planning phase, the total lifted load can be estimated. In addition to the item weight, the total load must include all rigging gear, slings, shackles, load line and load block weights. From the constraints, a preliminary working radius can be set. With this initial information, the crane selection process can begin.
- 4.4.4 Several interchangeable terms are used for the crane rating charts. Some of these are "crane chart capacity", "rated load", "chart load" and "book capacity". These all refer to the maximum load a given crane configuration is capable of safely lifting at the appropriate working radius and boom length. Note that all crane rating charts are determined based on 75% of tipping of crawler cranes and 85% of tipping for truck cranes (except when in the structural range) in accordance with ASME B30.5, Crawler, Locomotive and Truck Cranes. A LIFT MUST NEVER BE PLANNED THAT EXCEEDS THE PUBLISHED CAPACITY IN THE RATING CHART FOR THAT SPECIFIC CRANE. It is also very important to read the rating chart carefully. It tells which ratings are based on structural strength rather than tipping. The notes state the conditions of use such as a firm and level base for the crane to sit on, the maximum wind speed for a safe lift, the maximum length boom that can self-erect, the capacity reductions when jibs are used, etc
- 4.4.5 The CONTRACTOR is responsible for providing to ENGINEER a certified crane that is in good operation condition. This criterion for all cranes must be met upon arrival at the SITE. Certified crane refers to equipment meeting the requirements of certification inspections found in the OSHA and ASME B30.5 Standards, or such other standards as may be approved by ENGINEER and shall include all items specified by the manufacturer for inspection. Furthermore, ENGINEER will accept crane certification performed only by inspection companies accredited by OSHA or such other recognised standards as may be approved by ENGINEER. The purpose of these requirements is to have assurance that the cranes in use function as the manufacturer intended. ASME B3.5 also indicates that regular crane inspections are required and specifies the minimum requirements for these inspections. ENGINEER may require CONTRACTOR to conduct further inspections at more regular intervals and in greater detail to establish confidence in the integrity of the crane. The purpose of these inspections is to assure that the crane continues to function properly while being used on the SITE. It is the CONTRACTORS responsibility to fix or replace any items that are found to be deficient during certification inspections or frequent ENGINEER instructed inspections. Anytime a crane is damaged, the crane must be re-certified after the damage is repaired. Records of all inspections shall be kept on file by piece of equipment.
- 4.4.6 CONTRACTOR is responsible for the day-to day maintenance of any owned or third-party rental equipment. It is essential that preventative maintenance be performed in accordance with the manufacturer's specifications and records maintained at the site. The CONTRACTOR shall set up a programme of regular testing, inspection, and maintenance of cranes, and shall appoint a specialist rigging engineer to manage the program and monitor the cranes on the SITE. This programme shall require all cranes to be inspected on arrival at SITE and periodically afterwards. For each crane the following records shall be maintained:
- Annual test certificate and thorough inspection
 - Inspection certificate for hoisting wire and all lifting equipment associated with the crane.
 - Test records for load radius indicator and automatic safe load indicator.
 - Examination results after substantial alterations or repair.
 - Records of daily/weekly inspection of safety devices, electrical wiring, battery terminals, lights, tyre pressure, excessive wear, exhausts, brakes, boom, cables, sheaves, hooks and the like.

- 4.4.7 CONTRACTOR shall ensure that all electronic safety and warning devices fitted by the manufacturer are in proper working order at all time and that CONTRACTOR's operators are familiar with all electronic devices which are installed on the crane. During lifting operations, all warnings and alarms given by electronic devices shall be strictly adhered to. It shall be prohibited for CONTRACTOR or any of its personnel to deactivate, disable, remove or otherwise tamper with any electronic device fitted by the manufacturer

4.5 Procedures and Practices

- 4.5.1 The Rigging Procedures to be established by CONTRACTOR set out the basis for accomplishing each successful lift. Experience has shown that safe rigging work requires knowledge and understanding of the rigging process. Rigging work is serious business and should never be approached casually. Items such as lifted weight, stable rigging, sling strength, accessory capacity, crane size, and ground bearing pressure, power line proximity, weather conditions and hand signals must be integrated into the planning to have a safe and successful lift.
- 4.5.2 The CONTRACTOR shall submit for approval their rigging procedures to the ENGINEER's Construction Manager and the ENGINEER Rigging management Team within 45 (forty five) days prior to lift.
- 4.5.3 The CONTRACTOR shall determine the heavy lifts early in the planning of construction activities, to decide whether lifting plans and rigging studies or third-party experts are required.
- 4.5.4 The CONTRACTOR shall implement operating procedures for cranes which include
- Overload Protection – calculation of load weight, safety margins, safe load alarms and use of safe load charts.
 - Outrigger loading and use of pads for different ground stability.
 - Mandatory use of tag lines
 - Distances from excavations and from overhead electrical lines.
 - Restricted access areas around cranes to avoid people under loads and injury from crane movements and counterweights
 - Control of cranes with overlapping areas, so as to avoid collisions.
- 4.5.5 ENGINEER has established four lift categories: Basic, Intermediate, Major and Critical. These lift classifications shall be determined based on lifted load as a percent of crane chart capacity rather than size of crane or magnitude of load
- 4.5.6 Lift Definitions
- (a) Single Crane Lifts - A single crane lift is defined as a lift using only one crane to lift a load, not counting the tail crane. In other words, if the total lifted load is supported by only one crane when the load is free hanging, the lift is classified as a single crane lift.
- (b) Multiple crane Lift - A multiple crane lift is defined as a lift using two or more cranes to lift a load, excluding the tail crane. All guidelines and lift requirements described herein for single crane lift apply to each lift crane, but since multiple crane lifts are generally more complex than single crane lifts; the CONTRACTOR Rigging Team shall review all multiple crane lifts. Multiple cranes used solely for loading or unloading equipment and material are by definition considered multiple crane lifts, however, multiple crane lifts used solely for loading or unloading of equipment may not be subject to ENGINEER review when all cranes undertaking the multiple crane lift are at less than 85% chart capacity, the swing radius for all cranes is minimal and the load is only being minimally lifted to clear the transport. ENGINEER shall determine on a case-by-case basis whether it requires to review multiple crane lifts for the loading or unloading of equipment. CONTRACTOR shall provide ENGINEER with enough information, in advance of the lift occurring, to enable ENGINEER to determine with it requires to review the lift or not.
- (c) Tail Crane – Although the tail crane is not considered when classifying a lift as a single crane or multiple crane lift, all guidelines and lift requirements described herein for a single crane lift apply to the tail crane and must be considered as an integral part of the rigging study.

4.6 Rigging Accessories

- 4.6.1 The standard sling is constructed of Extra Improved Plow Steel (EIPS) and has an Independent Wire Rope Core (IWRC). The eyes of the sling are formed using a Flemish Eye splice (sometimes called a "Molly Hogan") with swaged steel fittings. The use of swaged aluminium fitting with a Flemish Eye is discouraged because this type of material requires additional proof testing. Fold back eyes with swaged ferrules (sometimes referred to as turn back or double back eyes) are not acceptable on.

In any case, all wire rope slings shall have a safety factor of 5 against the breaking strength of the wire rope. The appropriate reduction of efficiency for the end connections shall be considered when determining the allowable sling capacity. For example, sometimes it is necessary to make a special length sling using wire rope clips. Considering this type end connection, the sling capacity is only 50% of the allowable working strength of the wire rope.

All wire rope slings shall be labelled with the sling capacity, length and manufacturer in accordance with ASME B30.9 and shall be tagged with an identifying number. All wire rope slings of 1" diameter or greater shall have mill certifications showing the minimum breaking strength of wire rope from which the sling is actually made. Prior to a lift, all slings shall be visually examined to determine sling condition. If visual inspection indicates excessive damage, the sling shall be removed from service and destroyed. All wire rope slings shall be inspected per OSHA requirements.

If it is necessary to double a sling, either a wide body shackle or a sling saver sheave (SSS) must be used to keep from kinking the sling.

All new wire rope slings will be provided with a Certificate of Compliance issued by the sling manufacturer. This certificate specifies the material that was used in the fabrication of the sling, the type of end connection and the rated capacity for each type of hitch, straight pull, choker and basket hitch. This certificate is not a load test certificate.

- 4.6.2 Synthetic webbing (including round slings) slings shall have a safety factor of 5 against the minimum breaking strength of the sling and shall be marked with identification in accordance with ASME B30.9

The use of synthetic webbing slings shall be limited to materials that will not cut or damage the slings. All slings must be purchased new for the WORKS and visually inspected prior to each use to determine sling condition. If visual inspection indicates excessive damage, the sling shall be removed from service and destroyed.

- 4.6.3 Chain slings shall have a safety factor of four against the minimum ultimate strength of the chain. All alloy chain that is recommended for overhead lifting applications shall be marked with identification in accordance with ASME B30.9

All sling accessories such as hooks, rings or links shall have a rated load not less than the alloy chain with which they used.

- 4.6.4 All shackles up to and including 150-ton capacity shall have a minimum safety factor of 5. Those shackles above 150-ton capacity shall have minimum safety factor of 4. In all cases, the shackles shall be used in accordance with manufacturer's guidelines.

- 4.6.5 All new or modified spreader beams shall be designed, fabricated, tested and inspected in accordance with ASME B30.20. Test certificates shall be supplied by the test lab or fabricator. All spreader beams shall be marked with an identifying number and shall be provided with load test certification and design calculation.

- 4.6.6 Whenever feasible, the CONTRACTOR is encouraged to utilize the appropriate pin extractors as a means to reduce exposure to potential safety hazards.

- 4.6.7 Manufactured rigging accessories may be used up to the manufacturer's rated capacity provided they meet the requirements specified herein. Any specially fabricated items will be designed and tested within the guidelines for spreader beams.
- 4.6.8 The hooks or shackles (bails) on any crane load blocks (100 tons or larger) shall have a yearly magnetic particle examination. In severely cold weather, special examination and NDT consideration shall apply. All hooks shall be used and inspected in accordance with ASME B30.10.
- 4.6.9 No rigging equipment or accessories shall be modified. The only exception to this would be modifications to spreader beams and special lifting attachments, which may be modified only when engineered by a Professional Engineer. Repairs to any rigging equipment or accessories are to be made only by the manufacturer, or by a qualified person utilizing the repair guidelines provided by the manufacturer. Modifications or repairs to rigging equipment and accessories shall require load testing. Welding is not permitted on forged accessories.
- 4.6.10 It is ENGINEER's policy to be in conformance with all governing regulations. Crane use and rigging gear designs shall comply with OSHA and ASME B30 series requirements. In addition, all rigging attachments are designed in accordance with the AISC Allowable Stresses Design manual using a 50% impact factor. The more restrictive requirements govern.
- 4.6.11 The CONTRACTOR shall set up a procedure for inspecting all lifting gear as it is brought onto SITE and periodically afterwards. It shall include the identification of each item with its safe working load, colour coding and maintaining records of inspections. Slings shall be inspected on a monthly basis with a colour coding system applied to indicate month of inspection. All items such as spreader beams and pad-eyes shall have the available calculations/drawings.
- 4.6.12 At ENGINEER's sole option, ENGINEER may elect to provide the rigging equipment which is to be used between the crane hook and the lifting lug on the equipment. In such case, ENGINEER will arrange, and otherwise provide, the rigging equipment itself, all inspections, certificates and the like. CONTRACTOR shall take due care of ENGINEER's rigging equipment and shall ensure that all equipment is properly stored, used and subsequently returned to COMPANY. CONTRACTOR shall be responsible for notifying ENGINEER of any damage to rigging equipment.

4.7 Transportation

- 4.7.1 ENGINEER shall prepare all necessary haul roads to enable CONTRACTOR to transport equipment to its final erection location. CONTRACTOR shall however ensure that it surveys the haul route in sufficient time to enable ENGINEER to undertake any additional work that ENGINEER agrees with CONTRACTOR is required to permit the safe movement of equipment and / or to effect any necessary repairs to the haul routes.

CONTRACTOR shall take all due care when moving equipment along haul routes not to cause unnecessary damage either to road, road edge underground services, ditches, drains, trenches and such like and shall make good any damages resulting from CONTRACTOR's lack of attention or care.

CONTRACTOR shall ensure that during transport movement, dust and debris resulting from transport operations is minimised. CONTRACTOR shall arrange for mud, muck and debris caused during its operations to be cleaned up and removed from ENGINEER's roads and haul routes.

- 4.7.2 The CONTRACTOR is responsible for developing a transportation plan. The Plan must consider all relevant issues relating to the transport of the equipment and must be submitted to the ENGINEER Construction Manager and Rigging Superintendent for review and approval at least 30 (thirty) days prior to the date the movement is scheduled to begin.
- 4.7.3 Equipment and tools for transport, lifting, and the assembly of equipment shall be of adequate design, the correct type, and of suitable size/capacity to perform the work professionally and safely. For transportation of equipment or critical lifts the CONTRACTOR shall provide, as a minimum, the following transportation information.
- Trailer configuration, number of rows and lines and dimensions of the systems.
 - Position of load on trailer by dimension including centre of gravity location and as loaded height.

- Details of turntables if applicable.
- Drawbar lengths and ties between trailers where applicable.
- Prime mover – type and capacity.
- Axle loadings and imposed ground bearing pressures.
- Total capacity and payload build up.
- Lashing Points.
- Detailed Route surveys.

4.7.4 The CONTRACTOR shall be responsible for:

- Obtaining all permits associated with the lifting and transportation of materials using public facilities.
- Offloading materials at the work area, transport to the installation area and install in respective location.
- Providing all temporary facilities for transport, intermediate storage and erection of materials.
- Removing and restoring all obstructions removed to facilitate the transportation and erection of materials.

4.7.5 All items of equipment shall be loaded, off-loaded, and transported in accordance with the equipment vendor and/ or ENGINEER direction and safe working practices.

4.8 Rigging Studies

4.8.1 The CONTRACTOR is responsible to provide lifting and rigging studies for all lifts over ten (10) metric tonnes.

4.8.2 The CONTRACTOR shall be responsible for preparing and submitting lifting plans and rigging studies to the ENGINEER if one or more of the following criteria is met;

- Load greater than 20 tonnes (rigging equipment is not included in weight calculation)
- Crane capacity greater than 150 tonnes
- Use of more than 80% of the crane capacity
- Tandem lift by two cranes
- Lifting over live process equipment or pipes
- Erecting or dismantling a heavy crane

4.8.3 The CONTRACTOR shall be responsible for preparing and submitting lifting plans and rigging studies to the ENGINEER if the following criteria are met;

- Load is equal to or greater than 40 tonnes (rigging equipment is not included in weight calculation)
- Use of more than 80% of the crane capacity
- Tandem lifts by two cranes
- Lifting over live process equipment or pipes

4.8.4 The rigging study for equipment items from 10 to 20 tonnes shall include the following information, as a minimum:

- Check weight and dimensions of the load to be lifted.
- Angles of chain blocks or wire rope slings during operation and method of attachment to the load and supporting steelwork or structure.
- Crane configuration.
- Crane capacity at working radius and required boom length including copy of crane chart for which information was taken.
- Required sizes and capacities of slings, shackles and lifting beams
- Verification of lifting points on the load to be lifted.
- Crane accessibility and placement for the lift.
- Possible interference from erected items and structures.

4.8.5 The rigging studies for submittal to ENGINEER for equipment items over 20 and up to 40 tonnes shall include the following information, as a minimum:

- Check weight and dimensions of the load to be lifted.
- Dimensional Plan and elevation drawing, showing all stages of movement of the load from initial to final installed position.
- Angles of chain blocks or wire rope slings during operation and method of attachment to the load and supporting steelwork or structure.
- Details of skid beams, channels and packing arrangements under beams or channels.
- Itemized checklist for the entire lifting operation.
- Centre of gravity calculations for equipment lifted.
- Crane model.
- Crane configuration.
- Crane capacity at working radius and required boom length including copy of crane chart for which information was taken.
- Required sizes and capacities of slings, shackles and lifting beams including all certifications for these items.
- Verification of lifting points on the load to be lifted.
- Crane accessibility and placement for the lift.
- Possible interference from erected items and structures.

4.8.6 The rigging studies for submittal to ENGINEER for equipment items over 40 tonnes shall include the following information, as a minimum:

- Check weight and dimensions of the load to be lifted.
- Summary Sheet with submittal dates and revision history.
- Table of contents included a summary of the vendor drawings used and their latest revision.
- Dimensional Plan and elevation drawing, showing all stages of movement of the load from initial to final installed position.
- Angles of chain blocks or wire rope slings during operation and method of attachment to the load and supporting steelwork or structure.
- Details of skid beams, channels and packing arrangements under beams or channels.
- Description for entire lifting operation, indicating how construction equipment will be installed, load erected and construction equipment removed. Specifically indicate information that is not made obvious by the elevation or plan views.
- Itemized checklist for the entire lifting operation.
- Centre of gravity calculations for equipment lifted.
- Crane model.
- Crane configuration.
- Crane capacity at working radius and required boom length including copy of crane chart for which information was taken.
- Required sizes and capacities of slings, shackles and lifting beams including all certifications for these items.
- Include the identification number of all slings and shackles on the rigging study drawings.
- Verification of lifting points on the load to be lifted.
- Structural calculations if lifting frames / beams are to be used.
- Crane accessibility and placement for the lift.
- Possible interference from erected items and structures.
- Load bearing of the crane under the matting and bearing capacity of the ground required.
- Underground installations that may affect lift and protective measures as required.

4.8.7 If a lift involves a load of greater than 100 tonnes, or a load with wind area of greater than 100 sq meter or a crane with a capacity greater than 150 tonnes or a crane with a boom or a jib greater than 100m, an independent SUBCONTRACTOR with specialist lifting experience and knowledge shall be employed by CONTRACTOR, the selection of which is subject to approval by COMPANY. They shall

- Advise on all operations related to the transportation and lifting at the site.
- Review of lifting plans, rigging studies and design of lifting aids.
- Monitor the heavy lifts on site.

4.8.8 The SUBCONTRACTOR shall utilise the forms R-2, R-3 and R-4 appended hereto as Attachment

4 as appropriate for the lift.

- 4.8.9 Equipment weight shall be taken from latest revised vendor drawing. CONTRACTOR to verify they are utilising the latest drawing revision. The rigging study may not be changed without approval of ENGINEER and CONTRACTOR shall not deviate from the approved study.
- 4.8.10 CONTRACTOR is made aware that all rigging studies shall be submitted by the ENGINEER to its Home Office Rigging Engineer for their approval prior to any lift proceeding. The CONTRACTOR shall, in written format, promptly respond to any additional information that is required or clarifications needed from ENGINEER's Home Office Rigging Engineer.
- 4.8.11 As the CONTRACTOR resubmits rigging studies based on ENGINEER comments or revised information; they shall maintain a formal revision summary on the front sheet. The COMPANY, prior to CONTRACTOR performing any lifts, shall approve the rigging study in writing. The CONTRACTOR, as a revision is submitted, shall note the revision number on the front page along with a brief description of the revision. The CONTRACTOR shall always submit a complete rigging package with each submittal or revision and parts of the package are not acceptable.

4.9 Rigging Study Log

The CONTRACTOR shall maintain a rigging study log, which contains, as a minimum, the following information:

- Equipment Number
- Equipment weight from vendor drawing.
- Rigging weight
- Latest forecast delivery date
- Actual delivery date
- Forecast date to set in place
- Actual set date.
- Date Rigging Study submitted
- Latest Revision of Rigging Study.
- Date Rigging study approved by MAIN CONTRACTOR
- % of chart for main lift crane and tailing crane
- Ground bearing pressure for both main lift crane and tailing crane.

4.10 Spreader Bar Lifting Beams

- 4.10.1 Beams shall be used for lifting in accordance with the manufacturer's instructions. All spreader beams, lifting beams and links are to be proof loaded and provided with load test certification along with design calculations. The below the hook lifting devices shall be designed and fabricated in accordance with ASME B30.20. The lifting devices shall be marked with an identifying number and the rated load.
- 4.10.2 The CONTRACTOR shall supply all required lifting beams.

4.11 Matting for Cranes

The CONTRACTOR shall supply all necessary matting for use in the performance of their work. All lifts over 50 tonnes shall be performed on matting. For lifts under 50 tonnes, CONTRACTOR shall determine the requirement based on existing ground conditions.

4.12 Lifting and Tailing Lugs

Equipment shall only be lifted at lifting lugs and lifting trunnions provided for this purpose. These are shown on the equipment drawings. Note that none of the horizontal equipment items have been provided with lift attachments. The lugs are designed for straight pull unless noted otherwise.

4.13 **Vessel / Equipment Plumbing**

The CONTRACTOR will be required to remain connected to the vessel/ equipment to assist in the plumbing activities to be done by the mechanical contractor.

4.14 **Removal of Transportation Rigging**

The CONTRACTOR is responsible for removing transportation rigging from equipment prior to lifting. CONTRACTOR shall transport this to a location on SITE designated by ENGINEER and offloaded in a neat and organized manner.

4.15 **Removal of Erection Rigging**

CONTRACTOR is responsible, following satisfactory plumbing of the vessel/equipment by the mechanical contractor, for removing all rigging equipment used during the course of the lift. CONTRACTOR shall provide details within the rigging plan of how it proposes to de-rig the lifting equipment. For vessels/equipment that are of significant height, CONTRACTOR is to consider utilise self-releasing rigging equipment to avoid having to install scaffold or employing other means of access to manually de-rig the lifting equipment.

4.16 **Plastic Sheaves**

Plastic Sheaves are not allowed, in dynamic load positions, on lattice boom cranes rated at 150 ton and over. Metal sheaves must be utilised on 150T and overrated lattice boom cranes.

4.17 **Pre-Lift Meeting**

4.17.1 The CONTRACTOR shall conduct a pre-lift meeting to brief all personnel involved in the lift of their duties and responsibilities.

4.17.2 For lifts over 40 tonne a formal pre-lift meeting shall be held with ENGINEER a minimum of one (01) day prior to the lift.

4.18 **Crane Sizing**

The CONTRACTOR shall provide all cranes of sufficient duty such that all lifts shall be undertaken with the chart capacity at 85% or less. Any cranes to be used that are outside of this rating shall require approval of the COMPANY.

4.19 **Constructability**

The CONTRACTOR shall refer to DRAWINGS section for information that has been previously planned. The CONTRACTOR can review this information; however, they are still responsible for the planning and positioning of their lifts. CONTRACTOR shall co-ordinate the siting of all cranes with COMPANY.

4.20 **Reactor Erection Sequence**

ENGINEER has determined the most likely erection sequence for the [...] reactors using the most economical use of the erection sequence. This sequence is demonstrated in Attachment 4 hereto. Attachment 4 contains two separate erection sequence marked up drawings, the first being the erection sequence when a crane are used to install the reactors and the second being the sequence when a mast system is used.

This information is provided solely for information purposes to assist CONTRACTOR in planning the erection works for the [...] Reactors. In the event that CONTRACTOR considers there is a more economical or beneficial sequence from that shown in Attachment 4, then CONTRACTOR shall bring to ENGINEER's attention for review and consideration.

4.21 Detailed Description of Work

The detailed construction work activities comprising the WORKS are given in Attachment 1 hereto. These descriptions shall be read and construed in accordance with the following summation:

CONTRACTOR is deemed to understand that the work activities given in pursuant to this Article 4.21 are major and representative of the work items included in the WORKS. CONTRACTOR shall read these descriptions in conjunction with all other parts of the CONTRACT.

Accordingly, any work items or materials and equipment which are not expressly described hereunder, but which are inferred as part of the WORKS from drawings, specification or other provisions of the CONTRACT shall be deemed to be included in the WORKS.

4.21.1 Introduction of Functional Work Breakdown Structure (FWBS)

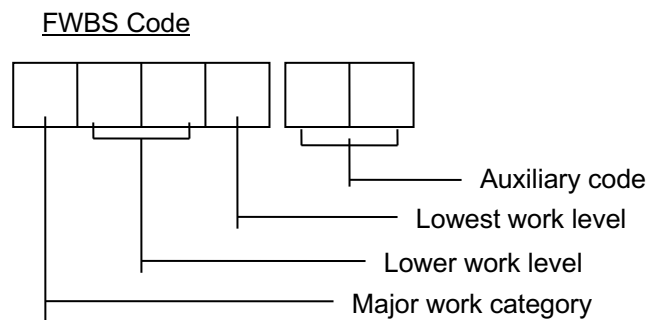
Detailed construction work activities comprising the WORKS are sub-divided into components in order to provide clear cut scopes of work to be performed by the CONTRACTOR.

ENGINEER employs code numbers for this work breakdown structure (Functional Work Breakdown Structure). Such code numbers (hereinafter called "FWBS Code") represent the components defined or specified in the respective job descriptions and work sequences given in the Exhibit-A attached hereto.

The CONTRACTOR shall note that the work and services to be performed by the CONTRACTOR have close reference to the method of measurement included in Section III – Schedule of Prices. The definitions and measurement methods of work items can be correctly interpreted in this manner.

(a) Structure of Work Breakdown

Functional work breakdown structure has been prepared such that complex activities in connection with construction work are segregated into major categories, depending on the nature of the work. The major categories of the work are further sub-divided into components in consideration of types, locations, materials, etc., until the lowest work level on which the respective works are controllable is reached. The fundamental structure is as shown hereunder.



2000	Concrete Structure
2100	Elevated Structure incl. Foundation
2110	Table Top for Equipment
2111	Foundation

ARTICLE 5 – AS-BUILT DRAWINGS

The As-Built drawing and document requirements are to be in accordance with the requirements of the CONTRACT.

ARTICLE 6 – HSE & SECURITY

- 6.1 CONTRACTOR shall have a project safety program, approved by COMPANY, which will be implemented by CONTRACTOR to ensure the safety of all personnel and property on site. Refer to SPECIFICATION about Health, Safety, Environment and Security herein and forming part of this Contract.
- 6.2 CONTRACTOR shall include a briefing for all workers during the SITE induction programme that provides guidelines on what to do in the event of a 'chance find' of archaeological artefacts or graveyards overlooked during the SITE clearance work conducted "by others". This shall include a simple discovery action card to be given to workers during the induction which shall be retained by them.

ARTICLE 7 – CONTRACTOR SERVICES

7.1 Project Management Organisation

- 7.1.1 CONTRACTOR shall provide the project management organisation, home office services, labour, specialists and vendor assistance services as necessary to execute the work in a safe and expeditious manner and to satisfy the CONTRACT requirements for quality and schedule completion.

As a minimum requirement, CONTRACTOR's project management organisation shall consist of :

- (1) Project Manager with B.Sc. (B.Eng.) and minimum 15 years experience in heavy lifting operations
- (2) Engineering Manager with B.Sc. (B.Eng.) and minimum 10 years experience in engineering heavy lifting operations
- (3) Construction Manager with B.Sc. (B.Eng.) and minimum 15 years experience in heavy lifting operations
- (4) Other staff with reasonable qualifications and experience

- 7.1.2 CONTRACTOR shall submit an organisation chart and resumes of its key personnel to ENGINEER for approval within fifteen (15) days of the EFFECTIVE DATE. Revisions to the organisation chart shall be submitted to ENGINEER for approval.

The organisation chart shall include, as a minimum, the following criteria and details:

- (1) Name of each department or group with a brief description of its responsibility.
- (2) Relationship among departments.
- (3) Project Manager who is responsible for the whole Project.
- (4) Construction Manager at the SITE in overall charge of all construction activities.
- (5) Field engineers and supervisors at the site.
- (6) Safety officer at the site.
- (7) Rigging Supervisor at the site
- (8) Rigging General Foreman at the site
- (9) Safety officer at the SITE.

- 7.1.3 The appointment of CONTRACTOR's key personnel shall be agreed with ENGINEER prior to appointment. These key personnel shall not be removed without prior written approval from COMPANY.
- 7.1.4 CONTRACTOR shall issue an overall manpower histogram showing splits between project management, engineering, procurement, construction and commissioning, each of which shall be further split between management and engineers for the design phase, buyers, expeditors and inspectors for the procurement phase, and first level supervision including foremen, direct and indirect labour for the construction and commissioning phases.
- 7.1.5 COMPANY'S approval of CONTRACTOR's organisational structure, key personnel, and numbers of personnel assigned to the job will in no way relieve CONTRACTOR of his responsibility to provide all staff required for completion of the WORKS in accordance with the CONTRACT.
- 7.1.6 ENGINEER shall have the right to screen all CONTRACTOR's employees before engagement for work and to refuse to allow a particular person, for good reason, to enter or to perform work on the WORKS. Furthermore, ENGINEER shall have the right to exclude from the SITE those persons who, for instance, infringe existing laws or regulations in force within ENGINEER premises.
- 7.1.7 CONTRACTOR's personnel failing qualifications of conduct and ability, in the opinion of COMPANY, shall on request by ENGINEER be removed from the WORKS, no reimbursement will be granted by ENGINEER in these cases.
- 7.1.8 For both ethical and legal reasons, CONTRACTOR shall adhere to strict principles relating to legality of payments made by them and to the integrity of all accounting records.

7.2 Engineering

- 7.2.1 ENGINEER will furnish CONTRACTOR with the specifications, standards, conceptual layouts and similar as listed in Section VIII – Technical Specification and Section IX – Drawings.

From time to time, ENGINEER may provide other documents to CONTRACTOR, such as, but not necessarily limited to, vendor drawings and equipment data sheet which CONTRACTOR is to consider as part of its overall design engineering works.

- 7.2.2 CONTRACTOR shall provide engineering services as described herein and elsewhere within the CONTRACT.
- 7.2.3 In performing his engineering, CONTRACTOR shall review, check and update all engineering and design documents provided by ENGINEER which shall be approved by COMPANY.
- 7.2.4 CONTRACTOR documentation including reports, calculations and studies shall be agreed and submitted to ENGINEER for review and comment.
- 7.2.5 CONTRACTOR drawings and specifications shall be submitted to ENGINEER for review and comment.
- 7.2.6 Document numbering shall be agreed between ENGINEER and CONTRACTOR.
- 7.2.7 Not used.
- 7.2.8 Not used.

7.2.9 Review of TECHNICAL INFORMATION

CONTRACTOR shall review and acquaint itself with all engineering documentation produced and/or provided by COMPANY. The CONTRACTOR shall review all such documentation for any discrepancies and ambiguities. Should any discrepancies or ambiguities be found, CONTRACTOR shall promptly inform ENGINEER in writing and shall follow COMPANY's instructions thereon. If the CONTRACTOR fails to take the above actions and executes or proceeds with the WORKS, ENGINEER shall reserve the right at any time to correct such discrepancies and ambiguities and require that CONTRACTOR complies with any such corrections.

In such a case, the CONTRACTOR shall immediately comply with such corrected or clarified

documentation and rework or re-supply any defective part of the WORKS without any claims against the ENGINEER.

Where there are any pending items in the engineering documentation provided by the ENGINEER, the CONTRACTOR shall promptly contact ENGINEER for instructions as to what should be done with such pending items with relation to subsequent work.

7.2.10 Vendors' documents to be issued by COMPANY

ENGINEER shall supply the CONTRACTOR from time to time with vendors' information and documents of the equipment to be installed by CONTRACTOR. The CONTRACTOR, in turn, shall check the vendors' information and documents concerning any discrepancies or problems may develop from the vendors' information and documents, or not.

If any of the information in the vendors' documents is inadequate or if there are any discrepancies in them, the CONTRACTOR shall promptly inform ENGINEER of the above problems or discrepancies within seven (07) working days from the receipt of the vendors' information and documents.

Should the CONTRACTOR fail to take such actions as mentioned in the paragraphs above, any resultant adverse effects on the CONTRACTOR shall be borne by the CONTRACTOR at his own responsibility and expense.

7.2.11 Correction, Modification and Revision

Should ENGINEER require the engineering documents to be corrected, modified or revised because of any of the following reasons, the CONTRACTOR shall conduct such rework at his own cost promptly:

- (1) Engineering documents do not meet nor satisfy the requirements of the CONTRACT.
- (2) Engineering documents do not meet nor satisfy the mandatory requirements of local codes and regulations
- (3) Engineering documents do not meet the requirements of internationally recognized and sound engineering practices.
- (4) The CONTRACTOR's faulty design or a discrepancy in his engineering products.
- (5) Failure to use the latest issue of the documents and drawings provided pursuant to the CONTRACT.

Should the CONTRACTOR fail to perform such rework, as requested by COMPANY, ENGINEER may either do so itself, or have another contractor do so, on behalf of the CONTRACTOR at the CONTRACTOR's cost.

7.2.12 Not used.

7.3 Not used

7.4 Construction

7.4.1 Construction Management

7.4.1.1 CONTRACTOR shall provide construction services as described below in this section.

7.4.1.2 The CONTRACTOR shall provide a SITEbased Construction Management organisation, headed by a Project SITEManager who will report to COMPANY'S Construction Manager, with suitably qualified and experienced personnel and SITEservices in order to assure the following functions are safely and expeditiously achieved:-

Management
Health, Safety, Environmental and Security (HSES)
Supervision
Information Management
Engineering
Quality Assurance/Control
Scheduling
Progress Measurement
Contract Administration
Cost Control
Administration
Personnel Relations
Camp Management
Fire Fighting
Medical

In addition to the above the following functions shall be assured:

- a) Material: to cover all aspects related to material receiving, storage, and issuing, SITEpurchasing, material tracking and maintenance of tools and plant equipment.
- b) Project control covering cost and scheduling, progress control and quantity surveying.
- c) Project control covering labour relations, camp administration, and liaison with RLC and Qatari governmental agencies, invoicing and accounting, safety and security.
- d) Obtain all required permits from appropriate authorities, including permit to work before commencing work on site, and building occupancy permits.
- e) Technical supervision assured by qualified and experienced superintendents and supervisors.
- f) Provision of resources (equipment and expertise) to support electronic management of information, including document management, CONTRACT administration, progress reporting cost control. Etc.
- g) Transportation of CONTRACTOR's personnel and material.
- h) Taking all reasonable precautions to protect all work completed or partially completed and furnished materials and equipment from damage by fire, theft, meteorological conditions or by construction or erection actions.
- i) Taking measures to protect all adjacent or adjoining property against damage by construction activities.
- j) Prompt reporting to COMPANY, in accordance with agreed procedures, of any accident, fire, flood, or any other event which damages or threatens to damage any part of the facilities or materials, and of strikes, labour disputes or disturbances which may lead to a work stoppage.
- k) CONTRACTOR shall ensure that his personnel for all categories of activities are qualified for the job in question and have suitable experience.
- l) CONTRACTOR shall endeavour to assign its own personnel and not recruit from third parties for management and supervisory positions.

- m) CONTRACTOR shall ensure that the key personnel in its field organisation are fluent in speaking and writing the English language. All other personnel under the control of CONTRACTOR, who are required to read technical documents or drawings, shall be conversant with the English language to the extent that it is necessary for their job.

Note 1 Should it prove necessary for CONTRACTOR to employ a translator this shall be included within his scope of work.

Note 2 Communication on all HSES issues shall be in English, Arabic and native language of all workers.

7.4.2 Management, Staff, Supervisory Personnel and Labour

CONTRACTOR shall supply and assign to the home office, engineering office(s), the SITE and all other places where any part of parts of the WORKS are to be executed, all management, and administrative staff, supervisory personnel and all necessary or required direct and indirect labour. In so far as direct labour is concerned, this shall include foremen, highly skilled, semi-skilled and skilled workers. CONTRACTOR shall also provide all other labour as required to ensure the proper support during performance of the WORK.

7.4.3 Temporary SITE Facilities and Services

7.4.3.1 ENGINEER provided facilities

ENGINEER shall provide the temporary SITE facilities and services as detailed in the SPECIFICATION – Materials and Services by Company.

7.4.3.2 CONTRACTOR provided facilities

CONTRACTOR shall provide all other temporary SITE facilities and services that are not expressly identified as being provided by COMPANY. Such facilities and services shall include, but not be limited to:

- SITE office with furniture
- Material storage facilities for CONTRACTOR's own materials
- Construction Equipment yard and maintenance shops
- Toilets and sanitary facilities
- Temporary buildings for changing clothes and resting
- Temporary fire protection measures
- First aid and medical facilities
- Security lighting
- Guard houses
- Fuelling station
- Parking lots
- Camp buildings and associated facilities for the CONTRACTOR's personnel
- Supply, installation and operation of all required or necessary communication facilities such as, but not limited to, telephone, telex, facsimile and radio facilities, including any required licences.
- All other necessary temporary facilities

The CONTRACTOR shall also provide as necessary or required, temporary roads, access ways, crossings, fences and gates for the above temporary facilities, and which shall include repair and maintenance as necessary to maintain in good order.

This provision of the temporary facilities shall include, but not be limited to, mobilisation, maintenance and demobilisation, including dismantling and cleaning.

Before starting to construct the above temporary facilities, the CONTRACTOR must obtain ENGINEER's prior approval of the temporary facilities plan including area requirements and locations of those temporary facilities.

It is also a mandatory requirement that CONTRACTOR provides all temporary facilities required by law or regulation.

7.4.4 Construction and Testing Equipment

CONTRACTOR shall provide all construction equipment, test equipment and transportation equipment both for materials and personnel as required by the CONTRACT.

Before use on site, all construction equipment shall be subject to inspection and testing, including noise.

CONTRACTOR shall employ an independent testing agency to carry out all testing of construction tools and equipment.

CONTRACTOR shall provide adequate servicing facilities and a stock of spare parts and consumables at SITE or in the area to minimise delay in case of equipment breakdown. CONTRACTOR shall continue to review requirements and shall increase capacity if required and ensure the schedule of work is fully maintained in the event of breakdown of equipment.

7.4.5 Tools and Consumables

CONTRACTOR shall provide all air, battery and electrically powered and/or hand tools and all consumables including lubricants, gases, welding rods, miscellaneous hardware, test material, etc.

Before use on site, all tools shall be subject to inspection and testing where appropriate.

7.4.6 Not Used

7.4.7 Quality Control

The CONTRACTOR shall conduct quality control in each phase of the WORKS in accordance with the requirements of the SPECIFICATION - Quality Management

CONTRACTOR shall prepare the required and necessary Quality Control reports using a format to be provided by COMPANY, or if not provided then a format to be agreed with COMPANY. Typical examples of ENGINEER's Quality Control forms are provided in Attachment 4 hereto for CONTRACTOR's information purposes.

7.4.8 Construction Documents and Reports

7.4.8.1 The CONTRACTOR shall prepare and submit to ENGINEER for approval necessary fabrication and construction procedures in three (3) copies at least two (2) months prior to commencement of the actual fabrication or construction. In preparing those procedures the CONTRACTOR must satisfy the contents and requirements to be prescribed by the ENGINEER.

7.4.8.2 The CONTRACTOR shall comply with the relevant procedures and submit to ENGINEER the documents and reports in three (3) copies as detailed hereunder.

7.4.8.3 ENGINEER reserves the right to add or delete at ENGINEER's sole discretion any reports and documents required and change the degree of detail and/or the number of copies at no additional cost to ENGINEER.

	<u>Daily</u>	<u>Weekly</u>	<u>Monthly</u>	<u>As Required</u>
- Construction schedule and progress report			o	
- Detail construction schedule		o	o	
- Report on equipment installed during the previous month for invoicing purposes			o	
- Overall construction schedule				o
- Detailed program of the field work	o	o	o	
- Field manpower status report	o	o	o	
- Construction equipment status report	o	o	o	
- Loss/damage report				o
- Application of test and inspection				o
- Other plans or reports to be submitted by the CONTRACTOR in accordance with the provisions of the Contract or instructions from time to time given by COMPANY				o

7.4.9 Not used.

7.4.10 Working Time

The normal working time prevailing at the WORKSITE shall be in accordance with all local and national laws and regulation.

In general, overtime work or holiday work is not permitted and therefore the CONTRACTOR shall mobilise an appropriate number of personnel and equipment for carrying out the WORKS so that the WORKS can be completed by working within the normal working hours. Nevertheless, if the CONTRACTOR requires to work overtime or on holidays, the CONTRACTOR shall so request to ENGINEER in writing, for authorisation.

7.4.11 Planning and Control

7.4.11.1 Schedule control

The CONTRACTOR shall prepare and submit the overall schedule for the WORKS and also detailed schedules for each phase of engineering, procurement and construction.

The CONTRACTOR shall prepare and submit the manpower schedule for field staff as well as foreman and labour.

Progress status of each phase of the WORKS shall be monitored and controlled by the CONTRACTOR and the reports thereof shall be submitted to ENGINEER.

7.4.12 Harmony with the entire project

It is expressly understood by the CONTRACTOR that the WORKS to be performed under this CONTRACT may not always be proceeded with in such an economical manner as the CONTRACTOR expects, and may eventually be interrupted for the reasons given below, without limitation thereto:

- (1) ENGINEER's request for a change in the work sequence, which may take place as and when ENGINEER reviews the overall schedule of the entire project.
- (2) Hindrance to the CONTRACTOR's execution of the WORKS due to ENGINEER's other subcontractor(s) working simultaneously at the same work area or at a place adjacent thereto.

In the above cases, the CONTRACTOR shall carry out the WORKS in compliance with the work manner or sequence instructed by ENGINEER, without any claim for loss of labour or other inefficiency.

7.4.13 Reinforcement of Manpower and Construction Equipment

It is expressly understood by the CONTRACTOR that his planned numbers of manpower and construction equipment work CONTRACTOR has deemed appropriate to execute the WORK shall not be deemed limitative in any way. If progress of a critical work item falls behind schedule, or if progress is not being maintained on those items which in ENGINEER's sole opinion will become critical unless preventative action is taken, then and in each case, ENGINEER shall have the right to require the CONTRACTOR, without additional cost to ENGINEER to mobilize additional manpower and construction equipment and/or take other necessary measures as may be required in ENGINEER's sole opinion, to avoid delays in or mitigate the affect of the timely completion of the WORKS or part thereof.

Further, it is also agreed that ENGINEER shall in no way be responsible for any loss or damage due to over commitment incurred by the CONTRACTOR arising out of a decrease in the required amount of labour and/ or construction equipment from that which CONTRACTOR had deemed appropriate to execute the WORKS.

ARTICLE 8 – SURVEY AND SETTING OUT

CONTRACTOR shall carry out all necessary survey and setting out works to carry out the WORK specified in Article 4.

ARTICLE 9 – COMPLETION & TURNOVER COORDINATION

- 9.1 CONTRACTOR shall be responsible for completing the Scope of Work in accordance with the CONTRACT drawings, specifications and procedures including the clearing of punch list items, testing and inspection.
- 9.2 CONTRACTOR shall prepare a Quality Control procedure that provides a framework for handover of quality documents in a structure to be agreed with ENGINEER on completion of the WORKS. The Quality Control procedure shall be in accordance with the SPECIFICATION section about Quality Assurance. The procedure should include, but is not limited to:
- QC documentation (including soil, concrete and other testing) and handover plan that is capable of handover by discrete areas with supporting QC documents.
 - QC documentation and supporting manufacturers certificates for all permanent materials.

ATTACHMENT 1

DETAILED SCOPE OF WORK REQUIREMENTS

HEAVY LIFT WORKS
FWBS CODE : 5000

1. Equipment installation work under FWBS Code 5000 covers transportation, hauling, rigging, and installing equipment.
2. Further details of work categories are broken down with relevant FWBS code.

It shall be noted that work items and work sequence show major items only. All other associated and minor activities until the completion of this work category, including the work stated in the para. 3 below, shall be deemed to be within this scope of work.

3. The following shall be deemed to be within the scope of the installation work under FWBS 5000.
 - 1) Preparation of work plans and procedures prior to starting the work.
 - 2) Transportation of equipment including pre-dressed equipment items from ENGINEER's designated lay down yard to the erection point including loading from temporary concrete blocks and unloading at the erection point, transporters or trailers.
 - 3) Installation and removal of reinforcing, protection or lifting materials used for the transportation or installation of equipment, as necessary.
 - 4) The CONTRACTOR shall hold lifting work for pre-dressed equipment so that other contractors can apply insulation at areas such as those covered by the saddle.
4. The following special conditions shall apply for the equipment erection works, and are in addition to the requirements stated elsewhere in the CONTRACT.

Ground Condition for Lifting

The areas where heavy lifting work is to be carried out will be pre-graded by ENGINEER (degree of grading work and levelling to be determined by ENGINEER The maximum permitted bearing capacity of the soil is to be 21T/M2 which CONTRACTOR shall under no circumstances exceed.

Any further ground preparation which CONTRACTOR deems appropriate shall be to CONTRACTOR's account, as will the maintenance thereof.

ATTACHMENT 2

RESPONSIBILITY MATRIX – MECHANICAL CONTRACTOR AND CONTRACTOR

Item	Description	CONTRACTOR	Mechanical Contractor	Remarks
A	Preparation of Foundation			
1	Taking out of jig plate		X	
2	Checking of foundation (elevation, centre, anchor bolt placement and the like)		X	
3	Surface preparation of foundation		X	
4	Level padding		X	
5	Setting of sliding plate / insulation block (if required)		X	
B	Preparation for ground area in vicinity of erection location	X		If required
C	Transportation of equipment, including pre-dressed equipment, from COMPANY's designated equipment laydown yard or other location to the erection point including loading and unloading of equipment as required.	X		
D	Erection	X		
E	Alignment & Tightening of Anchor / Setting Bolts		X	
F	Inspection for Alignment		X	
G	Welding of Washer & Liner Plate		X	If required
H	Setting of Drain-out Tube		X	
I	Grouting		X	
J	Removing of Protective Articles (if required)		X	
K	Cutting of Lifting Lug (if required)		X	
L	Internal / External Checking, Cleaning, Assembling		X	
1	- Closing of manhole & hand hole		X	

ATTACHMENT 3

LIST OF EQUIPMENT TO BE INSTALLED BY CONTRACTOR

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-AC	1	1C-1201	1200	HCN/NH3 Stripper	Vertical	3550	48300	205	Weight pre dress-up
C6-UD	1	0A-8101	8100	Derrick Structure Of Flare Stack	Derrick STR		150000	870	
C6-CE	1	0V-6201	6200	Deaerator	Horizontal			120	
C6-CE	1	0V-6202	6200	Deaerator	Horizontal			120	
C6-CE	1	0V-6203	6200	Deaerator	Horizontal			120	
C6-CE	1	0V-6204	6200	Deaerator	Horizontal			120	
C6-CE	1	0V-6205	6200	Deaerator	Horizontal			120	
C6-CB	1	0V-7401	7400	Instrument Air Buffer Vessel	Vertical	6300	31400	161	
C6-CB	1	0V-7402	7400	Instrument Air Buffer Vessel	Vertical	6300	31400	161	
C6-CD	1	0V-7701	7700	HP Hog Vessels	Vertical	5500	16850	147	
C6-CD	1	0V-7702	7700	HP Hog Vessels	Vertical	5500	16850	147	
C6-AC	1	1C-1211	1200	Soot Quench Scrubber	Vertical	4250	10740	141	
C6-AC	1	1C-1212	1200	HCN/NH3 Scrubber	Vertical	3600	25690	211	Weight pre dress-up
C6-AC	1	1C-1221	1200	Soot Quench Scrubber	Vertical	4250	10740	141	
C6-AC	1	1C-1222	1200	HCN/NH3 Scrubber	Vertical	3600	25690	211	Weight pre dress-up
C6-AB	1	1C-3401	3400	Water Distiller	Vertical	Top : 4800 - Bottom : 4800	29370	153	Weight pre dress-up
C6-AA	1	1C-3601	3600	Light Ends Stripper	Vertical	1900 / 3000	44660	92	Weight pre dress-up
C6-AC	1	1E-1111A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1111B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1112A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1112B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1113A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1113B	1100	Syngas Effluent Cooler	Vertical			110.3	

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-AC	1	1E-1114A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1114B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1115A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1115B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1116A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1116B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1117A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1117B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1118A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1118B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1119A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1E-1119B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-AC	1	1R-1111	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1112	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1113	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1114	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1115	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1116	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1117	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1118	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1119	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-AC	1	1R-1132A	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-AC	1	1R-1132B	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-AC	1	1R-1142A	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-AB	1	1R-1142B	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-AB	1	1R-3001	3000	Bulk H2S Adsorber	Vertical - Radial Bed	3600 (HOLD)	13080 (HOLD)	143.4	
C6-AB	1	1R-3002	3000	Bulk H2S Adsorber	Vertical - Radial Bed	3600 (HOLD)	13080 (HOLD)	143.4	
C6-AB	1	1R-3003	3000	Bulk H2S Adsorber	Vertical - Radial Bed	3600 (HOLD)	13080 (HOLD)	143.4	
C6-AB	1	1R-3011	3000	COS Hydrolysis / H2S Guard Bed Reactor	Vertical	5250	8500	295.5	
C6-AB	1	1R-3012	3000	COS Hydrolysis / H2S Guard Bed Reactor	Vertical	5250	8500	295.5	
C6-AB	1	1R-3013	3000	COS Hydrolysis / H2S Guard Bed Reactor	Vertical	5250	8500	295.5	
C6-AB	1	1R-3021	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3022	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3023	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3024	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3025	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3026	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3027	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3028	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1R-3029	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AA	1	1R-3121	3100	Second Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AA	1	1R-3122	3100	Second Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AA	1	1R-3123	3100	Second Stage HPS Reactors	Vertical	7032	12950	1205	
C6-AB	1	1V-3021	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3022	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3023	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3024	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3025	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-AB	1	1V-3026	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3027	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3028	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3029	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AB	1	1V-3041	3000	First Stage Intermediate HP Separator	Vertical	5400	6900	176.8	
C6-AB	1	1V-3042	3000	First Stage Cold HP Separator	Vertical	4850	8600	136	
C6-AB	1	1V-3082	3000	Cold LP Separator	Horizontal	4800	12000	138.2	
C6-AA	1	1V-3121	3100	Second Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AA	1	1V-3122	3100	Second Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-AA	1	1V-3123	3100	Second Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-UD	1	1V-8121	8100	Gas Reception Flare KO Drum	Horizontal	6500	32500	132	
C6-CE	2	0V-6206	6200	Deaerator	Horizontal			120	
C6-CE	2	0V-6207	6200	Deaerator	Horizontal			120	
C6-CE	2	0V-6208	6200	Deaerator	Horizontal			120	
C6-CB	2	OV-7403	7400	Instrument Air Buffer Vessel	Vertical	6300	31400	161	
C6-CB	2	OV-7404	7400	Instrument Air Buffer Vessel	Vertical	6300	31400	161	
C6-BC	2	2C-1201	1200	HCN/NH3 Stripper	Vertical	3550	48300	205	Weight pre dress-up
C6-BC	2	2C-1211	1200	Soot Quench Scrubber	Vertical	4250	10740	141	
C6-BC	2	2C-1212	1200	HCN/NH3 Scrubber	Vertical	3600	25690	211	Weight pre dress-up
C6-BC	2	2C-1221	1200	Soot Quench Scrubber	Vertical	4250	10740	141	
C6-BC	2	2C-1222	1200	HCN/NH3 Scrubber	Vertical	3600	25690	211	Weight pre dress-up
C6-BB	2	2C-3401	3400	Water Distiller	Vertical	Top : 4800 - Bottom : 4800	29370	153	Weight pre dress-up
C6-BA	2	2C-3601	3600	Light Ends Stripper	Vertical	1900 / 3000	44660	92	Weight pre dress-up

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-BC	2	2E-1111A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1111B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1112A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1112B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1113A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1113B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1114A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1114B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1115A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1115B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1116A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1116B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1117A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1117B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2E-1118A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BB	2	2E-1118B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BB	2	2E-1119A	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BB	2	2E-1119B	1100	Syngas Effluent Cooler	Vertical			110.3	
C6-BC	2	2R-1111	1100	Gasification Reactor	Vertical	3800	15545	148.6	
C6-BC	2	2R-1112	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1113	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1114	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1115	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1116	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1117	1100	Gasification Reactor	Vertical	3800		148.6	

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-BC	2	2R-1118	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1119	1100	Gasification Reactor	Vertical	3800		148.6	
C6-BC	2	2R-1132A	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-BC	2	2R-1132B	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-BC	2	2R-1142A	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-BC	2	2R-1142B	1100	Desulphurisation Reactor	Vertical	4800	6200	180.35	
C6-BB	2	2R-3001	3000	Bulk H2S Adsorber	Vertical - Radial Bed	3600 (HOLD)	13080 (HOLD)	143.4	
C6-BB	2	2R-3002	3000	Bulk H2S Adsorber	Vertical - Radial Bed	3600 (HOLD)	13080 (HOLD)	143.4	
C6-BB	2	2R-3003	3000	Bulk H2S Adsorber	Vertical - Radial Bed	3600 (HOLD)	13080 (HOLD)	143.4	
C6-BB	2	2R-3011	3000	COS Hydrolysis / H2S Guard Bed Reactor	Vertical	5250	8500	295.5	
C6-BB	2	2R-3012	3000	COS Hydrolysis / H2S Guard Bed Reactor	Vertical	5250	8500	295.5	
C6-BB	2	2R-3013	3000	COS Hydrolysis / H2S Guard Bed Reactor	Vertical	5250	8500	295.5	
C6-BB	2	2R-3021	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3022	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3023	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3024	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3025	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3026	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3027	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3028	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2R-3029	3000	First Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BA	2	2R-3121	3100	Second Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BA	2	2R-3122	3100	Second Stage HPS Reactors	Vertical	7032	12950	1205	

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C6-BA	2	2R-3123	3100	Second Stage HPS Reactors	Vertical	7032	12950	1205	
C6-BB	2	2V-3021	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3022	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3023	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3024	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3025	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3026	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3027	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3028	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3029	3000	First Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BB	2	2V-3041	3000	First Stage Intermediate HP Separator	Vertical	5400	6900	176.8	
C6-BB	2	2V-3042	3000	First Stage Cold HP Separator	Vertical	4850	8600	136	
C6-BB	2	2V-3082	3000	Cold LP Separator	Horizontal	4800	12000	138.2	
C6-BA	2	2V-3121	3100	Second Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BA	2	2V-3122	3100	Second Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-BA	2	2V-3123	3100	Second Stage HPS Reactor Steam Drum	Horizontal	4200	9100	106.3	
C6-UD	2	2V-8121	8100	Gas Reception Flare KO Drum	Horizontal	6500	32500	132	
C6-AC	1	1R-1131	1100	SGP Hydrogenation Reactor	Vertical	4500	6400	163.3	
C6-AC	1	1R-1141	1100	SGP Hydrogenation Reactor	Vertical	4500	6400	163.3	
C6-BC	2	2R-1131	1100	SGP Hydrogenation Reactor	Vertical	4500	6400	163.3	
C6-BC	2	2R-1141	1100	SGP Hydrogenation Reactor	Vertical	4500	6400	163.3	
C4-JA	1	1C-0201	0200	Main Absorber	Vertical	4600	30500	470	Cladding to be stainless steel 304L or 321.
C4-JB	1	1C-0641	0600	Demethaniser Column	Vertical	5150 / 2550	35960	240	

PCWBS	Phase	Equipment Number	Unit	Service	Type	Internal Diameter (mm) *	Length Height (mm) *	Weight (Ton) *	Remarks
C5-DB	1	1R-4001	4000	Reactor	Vertical	6000	20275	771	
C4-KA	2	2C-0201	0200	Main Absorber	Vertical	4600	30500	470	Cladding to be stainless steel 304L or 321.
C4-KB	2	2C-0641	0600	Demethaniser Column	Vertical	5150 / 2550	35960	240	
C5-EB	2	2R-4001	4000	Reactor	Vertical	6000	20275	771	

* All information on dimensions and weights given above is to be considered as approximate only. CONTRACTOR shall select its crane requirements according to the requirements of the CONTRACT. In the event that the final dimensions or weights of any item of equipment is greater than stated above, then the conditions set out in Article 4 of Section III – Schedule of Prices shall determine whether any adjustment in prices is permitted or not.

ATTACHMENT 4
REACTOR ERECTION SEQUENCE