

SECTION 8500 GANTRY CRANE

8501 General

(1) General

- All Sub-Sections of Section 8000 General Technical Specification shall be applied to this section.
- This Section covers the particular technical specification of the gantry crane installed in the El Salaam No. 7 Pumping Station.

(2) Scope of Works

This Section covers the technical specification of the following crane installed in the El Salaam No. 7 (Bir El Abd) Pumping Station.

- One (1) complete set of the gantry crane

The Contractor shall execute all works including the design, manufacture, tests, transport to the site, erection and site tests. The Contractor shall assume full responsibility for coordinated and adequate design of all equipment and shall exchange with other suppliers furnishing associated equipment or the installation contractor, all necessary drawings and other information required to ensure the satisfactory completion of the equipment as a whole.

8502 Equipment Requirements

(1) General

The basic materials and methods shall be in accordance with Sub-Section 8009. The materials chosen for the different parts of the equipment shall be suitable for quality of the equipment. Equivalent materials according to other specifications or better will be accepted when the Contractor shows clearly its chemical analysis and its mechanical properties.

The gantry crane shall be provided at the gate deck as shown on drawing. The gantry crane shall be of electrically operated and consist of gantry frame, hoisting and travelling equipment, rail safety clamps, controls, limit switches, reeled power cables and all other necessary components for its proper and efficient operation. The gantry crane shall be of all welded construction, except that the high-tensile bearing bolts and reamer bolts shall be used for all field connections. The rails (30 kg/m) and their fitting shall be supplied and installed by the Contractor.

(2) Performance

The gantry crane shall be designed in accordance with the following conditions.

- Hoisting capacity : 13 tons (See Note-1)

- Lifting speed of hoist : 2 m/min
- Traverse speed of trolley : 10 m/min
- Travel speed of gantry crane : 20 m/min
- Span (center to center of crane rail) : 3.5 m
- Lifting height : 14.0 m
- Power source : AC 380 V, 3-Phase, 50 Hz

Note-1: The Contractor shall submit the detailed data of hoisting capacity calculated based on the heaviest condition of the gate leaf.

The design of the gantry crane shall be such that all movements take place smoothly and positively. No slipping or creeping of the loads shall occur at any time. The crane shall be stable with a wind pressure specified in Sub-Section 8010 Clause (1) acting on the vertical surface of the crane and any load in the raised position, in any direction. The Contractor shall guarantee performances of the gantry crane specified above in this paragraph.

(3) Design and Construction

The gantry crane shall be designed and manufactured to conform to the following requirements. The Contractor upon approval of the Engineer shall make the details of construction of the gantry crane not specified herein.

(a) Gantry Frame

The gantry frame shall, in any case, be capable of withstanding the rated loads and the lateral forces due to starting or stopping the crane suddenly when the gate is transferred. The frame shall be of welded and built-up plate girder construction using rolled structural steel shapes and plates.

The lowest column shall be designed such that the reaction from all frames is divided equally between each wheel. Rail sweepers shall be provided for wheels. The frame shall be equipped with the rail clamps on the lowest column so as to hold the crane on the embedded rails at the position where the work is performed or to prevent undue movement of the crane when it is not in operation. The top of the gantry crane may be open, and all working parts of the mechanical and electrical components shall be designed as to protect from the weather. Easy access shall be provided to facilitate inspection and repairs. Walkways and access ladders shall be provided.

(b) Traveling Equipment

The traveling equipment built on the gantry frame, which is electrically operated, shall ride and travel on the traveling rails provided on the concrete slab at elevation 13.40 meters to handle the bulkhead gate or stoplogs. The traveling equipment to be furnished shall consist of mechanical equipment, i.e., torque shafts, bearings, gear reducers, couplings, wheels, etc., electrical equipment, i.e., electric motors, limit switches, electromagnetic breaks, etc., and all other necessary components. The torque shafts shall be finished commercial steel shafting. The bearings shall be of self-aligning ball or roller type. In the gear reducer, all

gears except worm wheels shall be of cast or forged steel with machine cut teeth and worm wheels shall be of phosphor bronze casting.

If worm gears are used, they and their supports shall be sufficiently rigid to prevent undue movements. Gears shall have removable housing with easily accessible provision for lubrication. High-speed gears shall be encased and oil bathed. Adequate inspection openings shall be provided together with an oil filler plug, drain cock and oil level indicator. Couplings shall provided with means for field adjustment and permanently attached to torque shafts after field adjustment.

The wheels of the crane shall be double flanged to suit the rails used. The wheels shall be of cast steel or forged steel and shall be heat-treated to provide a hardwearing surface. The wheels shall be provided with "oils" metal bushings turning or fixed axles of forged steel or other approved materials. The wheels shall be machined true and shall operate smoothly without deflection or vibration. Electric equipment for the gantry crane shall be provided the machinery deck. The control cabinet shall be equipped with all controlling and indicating instruments.

(c) Hoisting Equipment

The hoisting equipment shall be of the cable lift type suitably mounted on the gantry crane for raising and lowering the gate and stop logs with lifting beam. The hoisting equipment to be furnished shall consist of mechanical equipment, i.e., torque shafts, bearings, gear reducers, couplings, hoist drums, mechanical position indicator, manual operating device, wire ropes, etc., electrical equipment, i.e., electric motor, limit switches, electromagnetic brake, etc. and all other necessary components.

The torque shafts, bearings, gear reducers, couplings shall conform to the requirements of the relevant items specified in the Clause (b) here above. The hoist drums shall be of cast and/or welded steel construction, grooved to receive the full length of rope corresponding to the required lift plus two dead wraps on each drum at fully raised position, in addition to the length required for attachment to the drum. When the trash rack rake is at the fully lowered position, at least three dead wraps of the rope shall remain unwound. The minimum pitch circle diameter of drums shall be 400 times the element wire diameter of the stranded wire rope.

The rope grooves shall be in accordance with the recommendations of the rope manufacturer. All surfaces which are to come into contact with the ropes shall be machined true to approved tolerances and surface finished to minimize rope wear and to prevent permanent deformation of the rope. The hoist shall be provided with a manual-operating device, which can hoist under the full load designed. The full force on the handle of the device shall be less than 12 kilograms. While the device is being operated, the electric motor shall be disengaged. The electromagnetic brake shall have a means of manually de-energizing the brake during manual hoisting and of quickly energizing the brake when hoisting work has ceased. The wire rope assemblies shall be match-marked to exact length while under tension. The wire ropes shall be of galvanized steel, grease impregnated during manufacture, and

shall be supplied by a reputable manufacturer of hoisting ropes. Wire ropes shall be selected with lay suitable for preventing kicking.

The rope shall be designed so that the normal working load does not exceed one eighth (1/8) of the breaking strength of the rope; except that when the maximum hoist motor torque is applied, the working stress shall not exceed 80 per cent of the breaking strength of the rope.

(d) Control and Wiring

The available power for the electrical equipment to be furnished with the gantry crane shall be AC. 380 volts, 3-phase, 3-wire and 50 Hz. The gantry crane shall be operated from the machinery deck. The hoisting equipment shall be capable of raising, lowering or stopping the bulkhead gate and stoplogs by the corresponding push-button switches. Push-button switches so as to travel in the direction as designated on each switch shall operate the traveling equipment. The following limit switches shall be provided on the gantry crane for proper operation.

Upper over-travel limit switch to stop the hoisting equipment before the lifting beam and trash rack rake strike the hoisting equipment. Lower over-travel limit switch to stop the hoisting equipment to keep the rope wound on the hoist drums. Limit switches to prevent the gantry crane over-travel. Slack rope limit switch to prevent the slackening of the hoisting ropes in the event the downward motion is stopped by an obstruction. Limit switches to prevent crab over-traverse. Electro-mechanical interlock shall prevent simultaneous operation of the traveling and hoisting motors.

The contractor shall furnish the all power cables from the joint box on the gate deck El. 13.40 to the main incoming supply no-fuse breaker in the control cabinet. The contractor shall further furnish the secondary power and control cables and/or wires, which are necessary for the required operation of the gantry crane, for wiring from the main incoming supply no-fuse breaker terminal in the control cabinet. The power supply to the gantry crane shall be by the cab type cable retrieving on a spring-operated cable reel which shall be mounted in such a manner as to allow the gantry crane to travel over the full length of travel. The reel shall be fitted with a device to permit delivery of cable in both directions.

The contractor shall provide a control cabinet for operation of the gantry crane. This control cabinet shall be located in the machinery deck. The control cabinet shall be of weatherproof construction, completely enclosed, with keyed access doors and/or windows, assembled using angle or channel structural members, seam welded at the corners and finished smooth. All necessary switches, indicators, relays, transformers and other devices shall be installed within the cabinet. The following instruments shall be mounted on or within the control cabinet.

- Incoming supply molded case circuit breaker
- Volt meter
- Power supply indication lamps
- Ammeter,
- Starting devices for each motor

- AC 230 volts 10 A socket outlet
- Operation devices or operation mode indicate lamps
 - Fully raised indicating light
 - Fully lowered indicating light
 - Raising indicating light
 - Lowering indicating light
 - Crane traveling in right direction light
 - Crane traveling in left direction light
 - Crane stopped indicating light
 - Others necessary alarm lights and buzzers
 - Operation push-button switches for the hoisting equipment
 - Operation push-button switches for the traveling equipment
- Gate position indicator
- Mould case circuit breakers to protect each motor circuit and other circuits
- All other necessary devices or equipment such as step-down transformers, relays, contractors, switches, and miscellaneous wiring components

8503 Tests

(1) Factory Tests

The gantry crane shall be completely assembled at the factory and shall be tested in accordance with the standards of the manufacturer.

(2) Site Tests

The site tests shall include the following items and items required by the Engineer.

- Structure deflection test
- Full load test (including brake system tests.)
- Overloading tests (125% of the rated load)
- Operation test

(3) Test Reports

The contractor shall submit the Engineer with four certified copies of all reports including any analyses of the tests.

8504 Spare Parts

The Contractor shall state the necessary spare parts to be kept in stock valid for two years normal operation.

8505 Data, Descriptive Documents and Drawings

(1) Drawings and Data Submission

The Contractor shall submit with his tender the drawings and data as following.

- General drawings and descriptive data of their proposals together with complete detailed specifications, technical schedules, catalogues, etc.
- General information as to method of assembling, installation and other information as may be needed to show that the materials proposed meet requirements of these specifications.

(2) The Drawings for Manufacture

- a. Within 180 days after notice of award, drawings showing overall dimensions of the principal parts such as the suction pipe pump casing, pit liner, and embedded parts.
- b. Within 240 days after notice of award, all details of foundation requirements, proposed erection procedure, and details of all embedded parts so that design of second stage concrete can be confirmed.

8506 Instruction manuals

The Contractor shall prepare an operating and maintenance manual for guidance of the erection and operating personnel. This manual shall describe in detail the construction and recommended procedure for assembling, dismantling, maintaining and operating the equipment.

Four (4) copies shall be submitted to the Engineer for inspection and approval, at least three months before the first unit is to be commissioned. Following approval, ten (10) copies of the manual, suitably bound in sturdy covers, shall be supplied to the Engineer.

The Contractor shall also supply ten (10) copies of all bulletins and instructions prepared by manufactures of component parts of the equipment to the Engineer. These bulletins shall be either included with the operating and maintenance manual or bound separately and properly indexed for easy reference.

8507 Measurement and payment

Separate measurement or payment shall not be made for the work required under this section. Only when, all equipment or devices related to the gantry crane have been installed, connected and completed it is accepted by the Engineer.

All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bill of Quantities.

SECTION 8600 OVERHEAD TRAVELING CRANE

8601 General

(1) General

- All Sub-Sections of Section 8000 General Technical Specification shall be applied to this section.
- This Section covers the technical specification of the overhead crane installed in the El Salaam No. 7 (Bir El Abd) Pumping Station.

(2) Scope of Works

The Contractor shall execute all works including the design, manufacture, tests, transport to the site, erection and site tests.

- One (1) complete set of the overhead traveling crane

The Contractor shall assume full responsibility for coordinated and adequate design of all equipment and shall exchange with other suppliers furnishing associated equipment or the installation contractor, all necessary drawings and other information required to ensure the satisfactory completion of the equipment as a whole.

8602 Equipment Requirements

(1) General

The basic materials and methods shall be in accordance with Section 8000. The materials chosen for the different parts of the equipment shall be suitable for quality of the equipment. Equivalent materials according to other specifications or better will be accepted when the contractor shows clearly technical analysis and properties. The low speed overhead traveling crane shall be provided in the pumping station as shown on drawing.

The overhead traveling crane shall be of electrically operated and cab controlled type and be complete with main traverse, cab, main and auxiliary hoists, shafting, gearing, complete electrical equipment including motors and limit switches, current collector, trolley electrification, brakes, hoisting ropes, blocks and hooks, ladders, platforms guard and handrails and necessary components for proper and efficient operation of the overhead traveling crane.

(2) Performance

The design shall be such that all movements take place smoothly and positively. No slipping or creeping of the load shall occur at any time. The crane shall be designed for continuously repeated cycles up to one-hour total duration, and shall be capable of traveling with the full

load suspended in any position of the pumping equipment provided in the pump station.

Special care shall be taken to guard against oil or grease dripping from the crane. The Contractor shall guarantee performances of the overhead traveling crane specified in this section. The overhead traveling crane shall be designed in accordance with the following conditions.

- a. Hoisting Capacity
 - Main hoist: 100 tons
 - Auxiliary hoist: 20 tons
- b. Speed
 - Lifting speed of main hoist: 1.2 m/min.
 - Lifting speed of auxiliary hoist: 3.0 m/min.
 - Traverse speed of trolley: 10 m/min.
 - Traverse speed of crane girder: 20 m/min.
- c. Span (Center to center of crane rails): 17.9 m
- d. Lifting height: 30 m
- e. Power source: AC 380V, 3-phase, 50 Hz

(3) Design and Construction

The overhead traveling crane shall be designed and manufactured to conform to the following requirements.

(a) Crane Structure

The crane structure shall be of steel and all-welded construction. The main traverse girder shall consist of two main girders connected together at each end. A system of lateral bracing supported by auxiliary trusses shall be provided for each main girder. Checkered plate walkways and steel handrails shall be provided on top of each main girder.

An operator's cab shall be suspended from a main girder and access to it shall be from a staircase provided on the crane girder. The cab shall be of steel and toughened glass and close type. All controls shall be so arranged that the operator has a clear view of operations without moving from the operating position and an operator's seat shall be provided.

The complete girder structure shall be mounted on four pivoting bogies designed to compensate for any irregularities in the level of the running rails. Each bogie shall contain double-flanged steel wheels, which shall operate on fixed axles with ball or roller bearings. Two matched wheels, one at each end of the crane, shall be driven.

(b) Travel Mechanism of Crane Girder

The travel mechanism of the crane girder shall be mounted on the crane girder assembly and its drive unit shall be mounted at mid-span and shall incorporate a motor driving enclosed gear reducer through a flexible coupling to cross-shafts. Provision shall be made to permit access to the travel mechanism for inspection and maintenance. The shafts shall be mounted on ball or roller bearings.

(c) Crab

The crab frame shall be of fabricated steel construction. Wherever, possible, crab steelwork shall be arranged to support checkered plate walkways for convenient and safe access to all on the crab. The crab traverse drive unit shall incorporate a motor driving enclosed gear reducer through flexible coupling to cross-shaft, which shall be mounted on ball or roller bearings. Four steel crab wheels shall be double-flanged and shall be fitted with ball or roller bearings on fixed axles. Two of the wheel shall be matched as driving wheels.

(d) Travel and Traverse Brakes

Spring applied, pivoted-shoe, self-aligning brakes, incorporating thruster release, shall be applied for the travel mechanism of the crane girder and the traverse mechanism of the crab. These brakes shall release as soon as the main contactor of the crane is closed and shall operate only when the main contactor is tripped by the travel or traverse limit switches, or any other operation which causes the main contactor to open. In addition, mechanical or hydraulic brakes, operated by foot pedals from the cab, shall be fitted to the drive units for emergency use.

(e) Main and Auxiliary Hoists

The main and auxiliary hoist drums shall be fitted with bronze-bushings and shall operate on fixed shafts and shall be mounted in such a way that a drum and shaft can be readily removed together. The hoist drums shall be steel or cast iron and shall have accurately machined grooving to accommodate the hoisting ropes. The hoist ropes shall be performed ordinary lay construction.

A spring applied, pivoted shoe, self-aligning brake, incorporating thruster, release, shall be applied for the main and auxiliary hoists respectively and shall operate automatically as soon as the power supply to the motor is interrupted. A lowering speed control feature shall be incorporated in both hoists in order to reduce the speed to approximately one quarter to one third of full speed. The hooks of the main and auxiliary hoist fallbacks shall be of swiveling type, supported on a ball or roller thrust bearing.

(f) Gear and Bearing

All gears other than final drives, shall be enclosed in gearboxes with automatic oil circulation, oil filling and drain connections oil level indicators and inspection covers. All bearings shall be provided with means for lubrication either by automatic circulation, grease gun, or in the case of the final drive gear and hoist ropes, by direct manual application of heavy-bodied grease. The contractor shall provide all load, warning and instruction notices, necessary for the crane.

(g) Electrical Equipment

The Contractor shall provide, on the crane, adequately rated single phase transformers, suitable for continuous operation for the supply of power to the control circuits, lighting and power outlet circuits, etc. The electrical power supply to the crane shall be by means of three bare hard-drawn copper collector wires supported by brackets, attached to the building.

The Contractor shall supply and install the collectors wires, three collectors of renewable carbon-head type, and all necessary end strainers, brackets, insulators and other required fittings.

All motors shall be wound rotors, crane rated, totally enclosed type, 40% ED rated. Reversing drum-type controllers mounted in dust-proof metal casing and provided with starting resistances shall control the motors. A control and protection panel enclosed in a cabinet, of dust-proof sheet metal construction, shall be mounted within the cab. The equipment fitted to the panel shall include main isolating switch, main contractor, magnetic overload relays for each motor and all necessary fuses, control switches and wiring for the motors. Control circuits, a cab light and one power outlet. A "power on" indicating light shall be fitted to the cabinet.

A fallback operated, whole current over-hoisting limit switch shall be provided for each hoist. In addition, a shunt type limit switch shall be fitted to each hoist to limit the travel in the "raise" and "lower" directions. Shunt type limit switches shall be provided also for the traverse and travel motions of the crab and crane girder respectively. Striker gear for the traverse and travel limit switches shall be supplied and installed by the Contractor. All limit switches shall be self-resetting and shall be electrically counted in a manner permitting "backing out" after tripping. The traverse collector wires shall be of hard-drawn copper type. Collectors of removable carbon head type shall be fitted. All crane wiring shall be installed in conduits or cable ducts.

(h) Accessories

The following shall be provided for the overhead traveling crane:

- | | |
|--|-------|
| 1) Trolley wires insulators and brackets: | 1 lot |
| 2) Lubricating oil, grease, machine oil with 50 percent spare: | 1 set |
| 3) Other necessary accessories: | 1 set |

8603 Tests

(1) Factory Tests

The overhead traveling crane shall be completely assembled and tested in accordance with the standards of the manufacture.

(2) Site Tests

After complete assembly at the site, the overhead traveling crane shall pass an operation test including brake system tests. These tests shall demonstrate that all guarantees have been met and that the entire equipment meets the contract requirements in that it is properly installed and adjusted to operate correctly and safely. The following tests shall be carried and the results shall be certified.

- Structure deflection test.
- Full load test (including brake system tests).

- Overloading tests (125 per cent of the rated load).
- Operation test.

(3) Test Reports

The contractor shall submit to the Engineer with four certified copies of all reports of the tests. The reports shall include any analyses of these tests.

8604 Spare Parts

The Contractor shall supply the following spare parts.

For Over head Traveling Crane	Quantity
- Set of moving and fixed contacts, contactor and relay for switch	1

The Contractor shall submit the additional spare parts to be kept in stock valid for two years, and submit in such a detail to enable the Engineer to place additional order whenever necessary.

8605 Data, Descriptive Documents and Drawings

(1) Drawings and Data Submission

The Contractor shall submit with his bid the drawings and data as following.

- General drawings and descriptive data of their proposals together with complete detailed specifications, technical schedules, catalogues, etc.
- General information as to method of assembling, installation and other information as may be needed to show that the materials proposed satisfy the requirements of these specifications.

(2) The Drawings for Manufacture

- a. Within 180 days after notice of award, drawings showing overall dimensions of the principal parts such as the suction pipe pump casing, pit liner, and embedded parts.
- b. Within 240 days after notice of award, all details of foundation requirements, proposed erection procedure, and details of all embedded parts so that design of second stage concrete can be confirmed.

8606 Instruction Manuals

- a. The Contractor shall submit the operating and maintenance manuals for guidance of the erection and operating personnel. These manuals shall describe in detail the construction and recommended procedure for assembling, dismantling, maintaining and operating the equipment.
- b. The Contractor shall submit four (4) copies to the Engineer for inspection and approval, at

least three months before the first unit is to be commissioned.

8607 Measurement and Payment

Separate measurement or payment shall not be made for the work required under this section. Only when, all equipment or devices related to the overhead traveling crane have been installed, connected and completed it is accepted by the Engineer.

All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bill of Quantities.

SECTION 8700 METAL WORKS IN THE PUMP ROOM

8701 General

(1) General

- All Sub-Sections under Section 8000 General Technical Specification shall be applied to this section.
- This Section shall covers particular technical specification of the metal works installed to the El Salaam No. 7 Pumping Station.

(2) Scope of Works

The works shall include the design, manufacturing, testing, transport to the site, erection and tests at the site of the following complete in accordance with this specification.

- Four (4) complete sets of the suction pipe liner
- Four (4) complete sets of the pump discharge short conduits
- One (1) complete set of the discharge header
- Four (4) complete sets of 1500 mm sleeve coupling for the discharge valves
- Three (3) complete sets of 2400 mm diameter pipelines with a length of approx.74.5 m
- Three (3) complete sets of 2400 mm sleeve coupling for the pipeline valves
- Six (6) complete sets of 2400 mm closer type coupling for the pipelines
- One (1) complete set of the miscellaneous metal works
- Four (4) complete sets of the electrical insulation product

The Contractor shall execute all works including the design, manufacture, tests, transport to the site, erection and site tests. The Contractor shall assume full responsibility for coordinated and adequate design of all equipment and shall exchange with equipment suppliers furnishing associated equipment or the installation contractor, all necessary drawings and other information required to ensure the satisfactory completion of the equipment as a whole.

8702 Equipment Requirements

(1) General

The suction pipe liners shall extend from the suction sump outlet to the inlet of the 76-degree suction tube section as shown on drawing. The pump discharge short conduits shall locate between the pump casing extension and discharge header as shown on drawing. The discharge header shall have identical overall dimensions and be suitable for installation at the location shown on drawing.

The 1500 mm diameter sleeve coupling shall be provided on the short conduit between the discharge valve and Isolating valve as shown on drawing. And 2400 mm diameter sleeve coupling shall be provided at downstream side location just after the pipeline valves as shown

on drawing. The 2400 mm diameter closer type coupling shall be provided on the pipelines as shown on drawing. The pipelines shall provide from outlet of the discharge header to a location terminated at downstream side, approx. 74.5 meter from the pumping station. The inspection platforms shall provide in the pipeline valve chamber for handling the gate valves and approaching to the manhole as shown on drawing.

(2) Performance

The suction pipe liners shall be designed for full external hydrostatic pressure with suction sump high water surface at EL 11.94 m and with an absolute pressure of one atmosphere inside the suction pipe. The discharge header, pump discharge short conduits and closure conduits shall be designed and fabricated in accordance with ASME Boiler and pressure Code, Section VIII unfired pressure vessel code or Codes / Standards accepted by the Engineer. The discharge header and pump discharge short conduits shall be designed to resist the bursting stresses in these when subjected to an internal pressure equal to the maximum head plus head rise due to water-hammer. The sleeve couplings and closer type couplings shall be designed to resist the bursting stresses in these when subjected to an internal pressure equal to the maximum head plus head rise due to water-hammer.

(3) Design and Construction

(a) General

The basic materials and methods shall be in accordance with the Section 8006. The materials chosen for the different parts of the equipment shall be suitable for quality of water as shown in the chemical analysis. Equivalent or better materials according to other specifications may be accepted when the Contractor shows clearly the chemical analysis and mechanical properties.

(b) Suction Pipe Liners

The suction pipe liner shall be fabricated from welded plate steel not less than 10 mm thick and be reinforced on the outside by ribs or structural steel shape. The liner shall be provided with adequate means for securely anchoring the liner to the surrounding concrete. The interior of the suction pipe shall be smooth and shall have no abrupt changes in direction. The suction pipes shall be provided the pipe connection for the cooling water return pipe which is furnished by water supply works and 80 mm diameter air vent pipe extended to EL 12.10 over free water surface. The size of the cooling water pipe shall be decided based on required quantity of cooling water demand but shall not less than 250 mm. The location of the connection shall be as shown on the drawing.

The suction pipes shall be provided an unwatering opening with removable grating as shown on the drawing. The removable grating shall be fit to the unwatering block out. The inside surface of the removable grating and the grating support shall be flush with the inside surface of the suction pipe. The de-watering opening shall be designed to have a provision to prevent entering sand into the de-watering header.

(c) Pump Discharge Short Conduits

(i) Short Conduits

The short conduit shall be made of welded plate steel construction and be consist of a 1500 mm diameter pipe and flanges suitable for connecting to the isolating valve and discharge valve. The short conduit shall have flanged connections for filling or drain and air-vacuum piping. Size of the fill or drain pipe and air pipe shall be 50 mm in diameter respectively.

A sleeve coupling shall be provided as shown on drawing to permit axial movement of the short conduit and remove the isolating valve and discharge valve for maintenance.

(ii) Closure Conduit

The closure conduit shall be made of welded plate steel construction and be consisting of a 1500 mm diameter pipe and a flange suitable for connecting to the isolating valve. The closure conduit shall have preparation at the downstream end for field welding to the 1500 mm discharge pipe of the discharge header.

The closure conduit shall be provided with a 200 mm nozzle for cooling water supply. And flange shall conform to ISO standard and be faced and drilled. A tap shall be provided for connection a pressure gauge.

(d) Discharge Header

The discharge header shall be made of welded plate steel construction and be consisting of a 3800 mm diameter header pipe, three 2400 mm diameter delivery pipes and four 1500 mm diameters discharges pipes. Each discharge pipes and delivery pipes shall be provided flared pipe to match the header pipe. Sufficient strong and rigid reinforcement shall be provided at the joint of the header pipe and branch pipes The discharge header shall have the least number of sections practicable for shipment and handling. The connection between the header pipes or the header pipe to the pump discharge short conduits or the header pipe to the delivery pressured pipelines shall be prepared for field welding.

The field weld connection between the discharge header plates shall be completely radiographic tested for longitudinal lines and spot radiographic tested for circumference lines. The discharge header shall be provided pipe connections for filling and drain and air- vacuum valve and be located these as shown on drawing. Size of the fill or drain pipe and air pipe shall be 200 mm and 80 mm in diameter respectively. The discharge header shall be provided with a suitable number pads and connections for the application of jacks and tie rods during field erection.

The discharge header shall be provided with a man door approximately 500 mm in diameter for access to the interior. The man door shall be located approximately as shown on drawing. The man door shall be equipped with a hinged, stainless steel bolted cover and the interior surface shall be confirmed to the contour of the inner surface of the water passage. The man door shall be equipped with a handle and jack bolts and with a test petcock.

(e) Pipeline

The layout and arrangement of the pipelines shall be as shown on the drawings. Three 2400 mm diameter steel pipelines having a length of approximately 75 meter respectively shall be provided. Each pipeline shall be complete with bend pipes, thrust collars, a drain pipe, flanges, manholes and all other necessary components. The steel pressure pipeline shall be made of welded plate steel and have the least number of sections practicable for shipment and handling. The pipelines shall have minimum thickness of 22 mm except inclined straight pipelines (excluded bend portion) which have minimum thickness of 33 mm.

The connection between the pipeline pipes or the header pipe to the pipelines shall be prepared for field welding before shipment. The field welding of the steel pipeline segments shall be completely radio-graphed with 100 % coverage for longitudinal welding line spot radiographic tested for circumference. The 2400 mm diameter closer type expansion joints shall be provided on the buried pipelines as shown on drawing. The expansion joints shall be designed and fabricated to resist internal pressure specified in this Clause.

The connection between the pipeline and expansion joint shall be prepared for field welding. Details of the edge preparation works shall be submitted by the Contractor to the Engineer for approval. Outside surface of the expansion joint parts shall be covered by the vinyl sheet tightly before the pipelines are buried. The steel pressure pipeline shall be provided a 400 mm diameter pipe connection for filling and drain at the location shown on drawing. The steel pressure pipeline shall be provided with a suitable number pads and connections for the application of jacks and tie rods during field erection. Thrust collars shall be provided at the embedded portion of the steel pressure pipeline at the location shown on drawing. The thrust collar shall be capable of transmitting the forces due to hydraulic bulkhead pressure to the surrounding concrete.

The steel pressure pipeline shall be provided with a man door approximately 500 mm in diameter for access to the interior. The man door shall be located approximately as shown on drawing. The man door shall be equipped with a hinged, stainless steel bolted cover with a handle, jack bolts and a test pet cock. The interior surface shall conform to the contour of the inner surface of the water passage. The platforms for access to the manhole and handling 400 mm gate valve shall be provided. The closer type expansion joints shall be provided on the buried pipelines as shown on drawing. The expansion joints shall be designed and fabricated to resist internal pressure specified in this Sub-Section.

(f) Sleeve coupling

The sleeve couplings shall provide tightness and strength with flexibility and be designed and fabricated to resist internal pressure specified in this Clause. The sleeve coupling shall consist of a sleeve, flanges, gaskets, tightening bolts and nuts. The rubber gaskets shall firmly held between the coupling parts and the pipe. The sleeve couplings shall be designed to permit axial movement and allow removing the valve for maintenance.

(g) Closer type Coupling

The Closer type Coupling shall provide tightness and strength with flexibility and be

designed and fabricated to resist internal pressure specified in this Clause. The Closer type Coupling shall be bolted, segmental, clamp-type, mechanical coupling having a housing that encloses rubber gaskets. The rubber gaskets shall firmly held between the coupling parts and the pipe. The Closer type Coupling shall be designed to permit axial movement and allowed some degree of flexibility and alignment.

(h) Miscellaneous Metal works

The platforms for access to the pipeline manhole and handling the gate valve shall provide. The platforms shall design and consist of fabricated frame, ladder and checkered walkway as shown on drawing.

(i) Electrical insulation products

The Contractor shall provide electrical insulation between the isolating valve and closure conduit to protect galvanic corrosion in the equipment and piping flanges. The electrical insulating provision shall consist of gaskets and washers of polytetrafluoroethylene resins or equivalent, resin coated steel stud bolts, and nuts and washers of steel. To avoid special sized bolt holes on the flange of the valves and pipes, the stem of stud bolts shall be over-coated by the above resin between screwed portion and over total thickness of the flanges and be not exceeding nominal diameter of standard one.

8703 Tests

(1) Factory Tests

(a) Equipment test and inspection

Following tests and inspections shall be required.

(i) Mill sheets

The Contractor shall submit the following test reports to the Engineer for approval.

- All mill test reports of the steel plate for the suction pipe liners, discharge header, the pump discharge short conduits and pipelines.

The specimens having the plate thickness exceeds 12 mm for the principal stress carrying parts except material of the suction pipe liners shall be impact tested and satisfied that impact absorbing energy is 27 J (0°C) or more.

(b) Shop assembly and shop measurements

(i) Shop assembly

Each equipment shall be assembled, properly match-marked in the shop and be shipped to the site. Accurately established horizontal and vertical reference lines shall be marked on the assembled equipment to facilitate alignment during field erection.

(ii) Shop measurement.

During the shop assembly, or at other appropriate times, the Contractor shall obtain measurements of the controlling dimensions of the equipment.

Drawings showing the measurements and readings obtained shall be furnished to the 30 calendar days before the equipment is shipped.

(c) Paint inspection

After completion of coat specified, coated surface appearance and thickness of coated layer shall be inspected.

(2) Site Tests

The Engineer shall keep power to inspect assembly during erection, which include a complete verification of all parts with regard to elevations, clearances, pertinent fits, alignments, and quality of workmanship. All field welds of the discharge header shall be inspected by mean of radiographic for 100 % of inspection coverage. And the Contractor's inspector under witness of the Engineer shall carry out all radiographic examination on the field welds. Whereas such inspection will be conducted so as to interfere as little as possible with the assembly process, the Contractor shall conform to any justifiable request made by the Engineer as far as the rectification of defective workmanship is concerned. Unless otherwise specified, any rejection based on the inspection. The Engineer will be reported to the Contractor within ten days. Material that shows injurious defects subsequent to assembly and acceptance will be rejected and the Contractor will be notified.

(3) Test Reports

The Contractor shall submit to the Engineer four copies of all reports of the tests for approval.

8704 Spare Parts

The Contractor shall state the necessary spare parts to be kept in stock valid for two years normal operation, and submit in such a detail to enable the Engineer to place additional order whenever necessary.

	Quantity
- Set of gaskets for 1500mm sleeve coupling	1
- Set of gaskets for 2400mm sleeve coupling	1
- Set of gaskets for 2400mm closer type coupling	1

8705 Data, Descriptive Documents and Drawings

(1) Drawings and Data Submission

The Contractor shall submit the drawings and data for approvals of the Engineer listed as following.

- Outline drawings giving important dimensions together with complete detailed specifications.
- General information about method of assembling, installation and other information as may be needed to show that the materials proposed.

(2) The Drawings for Manufacture

- a. Within 180 days after notice of award, drawings showing overall dimensions of the principal parts such as the suction pipe pump casing, pit liner, and embedded parts.
- b. Within 240 days after notice of award, all details of foundation requirements, proposed erection procedure, and details of all embedded parts so that design of second stage concrete can be confirmed.

8706 Instruction Manuals

- a. The Contractor shall submit the operating and maintenance manuals for guidance of the erection and operating personnel. These manuals shall describe in detail the construction and recommended procedure for assembling, dismantling, maintaining and operating the equipment.
- b. The Contractor shall submit four (4) copies to the Engineer for inspection and approval, at least three months before the first unit is to be commissioned.

8707 Measurement and Payment

Separate measurement or payment shall not be made for the work required under this section. Only when, all equipment or devices related to the metal works described in the Sub-Section 8701, Clause (2) Scope of Works of this Section, have been installed, connected and completed it is accepted by the Engineer.

All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bill of Quantities.