

TENDER DOCUMENT

FOR

DEVELOPMENT OF SHIP DOCKING AND REPAIR
INFRASTRUCTURE IN PATHFINDER CREEK
AT VADINAR

VOL. III

SPECIFICATION FOR MECHANICAL AND FIRE
FIGHTING WORKS



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ADMINISTRATIVE OFFICE BUILDING,
POST BOX NO.50, GANDHIDHAM (KUTCH)
GUJARAT – 370201.



**DEVELOPMENT OF SHIP DOCKING AND REPAIR
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1. INTROUCTION

1.1. Project background

Deendayal Port Authority (DPA) intends to develop a ship docking and repair infrastructure at Vadinar jointly with Cochin Shipyard Limited. The Ship Repair facility shall include two numbers of 300m length floating dry dock and one number of 150m length floating dry dock with necessary onshore facilities. The facilities shall include the following.

- Floating dry docks
 - 2 Nos of 300m x 55m x 15m x 12m
 - 1 No of 150m x 32m x 12m x 10m
- Floating dock berthing Jetties of
 - Outfitting jetty-1 (325m x 20m)
 - Outfitting jetty-2 (325m x 20m)
 - Outfitting jetty-3 (200m x 20m)
- Guide pin piles for Floating Dry Docks (6 x Nos)
- Berthing fenders and bollards for ships and crafts at Jetty
- Approach Trestle to land ~ 231.1m
- Crane rails for ELTT cranes and end stoppers.
- Electrical Power Supply including substation facilities.
- Cable trenches including cable reaving slots.
- Desalination plant and Potable Water supply facilities
- Firefighting water pump house and facilities
- Navigational Aids

In the view of above, Deendayal Port Authority (DPA) appointed Department of Ocean Engineering, IIT Madras to prepare design and detail for the offshore facility.

1.2. Location

The location of the proposed jetties for floating dry docks is shown in figure 1.1. The proposed facility is south of Nayara Oil jetties and adjacent to the existing Coast Guard Jetty. The location is about 10 km from Vadinar and 50 km from Jamnagar. Airports are located at Jamnagar and Rajkot. Rajkot airport is about 120 km from Vadinar.



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Figure 1.1. Location of proposed outfitting jetties for Floating Dry Docks

1.3. Overall Layout of facility

The overall layout of proposed facility is shown in figure 1.2. The proposed facility for ship docking and repair consists of the following.

- (a) 3 Outfitting Jetties for docking FDDs and ships
- (b) Approach Trestle to land
- (c) Pump house cum substation building

The Floating dry docks will be developed by Cochin Shipyard Limited (CSL) under a joint agreement between DPA and CSL.

The proposed new jetty for 300m long FDD is 325m each (Jetty 1 & 2) arranged along the creek while the jetty No. 3 is arranged along the approach trestle. The pump house is located adjacent to the approach trestle and jetty. The existing approach trestle is converted and widened. The floating dry docks are arranged and docked against the jetty having 20m width. The large dry docks of 300m length are docked on opposite side of jetty 1 & 2 with an offset of 50m. The third dry dock with 150m length is docked on the outfitting jetty 3 along the approach. The pump house and substation is located at the entrance of the approach trestle.



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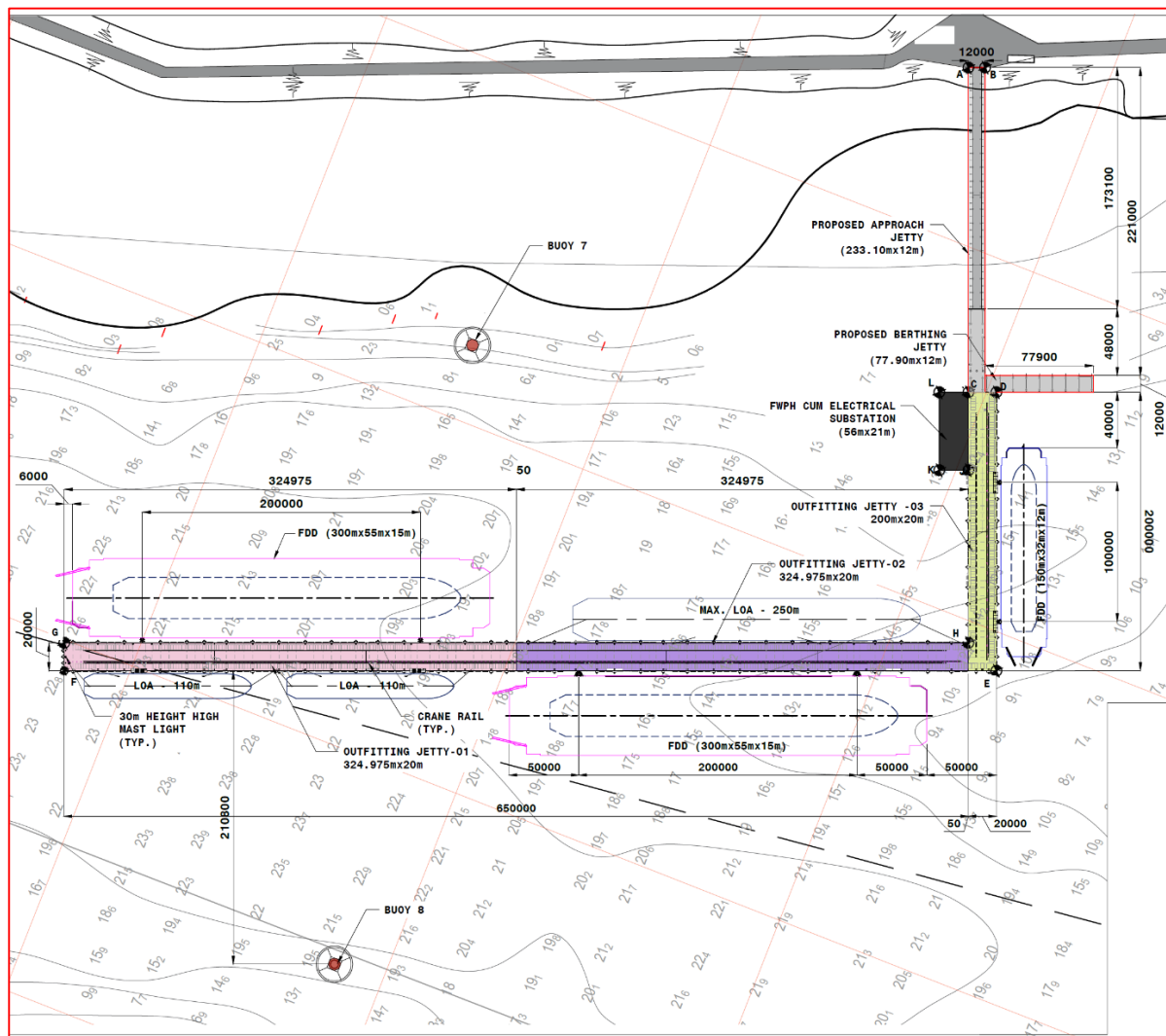


Figure 1.2 Location of pumphouse and substation



2. DESCRIPTION OF FIRE FIGHTING SYSTEM

2.1. Firefighting philosophy

An independent firefighting system is planned for the new outfitting jetties catering to the single fire scenario on the facility. Following principles are to be adopted.

- The jetties are to be designed as ship repair facility using floating dry docks. No cargo handling operations are envisaged.
- The firefighting system provided shall be common to both landside and seaside berths.
- In case of fire on tankers, the tankers shall be towed away immediately.
- The firefighting system shall provide firefighting needs of the jetty platform and approach trestle completely.
- Firefighting system shall be designed in accordance with IS 4651 Part V for fire water requirements & OISD-156 for other firefighting requirements wherever applicable.

2.2. Pump house location

The fire protection system proposed has been designed to provide fire protection cover to the installations on jetty in case of a fire. A fire water pump house cum substation building housing the fire water pumps, substation & control room is proposed to be located away from the jetty as shown in figure 2.1.



Figure 2.1 Fire water pump house location

2.3. Fire water requirement.

The firefighting system is provided to cater for single largest fire at the jetty. Fire water requirement shall be taken as per IS 4651 Part V (sea water) for multiple wharf or pier as 12,000 litres / min which is equal to 720 m³ / hour.

The proposed jetty is to cater for the 3 Floating Dry docks and vessels parked for repair and the fire water requirement is based on general firefighting as no hydrocarbon is handled at Jetty. However, no storage tanks are provided as the fire water pumps can be used for direct pumping at any time.

Number of operating pumps	= 2 (Engine Driven)
Number of standby pumps	= 1 (Engine Driven)
Capacity of one pump	= 360 m ³ /hour
Total capacity available	= 720 m ³ /hour

2.4. Fire water header size

Considering the scenario of having three pumps with one pump as standby,

Maximum allowable flow velocity	= 3 m/sec
Pipeline header size	= 12 inch
	= 0.305 m
Total flow rate	= 788 m ³ /hour

Hence 12" fire water header is adequate for demand of fire water.

2.5. Fire Water Distribution Network

The key features of the fire water distribution network systems proposed for the jetty are as under:

- The proposed system mainly consists of Fire Water Pumps, Network Pipe & Fittings, isolation valves and hydrants.
- The main network shall be laid above ground on the concrete slab supported at every 6.0m on the deck slab.

2.6. Brief Specifications of Major Fire Fighting Components

- Pipes up to and including 6" shall conform to IS: 1239 Part-1 (Heavy) and pipes of 8" and above shall conform to IS: 3589 Black pipes shall be used for firewater network system.
- All pipes for sea water application shall be internally glass flake polymer coating.
- Isolating valves shall be gate valves of cast steel construction for monitor system/ water curtain system. The isolation valve used in Foam concentrate line shall be of stainless steel.



2.7. Description of firefighting system

The firefighting arrangement consists of the following components.

- a) Fire Water Pumps – Main and Jockey pumps.
- b) Fire Alarm System
- c) Public Address / Talk Back System
- d) Fire Extinguisher
- e) Water Borne Fire Fighting Equipment such as hydrants.

A brief description of each system is given in the subsequent sections.

2.8. Fire Water Pump house.

The discharge capacity of each diesel driven pump is 360 m³/hr each and the total capacity of two pumps is 720 m³/hr. OISD guidelines stipulate that 50% capacity of total fire water demand should be kept as standby. As such it is proposed to use two pumps as main pumps and one pump as standby. Two numbers of Jockey pump (both electric driven) with discharge rating of 36 m³/hr shall be used to maintain pressure in fire distribution network. These pumps shall be connected to a common header of 12" dia. and runs across jetty for ground monitor and hydrants. Minimum line pressure at the farthest point of the jetty after losses is 7 kg/cm². Above pipeline will be tapped off from 12" dia. fire water network line at suitable location.

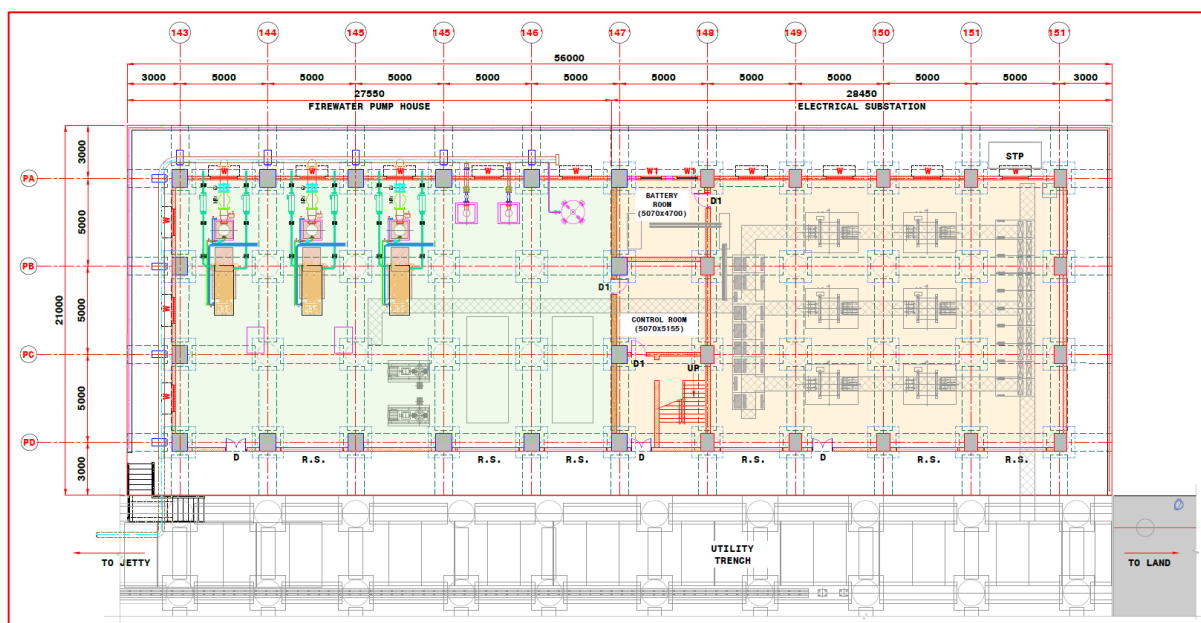


Figure 2.2 Plan view of Pumphouse cum substation

Following equipment shall be provided at Pumphouse cum substation building for firefighting requirement and for potable water supply system.

Table 2.1 Equipment list – Pumphouse

S. No.	Description	Capacity	Nos.
01,02 & 03	Fire water main pump – Diesel engine driven	360 m ³ / hr	03
04 & 05	Firewater jockey pump – Motor driven	36 m ³ / hr	02
06	High Pressure tank	3000 Litres	01
07 & 08	Pump for DTRO	600 m ³ / hr	02
09 & 10	DTRO plant	0.6 MLD	02

2.9. Material handling system

For material handling equipment for the main pumps, jockey pumps and other items inside the pump house, an Electrically Operated Travelling crane is proposed. The salient features of EOT crane are given below.

- Type of Crane : Double Girder EOT
- Capacity : 10MT
- Span : 15m
- Height of Lift : 8.0m
- Class of duty (As per IS 3177) : M5
- Hazardous Area Classification : Safe
- Long Travel (Bay Length) : 32m

The crane shall be designed within the head room provided (2700mm) under the roof of the pump house building above the corbel support for the crane rails.

2.10. International Shore Connection

International Shore Connections at one side of jetty shall also be provided at suitable locations. These shall be connected to the fire water mains through 6” pipeline along with isolating gate valves.

2.11. Fire Alarm System

The fire alarm panel shall be microprocessor based addressable type provided with a MIMIC layout diagram of the jetties. It shall have zone wise LED display for FIRE & FAULT conditions. The LCD display shall provide details of various FIRE & FAULT conditions. Provision shall be made in the panel for providing repeat annunciation to any other location. The panel shall provide potential free FIRE & FAULT contacts. The panel shall also have auto telephone dial facility. The panel shall be located at the control room.

The fire alarm system is provided with addressable Manual Call Points (Flameproof type) along the jetties and alongside the approach trestle. These shall be spaced at every 60 meters. These MCP shall be connected to the fire alarm panel by means of PVC insulated copper control cables.

2.12. Public Address & Talk Back System

The public address & talk back system proposed for the jetty shall consist of a main communication console located in the fire control room and speaker / talk back units located along the jetty and approach trestle. The spacing shall not be more than 100 meters on the approach trestle and jetty.

2.13. Fire Extinguishers

Suitable number of fire extinguishers, fire suit and first aid box shall be provided at jetty/control room as per guidelines of OISD-156. The proposed type, size and quantities are as follows:

- a) DCP 9kg = 10 Nos
- b) DCP 75kg (Wheeled) = 12 Nos
- c) Fire Fighting accessories as per OISD-156 Clause 4.10

2.14. Instrumentation & Control systems

- All instruments and equipment's are considered suitable for use in a hot, humid, marine and tropical industrial climate.
- As a minimum, all instruments and enclosures in field are considered weatherproof to min IP-65 for instruments & equipment located in field.
- All electronic/electrical instruments and equipment's are considered suitable for Zone-1 area classification as per IEC codes and tested by any recognized authority and shall be certified by PESO. Instruments shall be intrinsic safe or explosion proof.
- Fire resistant cable is considered for F&G signals and rest all cables are considered as Fire retardant cables.

2.15. Fire Water Distribution Network

The key features of the fire water distribution network systems proposed for the new facility are as under:

- The proposed system mainly consists of Fire Water Pumps, Network Pipe & Fittings, isolation valves, external hydrants, fire escape hydrants, hose cabinets with hydrant accessories, Water monitors at ground.
- The main network shall be laid aboveground on the concrete slab supported at every 6m span with steel supports from the deck slab.
- The external hydrants shall be provided at a spacing of not exceeding 30 m. throughout the jetty terminal. Every alternate hydrant shall be replaced by water monitors, which is to be operated manually during fire. Hydrant / monitors shall be placed alongside the berth / road for easy accessibility.



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- Hydrants shall be located at a minimum distance of 15 metres from the periphery of the tanker / vessel / dry dock or equipment under protection, so that the hydrants/ monitors are approachable & workable even in case of a serious fire.
- Each hydrant point shall be provided with one hose cabinet consisting of 2 Nos. 15 m long hoses with couplings and one branch pipe with nozzle will be suitably mounted on the wall or over ground near hydrant. Fog type nozzles shall be installed wherever live electrical equipment are likely to be involved in the fire (e.g. transformers)
- Fire escape hydrant valve will be located at or near floor landing of staircases at first floor of Fire water pump house /control room building. One first aid hose reel with shut-off nozzle shall be provided near fire escape hydrant to be used in case of small fires. Riser pipe feeding the fire escape hydrants is provided with isolation valve.
- The fire water distribution network piping layout is designed to supply water from two or more routes to each area. Adequate numbers of isolation valves shall be provided to ensure that when a particular section of piping to be isolated for maintenance work, the rest of the system remains in working condition all the time.

2.16. Portable Fire Extinguisher

The portable fire extinguishers are proposed to be in all facilities / buildings, and these can be used for extinguishing small fires. Portable extinguishers shall be provided as per Table -3 of OISD-156.

The extinguisher locations are decided based on following considerations:

- Travel distance of 15 meters maximum
- Uniform distribution,
- Easy accessibility,
- Nearness to doors, windows, emergency doors and escape routes

2.17. Brief Specifications of Major Fire Fighting Components

- Pipes up to and including 150mm NB shall conform to IS: 1239 Part-1 (Heavy) and pipes of 200mm NB and above shall conform to IS:3589 Black pipes shall be used for firewater network system.
- All pipes for sea water application shall be internally cement lined. For water curtain system, the pipes downstream of deluge valve & pipe for detector network shall be galvanized. The pipes carrying foam concentrate shall be of stainless steel.
- Isolating valves shall be gate valves of cast steel construction for hydrant system/ water curtain system. The isolation valve used in Foam concentrate line shall be of stainless steel.
- Hydrant valves shall be 63mm SS-316 ISI marked oblique pattern conforming to IS: 5290 Type A.
- Branch pipes with nozzle shall be 63mm SS-316 ISI marked short pattern (other than fog nozzles) conforming to IS: 903.



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- Fire hoses for hydrants shall be 63mm, Rubber-lined, with SS-316 instantaneous couplings duly bound at either end or conforming to IS: 636 Type-A.
- Hose cabinet shall be fabricated out of SS-316, with 3mm thick glass fronted doors suitable for holding two nos. fire hoses, one branch pipe with nozzle and one no. nozzle spanner.
- First aid hose reel shall conform to IS:884 and be provided with 36m long x 20mm dia. rubber hose pipe and gun metal shut-off nozzle.

2.18. Potable water Supply

The approximate freshwater requirement for domestic and industrial use is 550 m³ per day and hence it is proposed to have a desalination plant for supply of fresh water. The desalination plant capacity estimated for this purpose is 1.2 MLD. Two numbers of seawater pumps of capacity 600 m³/hour are provided to supply raw water to the desalination system.

Potable water to the jetties is to be provided through dedicated DTRO plant of 0.6MLD capacity located at the pump house.

High Density Polyethylene Pipes of diameter 8” nominal diameter has been proposed for the water supply system. Suitable diameter and the material classification HDPE pipe shall be as per IS 4984 – 1995 is given below.

Minimum required strength in MPa (PE 80) – 8 MPa

Maximum permissible working pressure MPa (PN 6) – 0.6 MPa

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3. TECHNICAL SPECIFICATION – FIRE FIGHTING WORKS

3.1. Scope of Work

The scope of work includes design, engineering and procurement, delivery to site, erection, testing, commissioning and handing over of fire-fighting System for ALCJ. The pump house building is supported over the pile foundation adjacent to the approach trestle in sea. The detailed design of the building has already prepared by the Design Consultant on behalf of Employer and the same shall be adopted by the Contractor. No major change to the building will be permitted. These shall include but not be limited to the following:

- a) Supply & installation of two (2) Main fire-fighting (vertical turbine type) Diesel engine driven seawater pumps (2 Main + 1 Standby) for Water Hydrant system including diesel drive and right-angle reduction gearing with propeller shaft coupling, control panels, including diesel tanks, associated piping, valves and pressure gauges, battery banks & battery chargers, cables, etc.
- b) Supply & installation of 1 no. of electrical motor driven vertical submersible type Jockey pumps including all accessories, DOL starters, cables, piping, valves pressure gauges, pressure sensors etc. complete for operation from control panel for maintaining the required pressure in water hydrant and tower monitor lines.
- c) Supply and installation of fire extinguishers as per OISD 156.
- d) Supply and installation of double headed fire hydrant of 63 mm size of SS 316 with necessary piping, controls etc. along with hose cabinets each with 2 nos. of 15 meters length reinforced rubber lined hose pipes with end couplings, nozzles, etc.
- e) Supply and installation of mild steel pipes with internal coating using glass flake & fittings for firefighting system including motorised valves, fittings, pipe supports, accessories, etc. Pipe lengths to be 12 meters with flanged joints and cement lined. All nuts, bolts, washers etc. used in the pipelines shall be SS 316. The flanges shall be forged steel type of suitable rating.
- f) Supply and installation of international shore connections at unloading platform.
- g) All Electrical and C & I for the complete fire-fighting system are under the scope of these works.

All the fire-fighting pumps shall be suitably installed inside the pump house building and keeping in mind the proper and efficient space utilization but without compromising the safety.

Notwithstanding the details furnished in this document, it shall be the responsibility of the Contractor to complete the work in all respects, commission and complete the final trials & performance tests to the satisfaction of Engineer's Representative / 3rd Party Inspection Agency.

This specification together with enclosed drawings outlines the functional requirements and the operating characteristics which the equipment must fulfil. Alternative technical features other than those specified may be acceptable subject to the approval of the Employer / Engineer. In any case,

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the performance of the system/ equipment delivered shall be guaranteed in every detail by the Contractor. Overall dimensions (boundary dimensions) and functional requirements as shown on drawings and/ or as specified shall be strictly adhered to.

All the power and control cables (including supply and laying) for entire firefighting system shall be under the contractor scope of work. Cables on approach trestle, fire pump room and control room shall be FRLS type. Fire Survival type cables shall be used on the jetty. All power & control cables shall be of approved makes. Flameproof / Explosion proof Junction boxes, Motors and cable glands shall be used.

Following documents shall be submitted by contractor for approval.

- i) GA drawing of drawings of complete systems as well as for sub systems.
- ii) GA drawing of diesel engine driven main pumps & Jockey Pumps.
- iii) Design Calculation(s), Data sheet(s), Performance curves of the Pump, etc.
- iv) P&I diagram of Fire Fighting system.
- v) GA & Layout of Fire pump house, Control room, etc.
- vi) Foundation Details of Pumps, Diesel Engines, Motors
- vii) Pipeline layout diagram.

Brief technicals write up of the system being offered and their design considerations shall be submitted. Technical schedules of all Pumps, Motors, and Diesel Engines, Jockey pumps, motorized valves, shall be furnished by the contractor for approval of Engineer's Representative.

The contractor shall prepare and submit a comprehensive scheme of training for a period of 3 months, covering all the systems such as fire protection system, foam system, Remote Control System etc. for operation, maintenance, troubleshooting etc. The programme prepared by the contractor shall be reflective and appreciative of the long-term interest in the sustained operation of the systems, equipment provided.

3.2. Vertical Turbine Firewater Pump - Main Pumps

The pumps shall be capable of direct suction from open sea and suitable for the lowest Sea water level. The pump shall be manufactured, tested and marked in accordance with NFPA-20, OISD 156, IS 12469-and other international standards & codes

The pumps shall be manufactured and supplied as required for fire protection service with specific drivers, controls and pump accessory items. It is the contractor's responsibility to comply with the requirements for the pump and controls from TAC and Underwriters Laboratories (UL) Listed Factory Mutual Research Corporation (FM) Approved or Equivalent.



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Pump characteristic shall meet the requirement of Tariff Advisory Committee and to be tested as per IS 1520. Selected pumps shall be capable of discharging 150% of its rated discharge at a minimum of 65% of the rated head. The shut-off head shall not exceed 120% of rated head for horizontal centrifugal pump. Pump shall witness hydrostatic pressure test to 1.5 the maximum design working pressure of pump. Pump casing must withstand the hydrostatic test pressure for a period of 5 minutes without evidence of rupture.

The complete assembled unit shall be designed so that all covered parts including shafts and bearings shall be easily accessible for inspection, maintenance and replacement with minimum down time. The rotor assembly with impeller and shaft sleeve shall be dynamically balanced at 150% of operating speed. Suction and discharge flanges shall be drilled in accordance with the standard IS 6392-1971. The gland packing should be easily accessible for changing without having to disassemble the pump.

Base plate and foundation bolts for mounting both the pump and drive shall be furnished. The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and pumping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic thrust etc. Suitable drip taps and drip lip shall be provided.

Operating philosophy for pump set shall be as follows:

- i. There shall be two independent lines from discharge header supplying sea water for firefighting system.
- ii. Motorised valves shall be mounted on the headers to control and direct the flow of fire water either to tower monitors or to hydrants and water curtain nozzles.
- iii. The Fire Fighting system shall be kept pressurised by the jockey pump.
- iv. Stopping of the major pump sets shall only be done manually by operation of the respective stop push buttons mounted near the pump.
- v. All pumps shall be capable of remote operation and shall be subjected to performance test.
- vi. The coupling between the prime mover and the pump shall allow each unit to be removed without disturbing the other.
- vii. For diesel engine driven fire water pump, the rated horse power of the diesel engine shall be higher of the following two values:
 - 20% in excess of the maximum horsepower required to drive the pump set at its duty point.
 - The BHP required to drive the pump is set at 150% of its rated discharge.
- viii. All the specifications of the system should suit the requirements of the selected engine, motors, Pumps & other Equipment.
- ix. A minimum six start attempt for each engine is required as performance criteria for this system.

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- x. All pumps shall have bolt foundation along with the heavy duty vibration damper. Each pump shall be provided with an adequate Name plate indicating Delivery Head, Capacity, RPM, etc. for the ease of operation & maintenance.

3.3. Diesel Engine

The diesel engine used shall be turbo-charged, compression ignition mechanical direct injection type, vertical inline, water cooled, heat exchanger type, four stroke, cold start, heavy duty compression ignition engine, capable of being started without the use of wicks, cartridges, heater plugs or ether, at an engine room temperature of 2°C and shall accept full load within 15 seconds from the receipt of the signal to start

The engine shall be provided with self-starting arrangement comprising of two independent sets of battery, cable & self-starter and manual cold starting kit. The rating and cooling system shall be such that the system will be able to work continuously for at least 6 hours under full load under ambient conditions without any overheating or any other problems. Each battery banks capacity shall be such that 8 attempts of starting will be possible with one set.

The engines shall be coupled with suitable propeller shaft flexible couplings to the gear box shaft with proper safety guards. Engine should also conform to TAC requirement / specification for fire-fighting use or UL / FM – listed and necessary certificates in this respect must be enclosed along with the submission. All technical submissions must be accompanied with detailed technical literatures, TAC approved certificate for pump & engine and detail drawing of steel skid frame for technical scrutiny. Technical submissions must also be accompanied with detailed foundation drawing and electrical/instrumental panel connection drawings.

The engine shall have protection against low lube oil pressure, high lube oil temp and high-water temp. The Engine must be capable of remote operations as well as manual operations. All necessary gauges such as lube oil gauge, water temperature gauge and lube oil pressure gauge to be provided and mounted on a separate panel kept away from the engine with necessary piping etc. and fitted to the same base plate with anti-vibration mounting. Silencer/muffler and other standard accessories are to be provided as necessary. Engine performance to be tested and certified as per IS: 10002.

M.S. (6mm thick) diesel tank of all welded construction shall be provided. The capacity selected for the diesel of the tank shall be sufficient to allow the engine to run on full load for six hours continuously, however the capacity of diesel tank shall not exceed 990 litres if higher capacity required then multiple tanks of 990 litres shall be provided. The tank to be provided with all necessary level gauges so that oil level in the tank can be viewed from outside the digital/analogy feedback of oil tank shall be provided inside the control room. Necessary hoses, for transfer of fuel from tank to fuel pump and return line from injector leak off to fuel tank to be provided. Additional engine starting panels for all engines shall be provided preferably wall mounted, comprising of start button, stop button, ammeter, battery charging indication with necessary piping & cables at the

pump room. The exhaust pipe of the diesel engine should be extended to outside the pump house and exhaust discharged at an appropriate height in the open air.

- Utilization: To give Drive to the pump specified
- Engine HP: To be selected based on Power requirement of Pumps.
- Speed: As specified by manufacturer
- Battery Starting: Minimum estimated starting time per attempt to be 3 sec.
- Battery Voltage: 24V DC
- Gear Drive: As per requirements
- Coupling: Mechanical Flexible Coupling.

3.3.1. Cooling System

A heat exchanger, the raw water being supplied from the fire pump discharge (taken off prior to the pump discharge valve) via a pressure reducing device, if necessary, to limit the applied pressure to a safe value as specified by the engine manufacturer. The raw water outlet connection shall be so designed that the discharged water can be readily observed. The water in the closed circuit shall be circulated by means of an auxiliary pump driven from the engine and the capacity of the closed circuit shall not be less than that recommended by the engine manufacturer. If the auxiliary pump is belt driven then there shall be multiple belts so that if half of the belts break, the remaining belts shall be capable of driving the pump. A failure actuated audio-visual alarm shall also be incorporated. The engine cooling loop shall have pressure reducing valve / orifice & pressure Solenoid Valve and it should allow flow through cooling loop only in the event of start of engine. It is possible to route the outlet of the cooling line back to suction header/ tank and therefore the system should work under back pressure of 1.5 kg/cm².

3.3.2. Lubrication System:

The lubrication system shall be self-contained with the following equipment:

- i. Sump: To store sufficient oil for circulation, suitable sump shall be provided in the engine.
- ii. Pump: Suitable pump shall be provided for forced lubrication.
- iii. Filter
- iv. Lubricating oil cooler
- v. Interconnecting piping

3.3.3. Air Filtration

The air intake shall be fitted with a filter of adequate size to prevent foreign matter entering the engine. Dry type air filter, heavy duty type with replaceable elements shall be provided. Efficiency of the system as also at various stages shall be furnished. Air shall be provided with a shield for

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protecting the filter element, and a ramp for deflecting dirty air onto the inner surface and along the axis of the casing, to improve efficiency of operation.

3.3.4. Exhaust System

The exhaust shall be fitted with a suitable silencer and the total backpressure shall not exceed the engine maker's recommendation. When the exhaust system rises above the engine, means shall be provided to prevent any condensate flowing into the engine. All the hot parts located at the working level shall be insulated. The exhaust system has to be designed assuming stack height as per Pollution Control Board norms. The exhaust system shall include:

- i. Exhaust manifold
- ii. Silencer: Sufficient length of straight pipe shall be provided after the exhaust silencer to leave the gases at sufficient height outside the pump room
- iii. Expansion joint

3.3.5. Engine Shut-Down Mechanism

The fire water system will be automated, hence the engine should be suitable for starting in a predefined sequence, the shutting down operation shall be manual operated and the engine should return automatically to the starting position after use.

3.3.6. Fuel System

- i. Fuel: The engine fuel oil quality and grade shall be as specified by engine makers. These shall be kept on hand at all times, sufficient fuel to run the engine on full load for 6 hours, in addition to that in the engine fuel tank.
- ii. The fuel tank shall be of welded steel constructed to relevant Indian Standard for Mild Steel Drums.
- iii. The tank shall be mounted above the engine fuel pump to give gravity feed unless otherwise recommended by the manufacturer.
- iv. The tank shall be fitted with an indicator showing the level of the fuel in the tank. The capacity of the tank shall be sufficient to allow the engine to run on full load for 6 hrs. The tank should also have level switch for low fuel level and tripping of pump/ alarm. Each tank should be fitted with isolation valve.
- v. There shall be a separate fuel tank and fuel feed pipe for each engine. Any valve in the fuel feed pipe between the fuel tank and the engine shall be placed adjacent to the tank and it shall be locked in the open position. Pipe joints shall not be soldered and plastic tubing shall not be used.

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3.3.7. Auxiliary Equipment

The following shall be provided:

- i. Fuel pump, fuel injection and control system for compression ignition.
- ii. A sludge and sediment trap.
- iii. A fuel level gauge and a level switch of approved make to signal fuel less than or equal to 30% of tank capacity.
- iv. An inspection and cleaning hole.
- v. A duplex filter between the fuel tank and fuel pump mounted in an accessible position for cleaning.
- vi. Means to enable the entire fuel system to be bled of air. Air relief cocks are not allowed; screwed plugs are permitted.
- vii. One number of portable pneumatic driven diesel transfer pumps of 50 LPM capacity shall be provided for refilling of diesel in the fuel tank

3.3.8. Starting Mechanism

Provision shall be made for two separate methods of engine starting viz.

- i. Automatic starting:
Automatic starting shall be done by means of a battery powered electric starter motor incorporating the axial displacement type of pinion, having automatic repeat start facilities initiated by a fall in pressure in the water supply pipe to the sprinkler and/or hydrant installation. The battery capacity shall be adequate for eight consecutive starts without recharging with a cold engine under full compression.
There shall be two independent battery banks with battery, cable & self-starter and manual cold starting kits.
Each engine shall be provided with two sets of batteries. One set shall be connected in the starting circuit and the other shall be standby and kept charged.
- ii. Manual starting:
Manual starting by electric starter motor thru Push Button in Panel or Key in Local start station shall be provided.

3.3.9. Governing System

The engine shall be provided with an adjustable governor capable of regulating engine speed within a range of 10% between shut-off and maximum load conditions of the pumps. The governor shall be set to maintain rated pump speed at maximum pump load the governor shall be capable of operating without external power supply.

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3.3.10. Instruments

Instrument control and protection required for the safe operation of the engine shall be provided. Instrument Panel on engine shall consist of (minimum)

- Starter Switch
- Lube Oil Temperature Gauge
- Water temperature Gauge
- Lube Oil Pressure Gauge
- Ammeter
- Tacho hour meter

3.3.11. Codes and Standards for the Diesel Engine

IS: 10002 – 1981 : Specification for performance requirements for constant speed compression ignition (diesel) engines for general purposes (above 20kW).

3.3.12. Name Plate

A corrosion resistant nameplate shall be permanently attached to the pump and prime mover. The nameplate shall be stamped with the following information:

- a) Manufacturers name
- b) Serial number
- c) Model number
- d) Rated capacity
- e) Rated head
- f) Speed in rpm
- g) Rating of the prime mover

3.3.13. Painting & Protection

- a) The pump and prime mover shall be painted Fire red (Shade No.536 as per IS:5) and suitably marked for identification.
- b) Unpainted exterior like machined surfaces shall be coated with suitable rust preventive.
- c) All threaded openings shall be plugged and flanged openings shall be provided with full flange dia. protective covers. The cover material shall be 4.5 mm thick metal plate bolted to the flange with a gasket in between using a minimum of four bolts.

3.3.14. Electrics

Each diesel engine driven firewater pump shall have an independent control/panel. The panel shall be of 240 V supply & shall give following Audio (A) Visual (V) alarm

- a) Engine Fails To Start : (A&V)



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- b) Low Lube Oil Pressure : (A&V)
- c) High Lube Oil Temperature : (A&V)
- d) High Water Temperature : (A&V)
- e) Low Fuel Level : (A&V)
- f) Engine Over Speeding : (A&V)
- g) Engine Running Normal : (V)
- h) Fuel Level Normal : (V)
- i) Power On (Battery Charged): (V)

Set of potential free contact points should be provided to connect the panel to REMOTE CONTROL SYSTEM.

3.3.15. Panel

The panel shall consist of:

- i. Push buttons, Auto/manual selector switches, circuits with auxiliary contactors and interlocks for starting/stopping/regulating of diesel engine pumps as per technological requirements mentioned elsewhere in the specification. Electronic timers shall be provided for achieving the logic of engine starting (for 8 trial starts) etc.
 - Provision of auto start of engine driven fire-fighting pump sensed by pressure loss.
 - Facility to start engine manually by means of push button / key
 - Panel should be suitable for engine with manual fully shut off arrangement for stopping the engine.
- ii. Battery Charger with provision of Boost & trickle charging and SC & O/L protection. The charger shall have the capacity to charge both the main and standby set of batteries.

3.3.16. Battery

Each diesel engine pump shall have independent 24 V DC lead acid battery (SMF) with teak wood stand and accessories, rated for quick starting of diesel engine. All power and control cabling (supply) between diesel engine control panel and Engine/Battery Charger/Batteries (Working and standby) is included in the scope. The Battery shall be 1+1 (1 working + 1 standby) with manual quick changeover facility.

3.3.17. Packing

- i. The Diesel Engine, pump& accessories etc. shall be packed, securely anchored and protected for domestic shipment by rail or truck. All unmounted components shall be suitably crated and firmly attached to the main pump unit for shipment.
- ii. The purchase order number and equipment number shall be stencilled on the crate.
- iii. One complete set of installation, operation and maintenance instruction shall be packed with the pump set.

3.3.18. Spare Parts

The Contractor shall supply the following spare parts for each of the diesel engines.

- i. Two sets of fuel filters, elements and seals,
- ii. Two sets of lubricating oil filters, elements and seals,
- iii. Two sets of belts (where used),
- iv. One complete set of engine-joints, gaskets and hoses,
- v. One No. of Inlet and Exhaust Valve each
- vi. One set of piston ring and 2 Nos injector nozzle
- vii. One Solenoid valve

3.4. Jockey Pump

Electrical motor driven vertical submersible type Jockey pumps shall be used in the pump house to maintain a required pressure in the fire water line. This pump will have auto cut in and cut out depending upon the pressure losses in the main pipeline due to any leakage and maintain the line in constant pressure. Since the proposed main pumps are designed to start automatically due to loss of pressure, the same will help to prevent the main fire water pumps from starting in case of NO FIRE conditions. Jockey pumps shall be capable to start automatically as well as manually.

Stopping of jockey pumps shall occur automatically due to restoration of system pressure sensed by pressure switches. The general information of the jockey pump shall be as per Table 3.2.

3.5. Fire Water Distribution Network

MS pipe of 12" NB dia. (minimum) shall be used as fire water distribution network. The diameter of the pipeline shall be established after the completion of pipeline hydraulic and network analysis during detailed engineering. Within the pump house, there shall be a 600 NB (24") header pumping sea water through the pump sets. Two sets of branch out connections from header shall be used for the following.

- Tower Monitor Line
- Hydrant Line

Pipes up to and including 150mm NB shall conform to IS: 1239 Part-1 (Heavy) and pipes of 200mm NB and above shall conform to IS:3589 Black pipes shall be used for firewater network system.

The header line shall be connected to air cushion tank to minimize the shock due to the sudden start and stop of the pumps. Both the fire water headers shall be externally connected by normally closed MOVs. These valves shall be operated only in the event of an emergency or to provide an alternative path of flow for water while a section of the system is under maintenance. Suitable pressure gauges to be provided in the fire headers / foam line at strategic locations. All exposed pipes shall be painted with a suitable painting system rated for marine seawater conditions.

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The Contractor shall provide the required pipe support, specials reducers, expanders, puddle pipe, fittings, flanges, gaskets, nuts and bolts etc. Fabrication and inspection of pipelines shall be in accordance with following codes: B1S-9595, 814, 822, 4853, 3703 and as per TAC guidelines.

10% of field weld joints shall be x-ray tested and if the results are unsatisfactory, the same has to be removed, re-welded and radio graphed to ensure sound weld. Doubler plates for piping supports shall be provided by contractor for running the main firefighting pipelines on approach trestle. The Contractor as required at his cost shall provide necessary steel clamps, saddles and support for duct foot bends etc. Suitable support pads to be provided to the pipelines wherever it rests on the pedestals. The vertical pipeline to water shall also be properly supported / fixed by providing suitable steel brackets/clamps and stays etc.

All pipelines to be laid on unloading platform, approach trestle and pump house are to be supported by providing steel saddle with clamps fittings and fixtures.

All pipelines shall be hydrostatically tested to 1.5 times of their respective operating pressure.

All pipes should be supplied in complete conformity to all requirements specified in the standards. Suitable pressure gauges to be provided in the fire water network / foam injection lines at strategic locations. Hydraulic pressure drop calculations shall be provided for each of the 3 pipelines namely Monitor System, Hydrant System and Foam System. The calculations must ensure that the pipe sizing being considered is adequate to ensure that the required pressure is being achieved at the base flange of each of the outlet equipment such as tower monitors, base monitors, hydrants, water curtain system etc.

The maximum allowable flow/velocity in the system should be not more than 2.5 m/s. The contractor shall calculate and confirm the pipe dia. and thickness prior to procurement and obtain approval from the Engineer's Representative.

Pipes shall be kept thoroughly clean during the course of installation. The ends of pipes shall be blocked with wooden plugs wedged home, at the end of each day's work to prevent dirt, rodents and insects etc., entering the pipe. The general information of the fire water header / pipeline network shall be as per shown in Table 3.3.

3.6. Pipe Protection

The sea water pipelines are envisaged to be flanged connections with stainless steel bolts. To the extend it is practical, all pipe sections and standard size fittings such as bends, reducers, tees etc. shall be flanged welded, cement lined and external painted in factory. The external paint system shall be such that it shall be guaranteed by the paint manufacturer for marine sea water environment. Only final finish coat of paint in approved colour shall be carried out at site after completion of the installation and testing process. All flanged pipe sections and flanged pipe fittings shall be inspected and cleared for dispatch from the factory.

3.7. Hydrant System

- i. Double headed hydrant shall be provided on berth area, along approach trestles, pump house / substation. Single headed hydrant shall be provided at each floor of control room building.
- ii. The hydrant system is designed to cater to the single largest fire demand likely to be posed at any of the various areas as referred earlier at seaside berth and landside berth.
- iii. All the hydrants are 63 mm size, 900 lpm of SS316 construction with instantaneous male couplings. Hydrant posts shall be spaced as per OISD 156.
- iv. Each double headed hydrant stand-post shall comprises of a vertical flanged tap-off of 100 NB from the main pipeline with an isolation gate valve, orifice plate flange as per standard practices. Each hydrant shall be numbered.
- v. The water will be supplied to hydrants from the common pump and pipe line provided for the ground monitor system.
- vi. Each equipment used in the system shall comply with TAC requirements in all respects.
- vii. Fire hydrant shall generally conform to IS: 5290 Type A. This shall be tested as per relevant BIS code. The ends shall be fixed with male couplings. Material of construction of hydrant valve branch pipes and coupling shall be SS: 316 of approved make. All hydrant outlets shall be situated 1.4 metre above floor level.
- viii. **Orifice Plate:** Suitable size of orifice plates of SS 316 construction shall be provided at all hydrants. The general information of the hydrant system shall be as per shown in Table 3.4.

The key features of the firewater systems proposed are as under:

- i. The proposed firewater system mainly consists of Fire Water Pumps, jockey pump, firewater network pipe & fittings, isolation valves, external hydrants, fire escape hydrants, hose cabinets hydrant accessories, Water monitors at ground.
- ii. The firewater network shall be laid aboveground on pedestals or taking supports from proposed pipe rack.
- iii. The external hydrants shall be provided at a spacing of not exceeding 30 m. throughout the jetty terminal. Every alternate hydrant shall be replaced by water monitors. Hydrant / monitors shall be placed alongside the berth for easy accessibility.
- iv. Hydrants shall be located at a minimum distance of 15 meters from the periphery of the tanker or equipment under protection, so that the hydrants/ monitors are approachable & workable even in case of a serious fire.
- v. One hose cabinet, consisting of 2 Nos. 15 m long hoses with couplings and one branch pipe with nozzle, will be suitably mounted on the wall or over ground near hydrant. Fog type nozzles shall be installed wherever live electrical equipment are likely to be involved in the fire (e.g. transformers)
- vi. Fire escape hydrant valve will be located at or near floor landing of staircases at first floor of Fire water pump house /control room building. One first aid hose reel with



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- shut-off nozzle shall be provided near fire escape hydrant to be used in case of small fires. Riser pipe feeding the fire escape hydrants is provided with isolation valve.
- vii. The fire water network piping layout is designed to supply water from two or more routes to each area. Adequate numbers of isolation valves shall be provided to ensure that when a particular section of piping to be isolated for maintenance work, the rest of the system remains in working condition all the time.
 - viii. Proposed firewater network system shall be connected to the existing Jetty network for redundancy of both the systems.

3.8. Hose Pipes and Hose Cabinet

The pipes shall be of fabric reinforced rubber lined woven jacketed for fire fighting purposes of approved make Hose pipes dia. 63 mm and length of 15m and tested to a bursting pressure of 42 kg/cm² and Proof Pressure 22Kg/cm² as per IS: 636/1988 Type B with IS mark fitted with SS 316 size 63mm. Both ends shall be provided with female hose couplings as per BIS: 903. Hose cabinet shall be suitable for housing 2 nos. hose pipes of above length, branch pipe and nozzle as required. Minimum 3mm SS 316 sheet to be used for fabrication of hose cabinet. The cabinet shall be located near to hydrant with suitable supporting / base.

The box shall be provided with double door and shall have locking arrangements. Provision for break glass recess for key shall be given in the box. The front doors shall be provided with transparent acrylic sheet fitted with rubber beading for transparency. The box shall be capable to resist the weight of hose with couplings. Suitable wall mounting bracket shall be provided in the cabinet.

3.9. First Aid Fire Fighting Equipment

The first aid equipment shall consist of portable fire extinguishers. For extinguishing small fires and for first aid use, it is proposed to have portable fire extinguishers and wheel mounted extinguishers. These portable extinguishers shall be of a pressure type using dry chemical powder. They shall be located on the unloading platform and breasting dolphins and at other strategic points. Carbon dioxide portable fire extinguishers (6.8 kg) shall be installed in the control and electrical room.

3.9.1. 75 kg DCP Fire Extinguisher (ISI Mark)

- i. Made of 6 mm thick M.S. Sheet (B.Q. Plate & design of vessel as per IS:2825) with radiography quality welding. The Extinguisher shall be conforming to IS:10658 (Latest) with ISI Mark duly embossed / punched. The Extinguisher shall be treated with anticorrosive treatment. Nonferrous parts shall be gunmetal. Design calculation of the extinguisher shall be submitted along with the offer.
- ii. The hose shall be of minimum 05 metres length and the bursting pressure shall not be less than 50 Kg/cm².



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- iii. Drain plug of not less than 25 mm diameter to be provided on the body.
- iv. The nozzle shall be of Trigger Controlled and capable of discharging powder as per ISI Specification.
- v. Automatically and manually operated Safety Relief Valve to be provided as per IS:10658 (Latest) specification.
- vi. Pressure gauge having minimum 50 mm dia. and range from 0 to 42 Kg/cm² to be provided on the body.
- vii. The extinguisher to be mounted on robust trolley having two heavy duty bearing fitted rubberised wheels and strong handles for easy mobility.
- viii. ISI Marked CO₂ gas cylinder shall be of suitable capacity and shall be approved by Department of Explosives with protector and thermal insulation and to be fitted with ISI Marked wheel type Valve.
- ix. Dry Powder with ISI Mark IS:4308 (Latest). The powder shall be packed in plastic rigidex material type bags with heavy duty LD lines duly hermetically sealed. The materials of packing and sealing is to be made in such a way that if the pack is kept inside the water bucket for 24 hours, not a single drop of water will penetrate inside the bag & the characteristics of the powder shall remain unaffected against moisture.
- x. Painting: The paint system offered shall be suitable for marine sea water location. The colour of finish coat shall be of approved shade.
- xi. As per IS: 2825, Dye penetrated test of the fillet weld of all nozzles and attachment – No discontinuities in the welding.
- xii. As per IS: 2825 Radiography (10% covering 50% of "T" Joints) - No discontinuities allowed.
- xiii. The extinguisher shall be hydro tested at 30 Kg/cm² and shall not develop any leaks at this pressure.
- xiv. In addition to markings stipulated in IS:10658 (latest) the following permanent punching at the bottom ring is required:
 - a) Manufacturer's name.
 - b) Year of manufacturing.
 - c) Manufacturer's serial number.
 - d) Purchase Order No. and date.
 - e) Inspector Stamp.
 - f) The date of hydraulic test shall also be marked. Space shall be left for writing the dates of subsequent hydraulic test.
 - g) Dry Chemical Powder filling height shall be marked on the extinguisher.
- xv. Following checks to be carried out:
 - a) Extinguisher is as per IS: 10658 (Latest) with ISI Mark.
 - b) Design calculation of extinguisher is correct.
 - c) Design of vessel as per IS: 2825.
 - d) ISI Marked CO₂ gas cylinder approved by department of explosives.

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- e) Dry Powder is with ISI Mark. The packaging material to be tested as per clause 4.1.1. of IS: 4308/1982. Also the material of the packing should be as per the specification only. Extinguisher vessel to be hydro tested at 30 kg/sqcm.

3.9.2. 5kg DCP Fire Extinguisher (ISI Mark)

With ISI Mark-2171 (Latest) complete with initial charge of CO2 cartridge (200 gms) with ISI Mark-4947 (Latest) and dry chemical powder with ISI Mark-4308 (Latest).

The Fire Extinguisher shall consist of the followings:

- i. Size of filler opening (inner dia.) shall be 63 mm.
- ii. Cap shall be of gunmetal / forged brass with chromium plating / black colour.
- iii. Hose shall be of braided plastic high pressure with one-meter length with nozzle of ABS Plastic.
- iv. All other components, design and performance, anticorrosive treatment shall be as per IS:2171 (latest).
- v. Certification that every extinguisher shall be radiography quality welding and fabrication and design of vessel as per IS:2825, 10% radiography of weld joints to be done. Design calculation of the extinguisher shall be submitted along with the offer.
- vi. In addition to markings stipulated in IS:2171 (latest) the following permanent punching at the bottom ring is required:
 - a) Manufacturer's name.
 - b) Year of manufacturing.
 - c) Manufacturer's serial number.
 - d) Purchase Order No. and date.
 - e) Inspector Stamp.
 - f) The date of hydraulic test shall also be marked. Space shall be left for writing the dates of subsequent hydraulic test.
 - g) Dry Chemical Powder filling height shall be marked on the extinguisher.

3.9.3. 6.8 kg CO2 Fire Extinguisher (ISI Mark)

CO2 type 6.8 Kg. capacity fire extinguisher assembled out of seamless steel cylinder having Explosive (CCE) Approval and ISI Mark (manufactured to IS:2878) complete with ISI marked wheel type valve, one metre length high pressure wire braided discharge hose with horn, mounted on two wheeled rubber tyre trolley and handle. The cylinder shall be fully charged with CO2 Gas. All other components, design and performance, anticorrosive treatment shall be as per IS:2878 latest. In addition to markings stipulated in IS:2878 (latest) the following permanent punching to be provided:

- a) Manufacturer's name.
- b) Year of manufacturing.
- c) Manufacturer's serial number.

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- d) Purchase Order No. and date.
- e) Inspector Stamp.

3.10. Valves

3.10.1. General

- i. All valves selected shall be strictly in accordance with the relevant fire-fighting codes & must be capable to withstand the requirements of the system under all conditions without getting failure.
- ii. All the equipment shall be designed manufactured and tested as per the Indian Standards/ British Standards given in the relevant paragraphs.
- iii. All valves shall be so designed that the effort! Torque required to operate the valve is minimum.
- iv. All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate. Each control valve shall be sized and selected to provide reliable operation and control at the specified operating and design conditions.
- v. All valves shall be designed for 100% tight shut off condition.
- vi. All the valves shall be provided with geared hand wheel. The face of the wheel shall be clearly marked with the words i.e. Open / Close and an arrow to indicate the direction for opening/closing.
- vii. For all the Ni-resist cast iron valves body shall be so designed that at all point, wall thickness is greater than the minimum specified in the various standards. Particular attention should be given to the distribution of material to limit the stresses within permissible range and to prevent stress concentration anywhere in the valve design.
- viii. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
- ix. The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. Nothing in this specification shall be construed to relieve the Contractor of his responsibility. Compliance to this specification shall not relieve the Contractor of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions
- x. The Valves shall be of motorised actuated valve confirming to IS:13114, ISO:15407 or equivalent. The electrical signal from the control panel shall actuate the valve.
- xi. Non return valve (NRV) shall be used to stop backflow & to ensure the flow on water in required direction only.
- xii. All valves shall be designed considering 100 Cycles of On-Off operation in a day.
- xiii. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.



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- xiv. The direction of flow shall be clearly stamped on the body of the valve. Riveted tags are acceptable
- xv. All gate and globe valves shall have bonnet-back seating arrangement
- xvi. All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be suitable flanged.
- xvii. The valves shall be designed on the basis of the following :
 - The internal parts shall be suitable to support the pressure caused by the actuators;
 - The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
 - All valves shall be provided with hand operated gearing provision for manual override so that they can also be operated manually when needed.
- xviii. All valves shall be capable of being closed against the design pressure. Where globe valve has been specified for regulation purpose, the disc shall be tapered plug type and suitable for controlling throughout its lift.
- xix. All valves shall open/ close fully within time required by the process but not later than 30 seconds after actuators starts with feedback. All valves shall be capable of sealing with design pressure applied from either end of the valve.
- xx. All valves shall have electrical feedback for positions. All valves shall have a mechanical manual operating facility.
- xxi. All operating spindles and gears shall be provided with adequate points for lubrication.
- xxii. Head loss curves through the valves for throttled flow conditions shall be provided for all valve sizes
- xxiii. The contractor shall submit the following:
 - Assembly drawings.
 - Manufacturer Valid quality certifications ISO or equivalent.
 - Certified copies of Manufacturer quality control Test results and reports.
 - Assembly shop drawings.
 - Instruction & training manuals.
 - Catalogues.

3.10.2. Gate Valves

- i. The Gate valves used shall be capable in accordance with the site's atmospheric condition.
- ii. All the gate valves shall have mechanical position indicator with adjustable position stopper and lock to prevent over travel. Gate valves shall conform to IS: 780-1984 RA 1990 or IS: 2906 - 1984 RA 1990.
- iii. Gate valves of adequate size be provided with by pass and drain arrangement. All the isolation valves, of size above manufacture from forgings.
- iv. All gate valves should comply with ISO 6002, IS:14846, IS:11323, IS:11335 or equivalent.



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- v. The test pressure shall be min. 1.5 times nominal pressure rating of the valves.
- vi. The valves shall be suitable for motorised actuated as well as hand wheel operation at least against the pressure differentials preferably geared type to reduce the operating tensions.
- vii. Bodies of valves shall be double-flanged ends and shall be fitted with seat rings securely fixed in machined recesses. The strength characteristics of the metal selected, appropriate to the standard flange thickness shall be according to IS 210:1978. Stem shall be of stainless steel and forged or machined from forged/rolled bar. No casting is permitted.
- viii. Hand wheels shall preferably be of the marine pattern conforming to IS 11218:1984.
- ix. The valve shall have internal parts made up of copper alloy or stainless steel; resilient seats shall not be used.
- x. Valve shall have seals and gasket made up of material suitable for the proposed application.
- xi. Where shafts enter castings they shall be provided with corrosion resistant bushes to prevent galvanic corrosion
- xii. Hydraulic testing of valves shall be in accordance with the requirements of IS 6157
- xiii. Valves shall be marked in accordance with the requirements of IS 9866
- xiv. All valves ordered shall be supplied with their body ends suitably sealed to exclude foreign matter during transit and storage.
- xv. Unless otherwise indicated in the Tender Documents for an alternative coating system, the internal and external surfaces of valves shall be prepared and coated with epoxy paint. The final coat shall be applied to external surfaces after installing the valves. All valves shall be painted externally before despatch.
- xvi. Main bearings shall be external. Valves with bearings that are accessible without emptying or removal of the valve body from the line shall be given preference. Bearings shall offer a long life and retain a low coefficient of friction.
- xvii. The gate valve shall have electrical feedback for position.

3.10.3. Non Return Valve (NRV)

- i. The swing check valves (non-return) provided in the piping system shall conform to IS:5312 or BS 5153 : 1974 (1991).
- ii. Non-return valves shall be double flanged for horizontal and vertical installation.
- iii. The valves shall offer minimum hydraulic resistance, shall not be subject to disc flutter and shall give a quick non-slam closure on reversal of flow.
- iv. The design of the body and body seals shall be such that they are free from pockets which may cause eddies or accumulate debris. Special care shall be taken that foreign objects, like bolts, cannot lodge in pockets on the downstream side of body seats and thereby prevent doors from closing fully.
- v. Access openings and covers shall be well designed and the creation of stress risers shall be prevented.



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- vi. Where shafts protrude through the valve at the non-drive end (NDE) they shall have flanged and bolted stainless steel, grade 316, bearing cover plates.
- vii. Sealing faces shall be securely fixed with a corrosion resistant material or shall be deposit welded with stainless steel. Corrosion protection of the contact area between mild steel and stainless steel shall be in accordance with Standard Specification.
- viii. Bearings shall be substantial and shall be designed to take the unbalanced thrust on doors or discs in the structural test.
- ix. Valve components shall be constructed of the material specified in the relevant latest standards.

3.10.4. Motorized Actuator for Valves

- i. The motor shall be flameproof 3-phase squirrel cage TEFC class F insulated (temperature rise limited to class B) IP 67 enclosures both for motor and its terminal box, and with high starting torque. The duty cycle shall be S2- 600 cycles per hour. Wherever required and specially, for outdoor duty, the motor shall be provided with anti-condensation heater.
- ii. Thermistor protection of motor with thermistor motor protection relay shall be provided, as required.
- iii. Each actuator shall be provided with extremely dependable both 'Open' and torque and / position limit switches. The torque and limit switches shall be provided with suitable means like mechanical selection, end position. The torque switch should not unnecessarily trip during initial unseating hammer blow effect. The anti-hammer feature of the torque switch latch shall be available throughout travel including at end position. Once the torque switch has tripped in either direction, it can only be reset by operation of the actuator in the opposite direction. Each switch shall have 2 No + 2 NC potential free double break contacts. Switch contact rating on inductive Circuits shall be 5A AC at 240 V AC.
- iv. Actuator shall be provided with motor over-riding feature like hand wheel for emergency manual operation and a limit switch shall be provided whose contacts shall be used in the motor control circuit to forbid the motorized operation during manual operation by hand wheel. Also when the motor is switched 'ON', the hand wheel connection shall be discharged automatically, Motor operation shall always have priority over manual operation.
- v. Internal wiring shall be tropical grade PVC insulated, stranded copper conductor cable of suitable rating for control circuits and required rating for motor. All wires shall be clearly numbered at both the terminal block and component ends. The Voltage grade of cables/wires shall be 1100 V terminals shall be segregated from the control terminals by means of an insulating cover. Separate terminal box fitted to switching unit shall be provided. The terminal box shall- be designed for the protection class of IP - 65 inside of the terminal shall be provided attached to the inside of the terminal



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box cover indicating serial number, external voltage values; wiring diagram number and terminal layout.

- vi. The actuator shall be suitable for operation at specified ambient temperature. All actuators whether for explosion hazardous locations or not, shall be neoprene O-ring sealed water tight and dust proof to IP-67 protection and shall at the same time have an inner watertight neoprene O-ring seal between the terminal box and the internal electrical elements of the actuator, fully protecting the switch mechanism, motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal box cover is removed on site for cabling / maintenance. Actuators for explosion hazardous application shall in addition be certified explosion proof of specified class group and division.
- vii. The actuators shall be operated from the control desk / Local Control shall be provided for local operation of the actuator for testing and maintenance purpose. Isolator along with starter for the actuator motor shall be located in the actuator. Separate power & control cable shall be used for each valve actuator.
- viii. The equipment shall comply with the requirements of latest revision of the standards. The actuator shall be sized to guarantee valve closure at the specified differential pressure and temperature.
- ix. The equipment shall also conform to the provisions of Indian Electricity Rules and other statutory regulations currently in force in the country.
- x. The offered equipment shall be brand new with state of the art technology and a proven field track record. No prototype equipment shall be offered.
- xi. The actuators shall be suitable for operating under site conditions and system conditions as specified.
- xii. Each actuator shall include the motor, actuator unit, gears, position indicators, limit switches, hand wheel, electrical starter and controls, terminal box, push button etc. as a self-contained unit. The actuator shall be sized to provide adequate torque and or thrust to ensure the complete intended travel of the valve under the worst operating and electrical power supply conditions.
- xiii. The motor shall be designed for valve actuator service with high starting torque and shall be suitable for Direct on line starting. It shall be rated for S2-15 minute duty and shall conform to relevant standards.
- xiv. The motor shall be provided with thermostat(s)/thermistor(s) embedded in the hot spots of motor winding for protecting the motor.
- xv. The motor shall be able to operate the actuator at 75 % of rated voltage.
- xvi. The motor shall have class 'F' insulation with temperature rise limited to class 'B' limits. Motor winding shall be treated to resist corrosive agents and moisture.
- xvii. Motor rotor shall preferably be of die-cast aluminium and, if brazed, shall be free from phosphorous.
- xviii. The reversing starter, control transformer and local controls shall be integral with the valve actuator, unless specified otherwise. Solid state control of valve actuator and

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electrically isolated interface for remote control requirement shall be provided, wherever these features exist in manufacturer's design.

xix. The integral starter shall be supplied with the following devices:

- Electrically and mechanically interlocked reversing contactors for opening and closing operations.
- Control transformer with necessary tapping and protected with suitable easily replaceable fuses.
- Terminal block for external cable connection fully prewired for internal devices of valve actuator

The actuator gearing shall be totally enclosed in oil-filled gear case suitable for operation at any angle. Grease lubrication is not permissible. All drive gearing and components must be of metal construction and incorporate a lost-motion hammer blow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gear case for inspection or disassembled without releasing the stem thrust or taking the valve out of service. For 90° operating type of valves drive gearing shall be self-locking to prevent the valve back-driving the actuator.

Torque limit switches shall be provided to protect the motor from over-loading by cutting-off the power supply to motor during opening and closing operations. The limit switches shall be preset. It shall be possible to set the value of maximum torque during closing from 50% to 100% of rated torque of actuators.

Travel limit switch shall be provided to cut-off the power supply to the motor at the end of preset limit of valve travel. The switches shall be provided with requisite number of potential-free contacts for valve actuator operation and for indication on remote panels.

A hand wheel with hand/auto lockable lever shall be provided for emergency operation of the MOV. The energisation of the motor shall automatically re-engage power operation. Vendor shall be solely responsible for the compatibility of the MOV actuator with the valve and for the selection and sizing of various electrical devices and components in the actuator.

The actuator shall be provided with minimum three adequately sized cable entries viz., one for power cable and two for control cables. Suitable double compression cable glands shall be provided with each actuator for all cable entries and sealing plugs for all control cable entries. The cable glands and plugs shall be made of Nickel-plated brass / SS316.

3.11. Remote Control System

The remote-control system is envisaged to control all fire-fighting operations from the control desk located at the control room on the top floor of the pump house building.

- i) All the major equipment shall be controlled from the remote-control desk such as

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- a) Fire Water Pumps PUSH BUTTONS START / STOP
- c) Jockey Pumps PUSH BUTTONS START / STOP
- g) All Motorised Valves – PUSH BUTTONS OPEN / CLOSE
- ii) The remote-control panel shall also have provisions for various indications / status of various equipment such as:
 - a) Fire Water Pumps LED ON / OFF
 - b) Foam Pumps LED ON / OFF
 - c) Jockey Pumps LED ON / OFF
 - f) Water Curtain System Motorised Valves LED OPEN / CLOSE
 - g) All Motorised Valves LED OPEN / CLOSE
 - i) Hydrant Water System Pressure LED NORMAL
 - k) Hydrant Line Pressure Indication 4-20ma Display

The system shall consist of all the required panels, components, inter-connection cables, field sensors on all the equipment / pipelines, junction boxes etc. to achieve the required functions.

3.11.1. Training Scheme

The Contractor shall prepare and submit a scheme of training for a period of 3 months, covering all the system Fire Protection system, foam system, gas detection system etc. operation, maintenance, troubleshooting etc. The programme prepared by the Contractor shall be reflective and appreciative of the long-term interest in the sustained operation of the systems, equipment provided.

3.12. International Shore Connection

Two numbers of international shore connection on each jetty shall be provided with isolation valve on unloading platform wherever required.

3.13. Testing At Manufacturer's Works

The following of tests shall be conducted at the Manufacturer's works:

3.13.1. Main Fire Pumps/Jockey Pumps

In addition to various routine tests, the pumps shall be subjected to the following tests.

- i. Pump assembly etc., shall be tested hydraulically up to twice the working pressure or 1.5 times the shut-off head of the foam pump.
- ii. The test pressure shall be maintained for minimum half an hour.
- iii. Foam pumps shall be operated at constant speed to establish full head capacity characteristics using water as the medium. A minimum of 5 points shall be covered to plot the curve.
- iv. Dynamic balancing test for rotating assembly

- v. The Foam pumps & Engine shall be tested for vibration at the guarantee points. Vibrations in excess of 75 microns at each bearing housing and shaft shall not be accepted.

3.13.2. Diesel Engine

At manufacture's works, tests shall be carried out during and after completion of manufacture of different component parts and the assembly.

Following tests shall be conducted.

- i. Performance test of the diesel engine to determine its torque, power and specific fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 11 hours at full load and one hour at 110% overload.
- ii. Functional checks and adjustment of speed governor
- iii. Over all mechanical and electrical inspection.

3.13.3. Valves / Motorized Valves

The following tests shall be conducted at Manufacturer's works:

- i. Body test: All valves when completely assembled shall be subject to the hydrostatic test at the appropriate test pressure as per relevant standards.
- ii. Seat test: After being subjected to the body test, valves shall show no leakage at the valve seat when subjected to the hydrostatic test at the appropriate test pressure as per relevant standards.
- iii. Performance test for electrically operated with respective actuators mounted in position to show valve opening and closing and observation of leakage.

3.13.4. MS / ERW Pipes

These pipes are to be hydraulic tested at Manufacturer or at suppliers work, Necessary Physical / Chemical / Hydraulic testing as per IS Standard to be carried out.

3.13.5. Motors

The following tests shall be carried out for the motors as detailed below.

- i. No Load test.
- ii. Reduced Voltage running test.
- iii. Locked rotor test.
- iv. Noise & Vibration test.
- v. Over Speed test at 155% for 15min.

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3.14. Painting

The painting scheme specified in this clause is applicable to all firefighting equipment and piping.

- i. Painting shall provide a continuous adherent film of adequate thickness on the surface being treated and protected from attack due to continuous exposure in industrial atmosphere prevailing at the site of erection of the equipment,
- ii. Paint shall be applied in accordance with manufacturer's recommendations as supplemented by this specification. The work shall generally follow IS: 1477 (Part II) - 1990.
- iii. Paint shall generally be applied by brushing, except the spraying may be used for finish coats only when brushing may damage the prime coats. Roller coats or any other method of paint application shall not be used unless specifically authorized. Spraying shall not be adopted on red lead or zinc rich paints. Daubers may be 'used only when no other method is practicable for proper application in difficult accessible areas.
- iv. Paint shall generally not be applied when the ambient temperature is 5°C and below. For paints which dry by chemical reaction, the, temperature requirements specified by the manufacturer shall be met with also paint shall not be applied in rain, wind, fog, or at relative humidity of 80% and above or when the surface temperature is below dew point resulting in condensation of moisture. Any wet paint exposed to damaging weather condition shall be inspected after drying and the damaged area repainted after removal of the paint.
- v. Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to affect detrimentally either the appearance or the service of the paint.
- vi. Each coat of paint shall be allowed to dry sufficiently before application of the next coat to avoid damage such as filling or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of same colour shall be tinted, whenever practical, to produce contrast and help identify the progress of work.
- vii. The contractor shall furnish paint manufacturer's test reports, technical data sheet pertaining to the paint selected. The data sheet shall indicate among other things, the relevant standards, if any, composition in weight per unit of pigment vehicles, additives, drying time, viscosity, spreading rate, flash point, method of application, quality of surface preparation required, corrosion resistance properties and colour.
- viii. Painting at works - Equipment like pumps, motors, diesel engine, diesel Oil storage tank, valves and fire hydrants shall be painted at works before dispatch but after the testing by proper surface preparation, primer coats and finish coats as specified below.
- ix. Surface preparation - All surfaces shall be cleaned of loose substances and foreign materials, such as dirt, dust, scale, oil, grease, welding flux etc. irrespective of whether the same has been spelt out in the standards in order that the prime coat is rigidly anchored to the virgin metal surface. The surface cleaning shall conform to pictorial



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representation of surface quality, grade Sa 2 1/2 of Swedish Standards Institution SIS 055900 or equivalent standards such as SSPC-VIS-1.67 or DIN 55928 (Part 4) or IS: 1477(Part-I) -1990.

- x. Paint - The sand blasted surface should be painted with two coats of Zinc-rich primer and two coats of epoxy paint of fire red colour. The thickness of the Zinc-rich primer shall not be less than 30 microns per coat and the thickness of each coat of epoxy paint of fire red colour shall be not less than 100 microns. The total dry film | thickness of the total painting shall be not less than 260 microns.
- xi. The zinc rich primer paint shall have 92% zinc content. Both the zinc-rich primer and the epoxy paint shall be compatible and the paint shall be of reputed and approved makes. All over ground lines shall be sand blasted and epoxy painted whereas the underground lines shall be double coated and double wrapped.
- xii. For electrical panels necessary metal treatment like hot alkaline degreasing. Cold water rinsing followed by pickling cold water rinsing, phosphating and passivation shall be carried out. The complete panel board shall then be dried out by the compressed air in dust free atmosphere. The boards shall then be epoxy powder coated to shade 623 of IS-5 over priming coats and finally baked.
- xiii. Pipes and pipe fittings shall be given one coat of zinc rich primer as mentioned in after testing and before dispatch to the site.
- xiv. The complete pipe work after erection and testing shall be given two coats of zinc rich primer and two coats of final epoxy paint as per relevant standards..
- xv. Colour Code
 - a) The colour code of the paint for Foam Pumps, Diesel engine and motors shall be fire red.
 - b) Pipelines & pipefitting and hydrants shall be fire red.
 - c) Water monitor shall be fire red

3.15. Accessories

- i. Junction box for welding generator in pump house - 1 No.
 - ii. Blowers, exhaust fans in pump house as may be required on site considerations.
 - iii. Wind socks - 2 Nos.
 - iv. Portable explosive meter- 1 no.
 - v. Safety showers / Eye wash fountains to be installed at Strategic Locations – 2 Sets
- Further accessories as required in OISD 156 shall be provided.

3.16. Erection

3.16.1. General

- i. The erection of all plant and equipment shall be carried out according to the latest engineering practice and according to the drawings, specification, instructions etc. duly approved by the Engineer's representative. The contractor shall carry out the work in presence and/or as per the instructions of site engineer/supervisory personnel deputed



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by the Engineer's Representative. The erection shall be carried out with highly skilled workmen.

- ii. The contractor shall take care of positioning, levelling and plumbing of all pipelines and equipment as well as supporting structures within the required accuracy and tolerance limits. It shall be deemed as a contractual obligation that the lines are not thrown out of alignment or lifted off during commissioning and subsequent operation.
- iii. There may be more than one contractor working in the area at the same time. As such, the, work has to be carried out in proper co-ordination and consultation with the Engineer's Representative and all other parties concerned with the work. The Tenderer shall take due notice of the working condition, practices and agreements current in the area of the plant site and satisfy himself before quoting.
- iv. It will be contractor's responsibility to take required precautions, actions to adequately safeguard the personnel carrying out the work and to ensure that the work is carried out in such a manner that maximum safety of men, machine material and environment is ensured.
- v. The contractor shall comply with relevant rules and regulations on Safety, Health and environment, ILO regulations, Dock Safety requirements etc. The contractor shall provide all personal protective equipment to workmen such as Helmet, Shoes, Suitable Gloves, masks, goggles, Safety Belts etc. as applicable.
- vi. The contractor shall be responsible for SHE (safety, Health, Environment) requirements.
- vii. The contractor shall be responsible for paying strict attention to statutory regulations for prevention of accidents and to other- safety rules. The regulations for prevention of accidents shall be displayed visible to all appropriate places and should be distinctly visible to all working personnel in area. Notices of warning sign and symbols shall draw attention to all possible sources of danger.
- viii. In case of any accidents, shall inform to CISF, Safety Officer and Police. All Welding may be carried out with proper safety precautions and with the Prior approval of Fire officer.
- ix. Housekeeping should also be given priority and it must be on a day to day basis.
- x. The contractor shall supply all required consumables, construction and erection materials, diesel oil, kerosene, solvents, sealing compound, tapes, brazing gases, erection bolts, nuts and packing sheets/compounds temporary supports, wooden blocks, spacers, templates, jute and cotton wastes, sand paper, etc. as required for the satisfactory completion of work.
- xi. Throughout the performance of work the contractor shall at his own cost keep structures, materials or equipment adequately braced by guys, struts, or other approved means which shall be supplied and installed by the contractor as required till the installation work is satisfactorily completed. Such guys, shorting, branching, strutting, planking, supports etc. Shall not interfere with the works under execution/executed by other agencies.



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- xii. The Tenderer shall be responsible for successfully erecting and commissioning of the plant and equipment supplied by him.
- xiii. The scope of work shall cover storage at site transportation, fabrication/assembly, laying/erection, testing, painting and commissioning of the Fire Fighting water system and the connected piping system as a whole (inclusive of valves and other auxiliary equipment) with necessary supports and supporting structures. The erection work shall be carried out as per the working drawings prepared by the contractor and duly approved by the Engineer's Representative.

3.16.2. Site Testing & Painting

After erection at site the plant and equipment shall be subjected to tests to prove satisfactory performance as individual equipment and also as a system on the whole. The Tenderer shall include and conduct field tests for all pumps and piping systems. These tests shall be made after installation is completed and before the systems are placed in service. Field tests covered by BIS and Government and local codes shall govern in so far as they exceed corresponding requirements of this specification or cover omissions therein. All tests shall be performed as specified in the presence of the Engineer's Representative and must be accepted by him. The Tenderer shall conduct a preliminary test and repair or correct all faulty work before calling the Engineer's Representative to the test for acceptance of the systems materials, tools, consumables, fuel, stores, apparatus and instruments as may be necessary to carry out such tests efficiently. Disposal of testing media must be done with full consideration to flooding or damage to the piping, other installations or property of the Engineer's Representative and safety of the personnel. The method of disposal shall be approved by the Engineer's Representative. The contractor shall be liable for any damages resulting from field tests.

3.16.3. Pipelines

- i. Erected pipelines together with fittings shall be tested by hydraulic pressure. The value of test pressure shall be equal to 1.5 times the working pressure or 20 kg/cm² whichever is higher for duration of 4 hrs.
- ii. The Foam Pumps and monitors shall be disconnected before the test Combined tests of equipment with the pipeline is not allowed.
- iii. Hydrostatic tests shall be conducted for each system of piping separately.
- iv. Air vents shall be provided at all high points of the piping where the test shall be conducted in order to purge air pockets while the piping system is being filled up. Hydraulic test pressure shall be maintained for duration of 4 hrs. At this pressure the pipelines shall be inspected and all welded joints shall be tapped by a hand hammer.
- v. Hydraulic test will be considered satisfactory if during the tests, pressure does not decrease and no leakage or mist is found in the joints fittings etc.

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- vi. The contractor shall arrange at his own expenses all equipment, material, instruments and consumables to conduct the various site tests to demonstrate specified performance of all plant and equipment offered by the contractor.
- vii. Representatives of the Engineer's Representative and Contractor shall make a statement regarding the acceptance of the erected pipelines mentioning defects found during the tests, characteristics of the defects and the method of their elimination.

3.17. Commissioning

- i. Before start of preparation for commissioning, all the equipment and pipelines shall be certified by the Engineer's Representative for commissioning.
- ii. The site shall be thoroughly cleaned of all sorts of foreign materials such as welding rod ends, welding beads, metal chips etc. by the contractor from the site before commencement of commissioning activities.
- iii. Before commissioning all the pipelines shall be blown with compressed air until the air discharged is free from dust particles etc.
- iv. All lubricants, oils and other consumables required for commissioning the system shall be supplied by the Tenderer.
- v. Commissioning of the various equipment and system shall be carried out by the Tenderer as per the accepted procedure and as per the instructions of the Suppliers of the equipment.
- vi. On completion of the installation but before powering of the electrical system, all installation shall be physically checked and properly tested. These checks and tests shall be conducted by the Tenderer under the supervision of the Engineer's Representative. Any defect observed during such checks and tests shall be made good by the Contractor before commencement of commissioning.

3.18. Test Certificates and Documents

For each of the items being manufactured, following test certificates and documents as applicable for each of the equipment, in requisite copies including original shall be submitted to purchaser / their representative. All test certificate must be endorsed by the Manufacturer and Contractor with linkage to project, purchase order and acceptance criteria.

- i. Raw materials identification and physical and chemical test certificates for all materials used in manufacture of the equipment (except IS 2062 - 1992 Gr. A & IS 210 - 1993, FG -150)
- ii. Welding procedures and welders qualification test certificates as per applicable code.
- iii. Details of stage wise inspection and certification record for fabricated items, castings, forgings and machined articles.
- iv. Control dimension chart with records of alignments, scariness etc.
- v. Manufactures material and performance / relevant test certificates for all bought-out items,



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- vi. Details of heat-treatment and stress relieving charts as per specification.
- vii. Non-Destructive Test reports as per respective code
- viii. Static / dynamic balancing certificate for rotating components /machines.
- ix. Hardness test certificate,
- x. Pressure Test Certificate.
- xi. Performance Test Certificate for all characteristics.
- xii. Geometric accuracy and repeatability test reports of machine tools.
- xiii. Routine / type / calibration / acceptance / special test certificates for electrical items.
- xiv. Diagnostic features of NC/CNC system and test for electrical items.
- xv. Surface preparation and painting certificates.
- xvi. Certificates from competent authority for the items coming under statutory regulations.

Where physical and chemical test certificates of material are not available, the contractor / Sub-contractor shall arrange to have specimens and test samples of the materials, tested in its own laboratory at his cost and submit the copies of test results in requisite numbers to purchasers / their representative for scrutiny & approval. Number to test samples against each heat / cast / lot or batch of materials shall be as per relevant Indian or international standards.

Where facilities for testing do not exist in the contractor / subcontractors laboratories or in case of any dispute, sample & test piece shall be drawn by the Contractor / subcontractor in presence of purchaser their representative & sealed sample shall be sent to any approved laboratory for necessary tests at contractor / subcontractors cost.

The purchaser / their representative shall have the right to be present & witness all tests being carried out by the contractor / subcontractor at their own approved laboratories. Also, the purchaser / their representative shall preserve the right to call for confirmatory test on samples, at his discretion. Valid calibration certificate of all measuring instruments & gauges used during inspection & testing with traceability to national, standard of NPL / NPL accredited testing laboratories shall be furnished along with "inspection call" prior to undertaking inspection by purchaser / their representative.

3.19. Guidelines for QA requirements

The offer of the firm should include details of quality control plans during various stages of manufacture/fabrication. The availability of in house quality control procedures and plans are essential pre requisite for tendering. Therefore the firm should have all essential Quality control facilities including testing of end product. The critical bought out items, like pumps, motors, diesel engine, monitors, valves, control system and components may be at the Engineers representative discretion permitted for testing at sub - contractor's / vendors works. All bought out critical items shall be procured from suppliers approved by the Engineers representative.

All bought out critical items shall be inspected by Trust approved Inspection agency. This inspection shall cover all aspects of material, workmanship, process and performance keeping in view Quality

Control parameters. This inspection will be at all stages, starting from raw material, fabrication, assembly and performance testing.

The equipment / material will be accepted after the same is tested by the inspection Agency & duly stamped before dispatch.

All costs towards the charges for the inspection agency during the manufacture and testing at the sub-contractor's / vendor works shall be borne by the Contractor. The offer will be evaluated for Quality control plan procedures, which would be rated in conjunction with final bid. The information Submitted shall be liable to verification prior to placement of order and a firm submitting factually inaccurate data, shall render itself for appropriate penal action.

3.20. Technical Data Sheets

Contractor shall submit the complete technical information in sufficient details for all major equipment like pump, motor, diesel engine, gear heads, monitors, ratio Proportioner, controls, piping, valves, jumbo curtain nozzles etc. The make and type of the machineries and equipment should be indicated clearly. The data sheets for major equipment shall be submitted for approval of Engineer's Representative prior to placement of order.

Table 3.1 Data Sheet for Main Fire Water Pump

Data Sheet No. 01		Rev. No.	0
Item		Main Fire Water Pump	Qty.
1.0	General		2 Working + 1 Stand by
1.1	Make / Manufacturer		Approved make
1.2	Model No.		Manufacturer to state
1.3	Type of Pump		Vertical Turbine
1.4	Type of Drive		Diesel Engine through Right Angle Gear Head
1.5	Service		Fire Fighting
1.6	Quantity		3 nos.
1.7	Liquid to be pumped		Sea Water
1.8	Specific Gravity		As per tender
1.9	Design Code		Manufacturer to state
1.10	Manufacturing Standard		Manufacturer to state
1.11	Performance & Testing Code		NFPA-20 & OISD 156
1.12	Fire Water Pump House Floor Level		As per tender
1.13	Low Water Level		As per tender
1.14	Sea Bed Level		As per tender
1.15	Maximum Wave Height		As per tender
2.0	Guaranteed Performance Data		
2.1	Rated Discharge / Flow		360 m3/hr
2.2	Total Discharge Head at Rated Flow		120 MWC (To be confirmed during detailed Engineering)
2.3	Pump / Bowl Efficiency (%)		Manufacturer to state
2.4	Engine Rating (HP)		Manufacturer to state
2.5	Vibration Level (Microns)		Manufacturer to state



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2.6	Noise Level (dB A) at 1.5 meters distance	Manufacturer to state	
2.7	Shut-off Head	As per NFPA-20	
2.8	Pump Rated Speed	1500 rpm (max)	
2.9	Range of Operation	20% to 150%	
2.10	Minimum Submergence	As per NFPA 20	
3.0	Constructional Features	Specified	Offered
3.1	Type of Impeller	Enclosed	
3.2	Casing	Bowl type	
3.3	Bearing Lubrication	Self Water	
3.4	Seal	Gland Packing	
3.5	Drive Transmission	Flexible coupling/Carden shaft	
3.6	Flange Drillings (Min)	ANSI B 16.5, FF, 150#	
3.7	Discharge Nozzle Location	Above Floor Level	
3.8	No. of Stages	Manufacturer to state	
3.9	Non Reverse Ratchet	To be provided	
3.10	Pump Starting with Discharge Valve OPEN	Yes	
3.11	Thrust Bearing	Anti-friction in gear box	
3.12	Line Shaft Bearing	Thordon Type	
3.13	Coupling Guard	Non-sparking (Aluminum)	
4.0	Material Of Construction. (Suitable for Sea water)	Specified	Offered
4.1	Casing (Bowls) & Diffuser	CE3MN	
4.2	Wearing Rings	- Do -	
4.3	Discharge Elbow	- Do -	
4.4	Column Pipes	- Do -	
4.5	Stuffing Box	- Do -	
4.6	Suction Strainer, Suction bell mouth, Casing neck ring	- Do -	
4.7	Impellers	- Do -	
4.8	Shaft & Shaft Sleeves	UNS 32760	
4.9	Muff Cplg and split collar, R.M Pipe	UNS 32760 / 32750	
4.10	Flexible Coupling	Cast Iron	
4.11	Base Plate (Sole Plate)	MS Fabricated (Epoxy Coated)	
4.12	Engine Cooling Water Piping	SS 316- BS 970316 S16	
4.13	All fasteners, bolts, studs, nuts etc.	- Do -	
4.14	Jacketing Pipe	- Do -	
5.0	Pump Load / Weight Data		
5.1	Pump Assembly Wt.	Manufacturer to state	
5.2	Engine Wt.	Manufacturer to state	
5.3	Gear Box Wt.	Manufacturer to state	
5.4	Coupling/ Guard/ Base Plate/ Base Frame Wt.	Manufacturer to state	
5.5	Fuel Tank/ Exhaust Piping/ Control Panel Wt.	Manufacturer to state	



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5.6	Total Static + Dynamic Load of Pump set	Manufacturer to state
5.7	Capacity of Overhead Crane Required	Manufacturer to state
6.0	Diesel Engine Details	
6.1	Make	Manufacturer to state
6.2	Model	Manufacturer to state
6.3	Type	Manufacturer to state
6.4	Duty	Fire Water VT Pump
6.5	Rated Speed	1500 rpm
6.6	Rated Power	Manufacturer to state
6.7	Turbo Charged	Yes
6.8	After Cooled	Yes
6.9	Secondary Cooling Circuit	Sea Water from pump discharge
6.10	Starting System	24V Batteries (1 set working + 1 set Standby)
6.11	Type of Governor	Manufacturer to state
7.0	Right Angle Gear Details	
7.1	Make	Manufacturer to state
7.2	Model	Manufacturer to state
7.3	Design Code	AGMA
7.4	Gear Box Rating	Manufacturer to state
7.5	Service Factor	Manufacturer to state
7.6	FM / UL Approved	Yes
7.7	Secondary Cooling Circuit	Sea Water from pump discharge
7.8	Non- Reversing Ratchet	Provided
8.0	Drawings/ Documents to be submitted	
8.1	General Arrangement Drawing	To be submitted with reference to the Fire Water Pump House Layout drawing enclosed in the tender
8.2	Pump Cross-sectional drawing	To be submitted for the offered model
8.3	Manufacturers Quality Assurance Plan	To be submitted for Pump, Engine & Gear Box Manufacturer
8.4	Engine & Gear Box Data Sheet	To be submitted for offered models
8.4	Experience Record	To be submitted for the offered Pump, Engine & Gearbox
9.0	Location of the Equipment	In firewater pump house – Safe Area (Indoor)

Table 3.2 Data Sheet for Jockey Pump

Data Sheet No. 02		Rev. No.	0
Item	Jockey Pump	Qty.	1 no.
1.0	General		
1.1	Make / Manufacturer	Approved make	
1.2	Model No.	Manufacturer to state	
1.3	Type of Pump	Vertical Turbine	
1.4	Type of Drive	Electric Motor Vertical Type	
1.5	Service	Fire Fighting	
1.6	Quantity	1 no.	
1.7	Liquid to be pumped	Sea Water	



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1.8	Specific Gravity	As per tender	
1.9	Design Code	Manufacturer to state	
1.10	Manufacturing Standard	Manufacturer to state	
1.11	Performance & Testing Code	NFPA-20 & OISD-156	
1.12	Fire Water Pump House Floor Level	As per tender	
1.13	Low Water Level	As per tender	
1.14	Sea Bed Level	As per tender	
1.15	Maximum Wave Height	As per tender	
2.0	Guaranteed Performance Data		
2.1	Rated Discharge / Flow	36m ³ /hr	
2.2	Total Discharge Head at Rated Flow	130 MWC (To be confirmed during detailed Engineering)	
2.3	Pump / Bowl Efficiency (%)	Manufacturer to state	
2.4	Engine Rating (HP)	Manufacturer to state	
2.5	Vibration Level (Microns)	Manufacturer to state	
2.6	Noise Level (dB A) at 1.5 meters distance	Manufacturer to state	
2.7	Shut-off Head	As per NFPA-20	
2.8	Pump Rated Speed	2900 rpm (max)	
2.9	Range of Operation	20% to 150%	
2.10	Minimum Submergence	As per NFPA 20	
3.0	Constructional Features	Specified	Offered
3.1	Type of Impeller	Enclosed	
3.2	Casing	Bowl type	
3.3	Bearing Lubrication	Self-Water	
3.4	Seal	Gland Packing	
3.5	Drive Transmission	Flexible coupling/Carden shaft	
3.6	Flange Drillings (Min)	ANSI B 16.5, FF, 150#	
3.7	Discharge Nozzle Location	Above Floor Level	
3.8	No. of Stages	Manufacturer to state	
3.9	Non Reverse Ratchet	To be provided	
3.10	Pump Starting with Discharge Valve OPEN	Yes	
3.11	Thrust Bearing	Anti-friction in gear box	
3.12	Line Shaft Bearing	Thordon Type	
3.13	Coupling Guard	Non-sparking (Aluminum)	
4.0	Material Of Construction. (Suitable for Sea water)	Specified	Offered
4.1	Casing (Bowls) & Diffuser	CE3MN	
4.2	Wearing Rings	- Do -	
4.3	Discharge Elbow	- Do -	
4.4	Column Pipes	- Do -	
4.5	Stuffing Box	- Do -	
4.6	Suction Strainer, Suction bellmouth, Casing neck ring	- Do -	
4.7	Impellers	- Do -	
4.8	Shaft & Shaft Sleeves	UNS 32760	



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4.9	Muff Cplg and split collar, R.M Pipe	UNS 32760 / 32750	
4.10	Flexible Coupling	Cast Iron	
4.11	Base Plate (Sole Plate)	MS Fabricated (Epoxy Coated)	
4.12	Engine Cooling Water Piping	SS 316- BS 970316 S16	
4.13	All fasteners, bolts, studs, nuts etc.	- Do -	
4.14	Jacketing Pipe	- Do -	
5.0	Pump Load / Weight Data		
5.1	Pump Assembly Wt.	Manufacturer to state	
5.2	Motor Wt.	Manufacturer to state	
5.3	Coupling/ Guard/ Base Plate/ Base Frame Wt.	Manufacturer to state	
5.4	Total Static + Dynamic Load of Pump set	Manufacturer to state	
5.5	Capacity of Overhead Crane Required	Manufacturer to state	
6.0	Electric Motor Details		
6.1	Make		
6.2	Model		
6.3	Type	Sq. Cage Induction – Vertical TEFC	
6.4	Duty	Fire Water VT Pump	
6.5	Rated Speed		
6.6	Rated Power		
6.7	IP Rating	IP 55	
6.8	Starting System	Direct On Line	
6.9	System Voltage	415V, 3-Phase, 50 Hz	
7.0	Drawings/ Documents to be submitted		
7.1	General Arrangement Drawing	To be submitted with reference to the Fire Water Pump House Layout drawing enclosed in the tender	
7.2	Pump Cross-sectional drawing	To be submitted for the offered model	
7.3	Manufacturers Quality Assurance Plan	To be submitted for Pump, Engine & Gear Box Manufacturer	
7.4	Engine & Gear Box Data Sheet	To be submitted for offered models	
7.4	Experience Record	To be submitted for the offered Pump, Engine & Gearbox	
8.0	Location of the Equipment	In firewater pump house – Safe Area (Indoor)	

Table 3.3 Data Sheet for Fire Water Pipelines

Data Sheet No. 03			Rev. No.	0
Item		Fire Water Pipelines – Monitor & Hydrant System	Qty.	Lot
A	PIPES	Flanged Joints at 12 meters (Max)		
1.0	Diameter Range	8" & above		
1.1	Makes	Approved make		
1.2	Type	ERW		
1.3	Material Standard	IS 3589		
1.4	Dimensional Standard	IS 3589		



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1.5	Schedule / Grade / Thickness	Suitable for system pressure
1.6	Pipe Ends	Beveled
1.7	Size / Qty.	As required
1.8	Pipe lining	Black pipe with internally cement lined
2.0	Diameter Range	Up to & including 6"
2.1	Makes	Approved make
2.2	Type	ERW
2.3	Material Standard	IS 1239 Part 1 (Heavy)
2.4	Dimensional Standard	IS 1239 Part 1 (Heavy)
2.5	Schedule / Grade / Thickness	Suitable for system pressure
2.6	Pipe Ends	Beveled
2.7	Size / Qty.	As required
2.8	Pipe lining	Black pipe with internally COATING USING GLASS FLAKES
B	FITTINGS	Flanged Joints
1.0	ELBOWS 90 Deg.	R = 1.5D, Butt Weld Bevel Ends
1.1	Material Standard	ASTM A234 Gr. WPBW / WPB
1.2	Dimensional Standard	ANSI B – 16.9
1.3	Size / Qty.	As required
2.0	ELBOWS 45 Deg.	R = 1.5D, Butt Weld Bevel Ends
2.1	Material Standard	ASTM A234 Gr. WPBW / WPB
2.2	Dimensional Standard	ANSI B – 16.9
2.3	Size / Qty.	As required
3.0	REDUCER	Butt Weld Bevel Ends
3.1	Material Standard	ASTM A234 Gr. WPB
3.2	Dimensional Standard	ANSI B – 16.9
3.3	Size / Qty.	As required
C	FLANGES	
1.1	Type	Slip On, Raised Face, 125AARH
1.2	Material Standard	ASTM A 105
1.3	Class	150 Lbs
1.4	Dimensional Std.	ANSI B 16.5
1.5	Size / Qty.	As required
D	FASTENERS	
1.1	Type	Stud with 2 nuts
1.2	Material Standards	SS 316
1.3	Dimensional Standard	ANSI B – 18.2
1.4	Full Thread	Yes
1.5	Size / Qty.	As required
E	GASKETS (All Sizes)	
1.1	Type	Spiral Wound (Suitable for above flanges)
1.2	Material Standards	Spiral Wound SS 316+ CA Fill
1.3	Dimensional Standards	API – 601
1.4	Thickness	4.4 mm
1.5	Size / Qty.	As required

Table 3.4 Data Sheet for Hydrant valves



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Data Sheet No. 04		Rev. No.	0
Item	Hydrant Valves	Qty.	Lot
1.0	Quantity	As per P&I Diagram	
1.1	Make	Approved make	
1.2	Standard of Manufacture	As per IS :5290 Type A	
1.3	Size of Valve / Outlet	63 mm Male Instantaneous Type	
1.4	Capacity	900 lpm at 7 Kg/cm ²	
1.5	Flange Size / Drilling	75 NB / Drilling dimensions as per ANSI B 16.5, 150 Lbs class	
1.6	Hydrostatic Test Pressure	18 Kg/cm ²	
1.7	Operation	Manual	
1.8	Recommended service condition	Sea Water	
1.9	Material of Construction	Stainless Steel SS 316	
1.10	Finish	Polished finish	

Note:

Each double headed hydrant stand post shall comprise of a vertical flanged tap-off of 100 NB from the main pipeline with an isolation gate valve, orifice plate between flanges, 100NB Tee, 2 100x 75NB reducers and 2 single head hydrant as specified above. Hydrant valve shall be at 1.5 meters from ground level.

Single headed hydrants shall be only inside the control building and shall be connected at each floor to a 150NB pipe riser which shall be tap-off from the main hydrant pipeline through a flanged connection, isolation valve and suitable sized orifice plate as required. Hydrant valve shall be at 1.5 meters from ground level.

Table 3.5 Data Sheet for Hose Box & Accessories

Data Sheet No. 05		Rev. No.	0
Item	Hose Box & Accessories	Qty.	Lot
1.0	Quantity		
2.0	Scope of Supply (Each Set)	Hose Box – 1 Hose 15 M Long – 2 Nos. Branch pipe + Nozzle – 2 Nos.	
3.0	Hose Box		
3.1	Make	Approved	
3.2	Standard of Manufacture	Fabricated	
3.3	Type / Size of Hose Box	Weather Proof / To store 2 nos. 15 meter long 63 mm size fire hose + 2 Nos. Branch pipe + Nozzle + one no. nozzle spanner	
3.4	Material of Construction	SS316 Sheet	
3.5	Finish	Polished finish	
3.6	General Arrangement	Suitable for storage of 2 nos. 15 meter long, 63 mm fire hose and 2 nos. branch pipe nozzles / Two glass panel doors with hinges / Handle type lock / MS Hammer with GI chain / Break-glass recess for keys. The hose box shall be self-supporting type	



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		suitable for outdoor installation on suitable pedestal.
4.0	Fire Hose	
4.1	Make / Brand	Approved make
4.2	Standard of Manufacture	As per ISI
4.3	Type / Size of Hose	A / 63 mm
4.4	Size / Type of end couplings	63 mm Female at both ends Instantaneous Type SS with Copper binding
4.5	Length of Hose	15 meters
4.6	Hydrostatic Test Burst Pressure Proof Pressure	38 Kg/cm ² 22 Kg/cm ²
4.7	Working Pressure	14 Kg/cm ²
4.8	Material of Construction	Cotton synthetic fiber, circular woven, jacketed, rubberized fabric reinforced rubber lined (RRL), MYSTOX Treated
5.0	Branch pipe & Nozzle	
5.1	Make	Approved make
5.2	Standard of Manufacture	As per IS
5.3	Type / Size of Branch Pipe	Short / 63 mm Male Instantaneous Type
5.4	Size / Type of Nozzle	20 mm Threaded
5.5	Working Pressure	14 Kg/cm ²
5.6	Material of Construction	SS

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4. SPECIFICATION FOR 10T EOT CRANE

4.1. Introduction

This crane will be installed in the newly constructed Pump House building at the Jetty. The technical specification for Electric Overhead Travelling (EOT) crane with Duty Class M5 is given in section 4.3.

4.2. Scope of the Supply

The scope of the supply of 10 Ton Double Girder EOT crane will include design, manufacture, assembly, testing and inspection at manufactures works, packing, dispatching, transportation, safe delivery at site, required fabrication at site, installation, testing, commissioning, performance testing, final painting at site and handing over to Authority. Scope of supply shall also include but not be limited to the following, along with necessary fittings, fixtures and accessories.

- a) Bridge structure with platform and hand railing.
- b) Travelling mechanism for long travel and cross travel shall include track wheel run ways rails, end stops with spring/rubber buffer and wheel stops.
- c) Trolley
- d) Hoisting Mechanism
- e) Service platform on both sides of crab girder
- f) Brake Mechanism separately for long travel, cross travel and hoisting
- g) Pendant control and wireless remote operation for all movements
- h) Electric Motors, control gear and switch gear
- i) AC variable frequency controls for all motions of the crane.
- j) Lighting fixtures and accessories for cranes
- k) Earthing of all electrical equipment in crane.

Following items are also included in Contractors scope.

- a) Consumable like first fill of lubricating oils etc. for the initial operation of the equipment till handing over.
- b) Commissioning spares and start up spares parts.
- c) Special tools and Tackles, if any required.
- d) Recommended spare parts for five years trouble free operation and maintenance.
- e) All drawings/documents along with operation and maintenance manuals as per requirement mentioned elsewhere in the tender document.
- f) Getting approval of design/ drawing and any other design calculation related to the equipment
- g) 415 V, 3 phase, 50 Hz power supply shall be provided at one point for EOT Crane. This point of connection shall be a MCCB housed in a suitable enclosure, located at an operable height near the crane. All further connections including supply, laying and termination of FRLS armoured power cables shall be in Contractors scope.

	<p style="text-align: center;">DEVELOPMENT OF SHIP DOCKING AND REPAIR INFRASTRUCTURE IN PATHFINDER CREEK AT VADINAR SPECIFICATION FOR MECHANICAL AND FIRE FIGHTING WORKS</p>	<p style="text-align: right;">Page: 53/ 71</p>
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- h) Trailing/Flexible Cables as required for the crane shall be in Contractors scope.
- i) Carrying out any modifications/deletions/additions/alterations in design / drawing / documents as required by Employer / Engineer's Representative for proper execution of works at site till completions and handing over of the equipment to the Employer.

4.3. Design

The crane shall be designed, manufactured erected and tested in accordance with the following or their latest version of IS codes.

- a) IS 3177-1999 Indian Standard Code of Practice for Electric overhead travelling cranes.
- b) Is 807-2006 Indian Standard code of Practice for design, manufacture erection and testing (Structural portion) of cranes and hoists.
- c) IS 2266 specification for steel wire ropes for General Engineering purpose.
- d) IS 13834 (Part 1) Cranes : General
- e) IS 13834 (Part 5) Overhead Travelling and Portal Bridges Cranes.
- f) IS 325 Specifications for Three Phase Induction Motors.
- g) IS 5749 Specification for Three Phase induction Motors.
- h) IS 5749 Specification for Forged Ramsom hooks.
- i) ISO 12488-1 Cranes Tolerance for wheels travel and traversing tracks.
- j) IS 800-2007, Design of steel structures.

4.4. Capability of the crane

The crane should be capable of:

- a) Hoisting
- b) Longitudinal travelling
- c) Cross traversing at specified speeds in both loaded and unloaded conditions.

4.5. Rigidity, Control & Safety

- a) The crane should be rigid, robust and sturdy construction.
- b) Crane controls should be conveniently located. Various controls should be suitable interlocked to prevent accidental movement of crane.
- c) Suitable limit switches, one each for long and cross travel and two for main hoist, should be provided to stop the crane and prevent over travel of various moving parts of the crane.
- d) Suitable buffers should be provided to prevent over travel of the crane mechanism in both longitudinal and cross transverse directions.
- e) Suitable guards or enclosures should be provided on the crane to prevent inadvertent contact with down shop leads (DSL) or any other exposed electrical conductors and cables.
- f) Suitable isolation switches and stop buttons should be provided to isolate the electric supply for maintenance or in the event of an emergency.



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- g) A safety hand railing of tubular construction should be provided on bridge foot walls, end carriage, trolley and any other places where access has been provided. Railing should not be less than 1000 mm high with an intermediate member at a height of around 500 mm.
- h) All Sheaves should be provided with rigid guards to retain the ropes in the grooves. Guard should fit top to the flange and should have a clearance between the sheaves and inside the guard of not more than 3 mm or 1/4th the diameter of rope, whichever is less.
- i) The crane should comply with the relevant regulations under the factories Act, India electricity Rules and other statutory regulations as applicable.

4.6. Maintainability

- a) Safe access for maintenance and removal of all mechanical electrical and structural components must be ensured. All parts requiring replacement, inspection and lubrication should easily be accessible without the need of the dismantling other equipment or components.
- b) All electrical cable should be so laid that they are not liable to damage and can be easily inspected and maintained.
- c) Access walkways (wherever required) of minimum 500 mm clear inside width with hand railing on both sides of girders for the full span length for inspection and maintenance of the crane shall be provided. Walkways shall be of chequered plate or non slip steel surface of minimum 6 mm thick. Walkways shall be rigid construction and designed to sustain a distributed live load not less than 3 Kn/sqm (0.3 kg/sqcm).
- d) Materials used for equipment and structural should be free from cracks, blow holes, laminations, pitting. Except for areas where superior grade is required, steel class should be as per IS 2062 latest.
- e) A tool box containing all tools required for the maintenance of the crane should be supplied with the crane.
- f) Fasteners for pedestal blocks, gear boxes etc. should be easily removable from the top of the platforms.

4.7. Structural Details

- a) The crane bridge should comprise of double girders of plate box type. Camber in the box girder should be as per the relevant IS code.
- b) All welded sub-assemblies of box girder should be stress relieved before final welding of the box girder.
- c) Position of the weld joints in top plate, side plate and bottom plate of the box girder assembly should be specified with respect to the maximum deflection plane (ie Plane passing through the centre point of the box girder).
- d) In the main bridge girders, in addition to the required full length diaphragms, short diaphragms should be inserted wherever required to transmit the trolley wheel load to the web plates and to limit the maximum stress in the trolley to safe permissible limits.



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- e) All fasteners should be hot dip galvanized. All load bearing fasteners should be of high tensile grade, and it should be of reputed make. Manufacturer should submit a test report for mechanical testing for the same.
- f) The bridge girders should be connected to the end carriages by large gusset plates. Ground tight fit bolts in reamed holes should be used for bolted connections.
- g) The calculated strength made by High Strength Friction Grip (HSFG) bolts should not be less than calculated net strength of the member. The calculated strength of other bolted joints in structural members should not be less than the net strength of the members plus 25%.
- h) All butt welds on structural members of bridge girders subjected to tension should be radio graphically tested. All other welds should be subjected to Magna flux or Dye Penetration Test.
- i) The box girders should be so constructed as to eliminate any possibility of accumulation of water or oil inside them.

4.8. End Carriage

- a) Crane bridge should be carried on end trolleys with solid forged wheels. The minimum end clearances on each side of the long travel wheels should be 10 mm. The wheels should be mounted on fixed axle or suitable anti friction spherical roller bearings which can be conveniently removed for maintenance.
- b) End carriage should be designed to be strong enough to resist all stresses likely to be imposed upon them under varied service conditions, including collision with stops. The length of the end carriage should be such that no other part of the crane is damaged in the event of a collision.
- c) End carriage should be fabricated from rolled steel sections or plates, welded together to form a box. Suitable stiffening diaphragms should be provided wherever required. The material used should be steel as per IS 2062 latest.
- d) Suitable jacking pads should be provided on each carriage for jacking up the crane while changing track wheels. These pads should not interfere with replacement of track wheels.
- e) The end carriage should be fitted with suitable safety stops to the crane from failing more than 25 mm in the event of breakage of track wheel, bogie or axle. These safety stops should not interfere with the removal of track wheels.

4.9. Crane Rails

Square bars of min 50mm x 50 mm or as per design of crane rails for longitudinal and cross travel should be supplied, installed and tested by the supplier. Rail materials should be of quality B (as per IS 2062). Hardness of the rail shall be marginally lower than the wheel hardness.

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4.10. Trolley Frame

- a) The trolley frame should be welded rolled steel box section, designed to transmit the load to the bridge rails without undue deflection. It should be made rigid by providing suitable diaphragms. The materials used should be steel as per IS 2062 latest.
- b) The drum bearings and supports for upper sheaves should be located so as to equalize the load on the trolley wheels as nearly as possible.
- c) The trolley wheels should be suitable to the crane rails. The axle bearing should be of spherical roller type. The bearing housing should be designed for easy removal of wheels and bearings for maintenance. The wheel assembly should be fitted in L type housing, for easy removal of the wheel assembly.
- d) All the Mechanical and electrical equipment should be placed above the trolley top plate as far as practicable. For any parts placed below the trolley top plate, access for maintenance, repairs and replacement should be provided. Where the clearance between bottom member of trolley frame and the CT rails is over 25 mm, the trolley should be fitted with substantial safety stops to prevent the trolley from falling more than 25 mm in the event of breakage of track wheel, bogie or axle. These safety stops should not interfere with the removal of wheel/. Details of the arrangement should be explained in the offer.

4.11. Rail Wheels

- a) The rails wheels shall be suitable to the crane rails mentioned at Sl. No. 10. The wheel diameter and rails sizes shall be suitably selected so as to meet the requirement of wheel loadings for the specified duty class of crane.
- b) the wheels should be manufactured from medium carbon alloy steels and shall be forged and heat treated to have ,=minimum hardness of 34 HRC (BHN) on the tread and flanges to a depth of not less that 8 mm. steel used for wheels shall not contain more than 0.060 percent of either sulphur or phosphorus. The wheels shall be mounted in such a manner as to facilitate easy removal and placement..
- c) The wheels should be shrink fit on the axis. Hardness of the machined wheel(for both CT and LT) should be checked with portable with pot holes hardness tester and value to be verified with the test reports during factory acceptance test.

4.12. Rope Drums

- a) The rope drums shall be designed to withstand the compressive stresses caused by the rope wound on it and the bending stress due to beam action of the drum.
- b) Seamless pipes will be an acceptable alternative. The steel used shall be to IS 2062 1984 quality. If it is fabricated pipe then, the rope drum shall be stress relieved after fabrication. T joints shall be radio graphically checked.
- c) The drum shall be designed to take the entire length of the rope in a single layer. Free extra turns as specified in IS 3177 shall also be provided. The drum shall be flanged at both ends.

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- d) Crane shall be designed with number of rope having 4 falls.
- e) Weld joints of the web with rope drum shaft and inner diameter of the rope drum should be radio graphed. This should be applicable to seamless rope drum also.

4.13. Wire Ropes

Wire ropes in the crane should be galvanized type and of reputed make. Preferably Hyflex type wires ropes should be used. If it is conventional type, then it should be 6 x 36 construction and made from best plough steel of tensile strength 180 kg/mm²

4.14. Gearing

Only helical gears should be used. Gearing in all motions should be suitable case carburizing low carbon steels and should conform to relevant India/International standards. They shall generally be in accordance with IS 4460-1967 latest. All gears should be hardened and profile ground for longer life and silent operation. Minimum surface hardness of pinions and gears should be in the range of 55-60 HRC. The hardness of gears should be at least 2-3 HRC less than that of pinions.

4.15. Gear Boxes

- a) All gear boxes shall be of completely enclosed splash lubricated type. All gear boxes shall be oil tight and sealed with neoprene; 'O' rings of suitable section. All gear shafts shall be supported in bearings mounted in the gear boxes. Gear boxes shall be made supported in bearings mounted in the gear boxes. Gear boxes shall be made of graded CI/MS fabricated. All gear boxes shall be stress relieved and the method of doing so shall be explained in details in the offer. Gear boxes shall be provided with breather vents, easily accessible drain plugs and a suitable oil level indicator such as a dip stick. Adequate radial clearance between the gear Box inner surface and outside diameter of the gears shall be ensured and clearance proposed to be provided shall be indicated in the offer. The facial clearance between the inner surface of the gear box and the face of the nearest gear/pinions shall be le=at least 10 mm. all gears and pinions shall be of ground type so as to reduce noise levels to the minimum. The permissible over all noise level should be ~75 dBA at 1 m distance from the gear box. (Noise level measurement will be done at the time of pre dispatch inspection and also after installations at site.)
- b) all gear boxes should have drips pans to avoid oil falling on shop floor.
- c) LT/CT gear boxes- These should be of a modular, integral design. Motors may be either flange-mounted or foot mounted or a combination of the two.

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4.16. Drives

- a) The wheels of each end carriage should be driven by independent synchronized drive motors mounted near each end carriage. 40% CDF, S4 duty class F insulation, 150 starts/ stops per hour.
- b) A separate cross transverse motor should be used for cross transverse drive through a suitable gear box, 40% CDF, S4 duty class F insulation, 150 starts/ stops per hour.

4.17. Brakes

- a) For LT & CT motions: the maximum braking torque to arrest long travel and cross transverse motions should not be less than 125% of full load torque for each brake. The Lty & CT motion brakes should be provided with (electromechanical (EM) fail safe DC disc type-01 No for each.
- b) For Hoist motion, two brakes should be used and the braking torque for each brake should not be less than 125% of full load torque. One of the two hoist brakes shall be applied with a time lag of 3 seconds in relation to the first. The hoisting motions should be provided with Electrohydraulic Thruster (EHT) Brake- 01 No. Electromechanical (EM) fails safe, D.C. Disc Brakes -01 NO.

4.18. Rope sheaves

All sheaves should be of cast/forged steel. They should be identical with exemption of the equalizer shave. The equalizer sheave should not be mounted above the trolley floor and should be easily accessible and removable from trolley floor level. Sheave should be smooth finished for getting increased rope life. The supplier should further ensure that wire ropes are parallel with each other.

4.19. Bearings

- a) Ball and roller anti friction bearings shall be of reputed make.
- b) For long and cross traverse wheels, spherical roller bearings shall be used. Bush bearings should not be used at any location.

4.20. Lifting Hook

Standard plain shank type trapezoidal section hooks should be used. The hooks shall be solid, forged, heat treated of rugged construction and provided with a standard depress type safety latch. Lifting hooks shall have swivels and operate on thrust bearings with hardened races. Lock to prevent hook from swiveling shall be provided. These hooks should conform to the relevant Indian Standard Specifications IS 3815 latest and IS 8610 latest. Certificate of test and examination shall be submitted by the Contractor. Certificate should indicate serial No. and date of testing.



4.21. Buffers

Spring loaded or other suitable buffers should be fitted on the four corners of the crane also at the four ends of the bridge girders. Buffers should be rigidly bolted in place, preferably along the centre line of the crane rail or trolley rail as the case may be. All buffers should have sufficient energy absorbing capacity to stop the bridge or trolley when travelling at a speed of least 40 % full load rated speed. Bridge buffers should have a contact surface of not less than 125 mm diameter.

4.22. Lubrication

- a) All gears and bearings enclosed inside gear boxes should be splash lubricated. Bottom blocks and pedestal bearings should have independent greasing points.
- b) Lubricating chart should be provided in the manual, indicating all lubrication points, the type of lubricants required and the recommended frequency of lubrication. Maintenance manual to be supplied along with the crane, minimum two nos of hard copies.

4.23. Scope of Supply for Electrical Components

All accessories and auxiliary electrical equipment including drive motors, electrically operated brakes, controllers, AC variable frequency controls, conductors, protective devices, operating devices, cables, conduits etc. necessary for the safe and satisfactory operation and maintenance of the crane shall be included in the Contractors scope of supply. Electrical equipment shall be adequately rated to permit simultaneous operation of any combination of motions of the crane for its duty services.

The scope of supply relating to electrical portion shall cover.

- a) Indicating lamp and sound alarms: All indicating lamps shall be LED type with appropriate protection. Sound alarm should have sufficient dB level such that it would be audible in the crane operating area.
- b) Shrouded down shop leads.
- c) Main current collectors (One Forward and another in rear)
- d) Power Disconnecting switch on the crane bridge walk way, to be provided immediately after the, main current collection gears.
- e) Motors
- f) Protective Switch gears.
- g) Motor Control Panels.
- h) Squirrel cage motors with VVVF drive for all LT, CT & Hoist motions.
- i) DC disc brakes for all motions.
- j) Limit Switches.
- k) Socket outlets.
- l) Power and control cables CT motion cables should not run in cable drag chain.
- m) Drag link cable system of IGUS make



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- n) Pendant & wireless remote: Double step push buttons and two numbers of wireless remote control having 100 m range operation. There should be override provision on the pendant for the remote. A master key control on the pendant should be provided. An emergency PUSH BUTTON to complete shutdown should be provided. The control pendant should have separate movement in CT direction independently from trolley.
- o) MCB should only be used in the crane in lieu of HRC fuses.
- p) Earth wire on crane portion.
- q) Shrouded bus bar GI conductor along with Isolator switch at the ground level. Cabling from the isolator to the shrouded bus bar should be in Contractors scope.
- r) Three 250 W Metal Halide luminaries under the crane, operable from pendant as well as from wireless remote control.

All sundry erection materials required for installation and connection up of electrical equipment with cable lying and fixing accessories shall be included in the price of the crane. A load cell conforming to IS 3177 should be provided in the crane for the online measurement of the weight of the load hoisted along with following feature.

Technical requirement

- 1. Graduation should be 50 kg or better with a display of 200 mm character height.
- 2. Accuracy $\pm 0.2\%$ or better.
- 3. The system should have Tare zero facility. Provision should be made for setting ON/OFF, Zero and Tare through Remote Control.
- 4. The supply voltage should be $220 \pm 10\%$ single phase, 50 Hz. AC
- 5. There should overload indication (OL)

4.24. Power supply conditions

Power supply shall be available at $415 \pm 10\%$ volts, 3 Phase, $50 \pm 3\%$ Hz.

4.25. Specification for Shrouded Bus Bar Conductor

Shrouded Bus bar conductor shall conform to the following:

- a) The conductor system shall be finger safe to IP 21 with necessary supporting technical evidence of same and the conductor and materials shall be of suitable metal (Galvanized Iron) insulated by a high impact gloss finish VR 935/2 PVC compound which shall have a step/groove shrouded all along its length for effective moulding of the conductor system.
- b) The conductor shall be in minimum 4 mtrs to be joined with moulded joint of the same materials as the conductor and these.
- c) Conductors shall be supported by way of a single piece moulding, four pole hangers with single bolt fixing.
- d) The current collector arm should be aluminium die cast totally insulated and the connection cable shall be fully enclosed and double insulated within the collector arm with a proven

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performance. Two sets of current collectors should be used one in forward and another on rear on DSL.

4.26. Crane Control

Pendent push button control and wireless remote control for long travel and cross travel and hoist motions,. For switching ON and OFF the motor of a particular motion, the supply voltage to the pendent control shall be 24 V AC/DC which shall be obtained through a suitable transformer. Necessary flexible multi core cable with sufficient length shall be supplied to enable the crane to be operated from floor level. Pendent shall be moving type and the movement of pendent will be independent of trolley via a separate track along girder length. On all the motions the circuit shall be so designed that brakes come into operation immediately in the event of tripping of motor main circuit breaker.

The pendent control shall be capable of withstanding rough handling without being damaged. The cover shall be firmly secured.

The mass of the pendent shall be supported independently of the electric cable by means of wire rope/chain. The pendent and the push buttons should be step type.

Crane operating nomenclature (crane directions, speeds, luminaries, start/stop, emergency stop etc) should be clearly mentioned on the pendent. It should be similar to that painted on the crane structure and wireless remote.

On all pendent cranes safety means shall be provided to prevent inadvertent operation from floor while maintenance work is being carried out on the crane.

Adequate guards shall be provided to prevent accidental contact of pendent ropes or holding wire rope/chain with cross transverse.

Along with the push button pendent, a wireless remote control should also be offered for operation of LT, CT, Hoist motion and luminaries under the crane.

Wireless remote control should have two transmitters and one receiver with a range of 100 meters of operation. The wireless remote control transmitters should be impact resistant.

Crane operating nomenclature (Crane directions, speeds, luminaries, start/stop emergency stop etc.) should be clearly mentioned on the wireless remote control. It should be similar to that painted on the crane structure and crane pendent. Selector switch shall be provided on pendent / remote control for the operation.

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4.27. AC Variable Frequency Control

Independent AC variable frequency control of adequate capacity for main hoist, CT & LT shall be used by using independent variable voltage frequency drives. However common controller for both the motors of LT may be used.

4.28. Contactors

All contactors shall be of AC 4 Class of duty with rating sufficiently higher than the full load current of the respective motors at the specified duty cycle. The directional contractors of all motions shall be suitably interlocked for correct sequence of operations.

The contactors shall have high contact reliability.

4.29. Circuit Protecting Switch Gear

- a) In the crane push button operated contactor shall be provided for circuit protection.
- b) Each control circuit branch to every contactor panel shall be provided with facility for isolation and protection against short circuits and sustained high overload by means of approximately rated miniature circuit breaker.

4.30. Limit Switches & Locks

Hoist motion shall be provided with limit switches to prevent crane from over hoisting and over lowering. Two limit switches shall be provided for proper back up protection. One of the limit switches should be based on Gravity, Geared limit Switch shall be bracketed by manual reset type gravity type limit switch. The limit switch should be provided with counter weight which is lifted with wire rope to prevent over hoist position.

The first limit switch shall act in the event of over hoisting and over lowering shall be snap action/pin type self-resetting features and incorporated in the control circuit of respective drive motor.

All the limit switches shall have minimum IP 55 class of enclosure. The contacts shall be rated for 10 A, 500 VAC.

Other limits switch for slewing, skewing of crane etc. shall be provided.

Long travel and cross travel motions should be provided with three limit switches at each end.

First limit switch: to change the travel speed to creep speed

Second limit switch: to stop supply to relevant motor for further motion. This action should be accompanied with an alarm sound and light indicting that maximum limit has been reached.

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Third limit switch: Should be a proximity/non-contact type switch and shall be used as a backup limit switch which shall cut off power for forward direction to all related motors. Only return supply should be available for retracting back.

Limit switch for hoist cross and long travel motion shall be supplied installed and wired by the manufacture. Limit switch should be lever type shunt limit switches for extreme travelling position in both directions. All limit Switches should be self-reset by operating the motion in the reverse direction by spring action. The limit switch shall operate when it reaches a predetermined position when the lever is moved over a projecting member fixed to the girder/gantry.

Limit Switches for LT & CT should be positioned in the following way.

Third limit switch: with a gap of 20 to 30 mm between crane ends and buffers. In any case crane should not touch the buffers.

Second limit switch: About 20 to 30 mm from the third limit switch. The distance to be designed such that crane should not over cross third limit switch due to crane inertia with full load and in automatic creep speed mode. Mode of operation for crane speed for LT & CT between second and third limit switch position should only be strictly creep speed.

First Limit Switch: Distance between second and first limit switch should be designed and implemented by the Contractor/. The distance should be such that in any case crane should not over cross second limit switch during deceleration from full speed to creep speed with full load. Between first and second limit switch, LT & CT full speed operation automatically get converted to creep speed.

Audio visual alarm for all the limit switches should be provided. Safety latch and swiveling lock should be provided for the hook.

4.31. Emergency Stop Push Buttons

Safety switches of sustained contact type shall be provided at each end of the crane bridge so that under any emergency conditions, by operating anyone of the switches, the incoming circuit breaker is tripped thus cutting power to all motions. One number of emergency stop buttons should also be provided on pendent.

4.32. Control Panel (IP 55 Class Protection)

- a) All power and aux contactors shall be mounted in CRCA (cold rolled cold annealed) sheet steel cubical with lockable hinged doors. Door hinges shall be of such type that during the repair works inside the panel the entire door can be lifted out and placed away enabling better access inside the panel. Each motion shall have its individual panel. However,



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common panel with separate compartment for each motion shall be acceptable. The panel shall be dust and vermin proof.

- b) Panels shall be front wired with readily accessible terminal locks for making connections in the external equipment. Panels shall be pre wired into terminal strip. Single core, FRLS insulated copper conductor of minimum 2.5 sqmm shall be used for control wiring in the panel.
- c) All contactors etc shall be mounted securely in a vertical arrangement with the consideration of the vibrations encountered in the operation of cranes. This bottom most row of the equipment mounted inside the panel except terminals strips shall be at least 150 mm above the peal bottom cover to facilitate inspection and repairs.
- d) All the equipment shall be so mounted in panel as to enable its easy removal/replacement from the front.
- e) The terminal strips shall be inside the panel preferably in a horizontal manner leaving enough space underneath the strip for termination of cables in a convenient manner. Power and control terminals shall be segregated. Power terminals blocks shall be separated from each other by means of replaceable insulated spacers. Terminal block shall have adequate clearance to avoid tracking. A minimum of 20% spare terminals block shall be provided in terminals strips.
- f) All equipment inside the panel shall have permanent identification labels in accordance with circuit diagram as also the power control terminals.
- g) Terminal blocks shall be of robust and of such construction as to preclude possibility of cable connections getting loose during vibrations on crane.
- h) Sheet metal used for fabrication of panels shall have a minimum thickness of 2.0mm. Panels shall be mounted such that bottom of panel is at least 150 mm above the floor.
- i) Contactor panels shall be well braced to the crane structure and each panel shall be provided with adequate number of lifting lugs.
- j) All the panels and cabinets shall also be provided with LED luminaries for interior illumination.

4.33. Cabling

- a) All wiring for power control circuit shall be carried out with 1.1 KV grade flame proof Retardant Low Smoke (FRLS) insulated copper cables as per IS 694 and IS 1554 Pt-I with smoke index and typical index corresponding to ASTM 2843 & IEC 332-I
- b) Minimum size of the cables for control circuits shall be 2.5 sq mm and minimum size for power cables shall be of 4 sq mm copper.
- c) All cables shall be systematically laid in 2.5mm thick hot dip galvanised GI cable trays, wire reinforced PVC conduits and in cable drags of suitable type.

All cables shall be of reputed make and approved ISI brands. CT cables of the crane shall run on cable drab chain.

4.34. Identification of Circuit Cables etc.

Labels of permanent nature shall be provided on support of all switches, fuses, contactors, relays etc. to facilitate identification of circuits and replacement.

4.35. Climatic Conditions

The Ambient temperature will be +50°C (max)

4.36. Earthing

Earthing to the crane shall be effected through tracks rails crane structure. As such all the electrical equipment mounted on crane structure by means of earthing links. Equipment fed by flexible cables shall be earthed by means of spare core provided in the flexible cable..

4.37. Testing and Qualification of the Specification

Tolerances of crane rail installation and operation like span of crane horizontal and vertical straightness of travelling track, height of traversing track (Lateral slope) should be as per international standard ISO 12488-1. Tooling required for qualification of the crane should design for a minimum life of 30 years. The crane manufacture must submit a detailed quality assurance programme indicating quality assurance plan (QAP) applicable at various stages of crane fabrication starting from raw materials to final crane testing. Manufacture should also submit detailed test reports for radio graph and mechanical testing for all the batches of welding rods used. A detailed QAP with necessary drawing documentation and calculation for obtaining necessary approval should be submitted to the purchaser before taking up crane fabrication.

4.38. Pre Dispatch Inspection

Pre dispatch inspection as per latest version IS 3177-1999 codes. The crane will be inspected and tested during different stages of its manufacture, starting from raw materials till the completion of the crane, by the purchaser or his authorised representative at the supplier's. However the purchaser of authorised representative is free to institute any further checks at any stage of the work.

4.39. Erection, Commissioning and Proving Tests

- a) The contractor shall arrange erection and commissioning of the crane. Adequate number of teams of technical experts should be made available so that erection and commissioning delays are eliminated. Such personnel will be required to be present Immediately as soon as we call upon for erection after receipt of crane at our work site.
- b) Following items of work shall also be performed by the contractor

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- c) Checking of alignment of gantry rail at site. Any rectification required, however, will be done by the purchaser.
- d) Installing of the crane structure and associated machinery in position
- e) Complete fitting and wiring of all electrical items
- f) Fixing of down shop leads
- g) Commissioning of the equipment. The crane performance shall be demonstrated after successful commissioning.
- h) The contractor shall carry out the startup and trial operation tests (Commissioning) receipt of authorization from the purchaser. In addition to test indicated in IS 3177 latest, the following tests shall also be carried.
- i) the earthing of the crane and control equipment, to be tested as per the Indian Electricity Rules.
- j) The Operation of brakes on long travel, cross transverse and hoisting motions.
- k) Inching control and speed as specified in Table 4.1
- l) Operation of the crane with no skewness in crane during long travel and cross travel, motions, presence of vibrations and usual noise in operations.
- m) The trials shall be carried out initially under no load conditions and on satisfactory completion of above, trials shall be repeated for various loads until the full rated load and operating range are covered.
- n) During trials run operation, all necessary adjustment shall be made so as to ensure compliance with the operating characteristic for the complete equipment as stipulated in the technical specifications.

4.40. Painting and Colour

The crane should be epoxy painted (Golden Yellow Colour) with at least two coats of epoxy primer after obtaining surface finish better than or equal to SA 2 ½. All motors, brakes and panels should also be epoxy painted. Final coating thickness of the painted surface should be of 120 to 150 µm and same will be tested with DFT meter after final painting during factory acceptance test.

4.41. Spare

Supplier should give a list of standard spare, sufficient for normal operation. The price of same shall be quoted separately. The buyers will have the right to decrease nos. of the items to be purchased and their quantity.

4.42. Important Notes to the Contractor

- a) The offered item is from a reputed manufacturer possessing ISO 9001-2008 OR Equivalent or Management programme certification.



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- b) The Contractor should provide satisfactory evidence, acceptable to the employer to prove that they are purchased it from licensed manufacture and possess adequate plant and manufacturing capacity/ facilities and also have quality assurance programme.

The following documents shall be submitted in the form of technical datasheets and drawings with the bid.

- a) General arrangement (GA) drawing to scale (Showing elevation, cross section and plan of the crane) indicating clearances, hook, approaches, lift, location and direction of view of operator, wheel base and wheel loads etc. of the crane being offered along with the quotation.
- b) Submission of duly filled “ Guaranteed Technical Particulars” (Technical , data sheet as per Table 4.2)

Table 4.1 Data Sheet for 10 Ton Double Girder EOT Crane

1.	Location	Fire Water Pump House	
2.	Designation	EOT	
3.	Duty class of Crane (As per IS 3177)	M5	
4.	Quantity	01	
5.	Crane classification	As per IS 13834	
6.	Mechanical class	M5	
7.	Electrical class	M5	
8.	Type	Overhead	
9.	Type of girder	Double	
	Capacities		
10.	Main Hoist	10 Ton	
11.	Span	13 ±0.2 M	
12.	Longitudinal travel (bay length)	30 ±0.5 M	
	Lifting range		
13.	Main hoist	8.2 M from hook height	
	Type of hook		
14.	Main hook	Swiveling type with plain shank having trapezoidal section	
	Speeds		
15.	Main hoist	30.m/min*	(* Inching Speed : 10% of nominal main speed through VVVFD) By pendent control & also speed control through wireless remote control
16.	Long travel	20.0 m/min*	
17.	Cross travel	10.0 m/min*	
18.	Creep speed	Pre settable. Minimum 10% to 100% in steps of 10% of full speeds by VVVF	
19.	Operating mode	Push button travelling type & wireless remote control.	
20.	Hazardous classification	area Safe	
21.	Motor Rating appx.	a) Hoist : 11.0 kW x 1 No. b) CT: 0.55 kW x 1 No. c) LT : 1.1 kW x 2 Nos.	

Table 4.2 Guaranteed Technical Particulars

(Technical data to be submitted upon award of contract)

Sl. No.	Description	Date
1.0	General	
1.1	Manufacturer	
1.2	Type/model	
1.3	Design according to standard service class/load class	
1.4	Nominal load carrying capacity	
1.5	Span	
1.6	Highest position of hook	
1.7	Lowest position of hook	
1.8	Lifting sling length	
2.00	Speeds	
2.1	Long travelling speed (Main & Creep)	
2.2	Cross travelling speed (Main & Creep)	
2.3	Hoisting speed (Main & Creep)	
3.0	Location	
4.0	Clearance and hook approaches as per tender	
5.0	Types of control proposed	
6.0	Constructional features	
6.1	Weight of complete crane- un laden	
6.2	Weight of trolley/crab	
6.3	Weight of hoist- un laden	
6.4	Maximum wheel load	
6.5	Wheel loading diagram attached	
7.0	HOISTING SYSTEM	
7.1	Rope	
7.2	Rope diameter	
7.3	Rope construction	
7.4	Rope materials	
7.5	Rope strength	
7.6	No. of rope fails	
7.7	Factor of safety	
7.8	Drum diameter and length	
7.8.1	Drum materials	
7.8.2	Stress relieved	
7.9	Type of bearing /make	
8.0	Hook	
8.1	Hook materials	
8.2	Safety latches provided	
8.3	Sheaves	



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8.4	Lower sheave diameter	
8.5	Lower sheave material	
8.6	Equalizer sheave diameter	
9.0	Hoist brake	
9.1	Type/make	
9.2	Size	
9.3	Torque	
9.4	Brake drum	
9.5	Materials	
9.6	Width	
9.7	Coupling type	
9.8	Gear materials	
9.9	Pinion materials	
9.10	Type of gear /pinions	
9.11	Limit switch	
9.12	Type /number/make	
10.0	Cross travel	
10.1	CT brake	
10.2	Type/make	
10.3	Size	
10.4	Torque	
10.5	Brake drum	
10.6	Materials	
10.7	Width	
10.8	Coupling type	
11.0	Gear box	
11.1	Gear box input	
11.2	Gear box out put	
11.3	Gear materials	
11.4	Pinion materials	
11.5	Type of gears/pinion	
12.0	Wheels	
12.1	Materials	
12.2	Hardness	
12.3	Type	
12.4	Diameter	
12.5	Wheel bearing make	
12.6	Limit switches	
12.7	Type/make	
12.8	Type of stopper	
12.9	No. of driven wheels	
13.0	Long travels	
13.1	End carriage length mm	
13.2	Coupling type	
13.3	Gear box	
13.4	Gear box input gear box out put	



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13.5	Materials of gears						
13.6	Materials of pinions						
13.7	Type of gears/pinion						
14.0	LT brakes						
14.1	Type						
14.2	Make						
14.3	Size						
14.4	Torque						
14.5	Brake drum						
14.6	Materials						
14.7	Width mm						
15.0	Motors (fill separately for each main and creep motors)						
15.1	make	Main	Creep	Main	Creep	Main	Creep
15.2	Type						
15.3	Rating						
15.4	Permissible starts/hrs						
15.5	Rated torque						
15.6	CRANE CONTROL						
15.7	Type						
15.8	Inching speed control						
15.9	Inching speed in % full load speed						
15.10	Detailed write up furnished on inching speed control						
15.11	Individual control panel furnished for all crane motion.						
15.12	Detailed write up on speed control furnished?						
16.0	Drive						
16.1	Make & Model						
16.2	Rate						
17.0	MCCB						
17.1	Make & Model						
17.2	Current Ratings						
17.3	No. of poles						
18.0	Contactors						
18.1	Make & Model						
18.2	Current Ratings						
19.0	Power Cable						
19.1	Make						
19.2	c/s of cable						
19.3	Type of insulation						

Note: if above clauses are found inadequate for furnishing any important information of the offered crane, the supplier may append additional sheets.