INLAND WATERWAYS AUTHORITY OF INDIA

(Ministry of Shipping, Govt. of India)

A-13, SECTOR – 1, NOIDA - 201301(UP)

CORRIGENDUM- 3

Sub: E-Tender of design construction and supply of 2 no. self-propelled Cutter Suction Dredger for NW-2.

For the above E-tender, certain changes in technical specification of Self-propelled CSD has been incorporated. Accordingly, the revised specification is attached herewith in this corrigendum.

Chief Engineer-III

(SECTION-V)

TECHNICAL SPECIFICATIONS

Technical Specifications

CONTENTS

1. GENERAL

1.1 Intent

This specification is intended to describe the construction of a **self-propelled cutter suction dredger** completely outfitted and equipped as detailed in this specification. The vessel shall be built in accordance with good shipbuilding practice and comply with the requirements of classification society and other statutory authorities as stipulated under section 1.4 & section 1.5.

The responsibility for developing the design and performance of the vessel is with the Builder. All technical data for the vessel and power rating, size etc. of machinery, outfit and equipment given in this document are indicative. Therefore, the requirements are to be computed by the Builder in due course of detailed design, but Owner's requirements on capacity, loads, speed and minimum deck area would remain applicable.

The builder shall ensure to design, construct and supply the vessel (Self-Propelled Cutter Suction Dredger) with the dredge machineries and equipment of modern, latest with proven design and good performance from the reputed manufacturers and suppliers. The general information on the installation of machineries and equipment is to be submitted along with the proposal.

Any items not specifically mentioned in this specification but functionally or statutorily necessary for the type and size of the vessel shall be furnished by the Builder.

Any modification or alteration to this specification shall be executed under mutual agreement of the Owner and the Builder. IWAI shall have the right to suggest modifications and alterations in the specifications and drawings during construction. Cost and time implications, if any, shall be mutually agreed. All modifications shall be proposed and agreed to in writing.

Plans to be submitted together with the technical bids:

a) General Arrangement with principal dimension and main particular
b) Mid ship section
c) Layout of the engine room with details of the main engines & machineries etc.
d) Proposed Dredge Pump characteristics & capacity
e) Dredge machinery & equipment.
f) Propulsion system & powering calculations
g) Preliminary Trim and stability calculation
h) Electrical load analysis

Note 1: The capacities indicated in the specification are indicative and it is the responsibility of the bidder to justify the values proposed by him to meet the performance and endurance capabilities of the vessel.

Any material/fitting/equipment or procedure not described or left out of these specifications, but considered as normal and necessary for intended services of this vessel shall be supplied and fitted by the builder without extra charge.

The builder shall be responsible for all the extra work, which arises out of the recommendation, and remarks made by the Classification Society as well as IWT surveyors.

1.2 Objectives for an optimum design & construction

1.2.1 The vessel shall be a mono hull steel cutter suction dredger (hereinafter called "the vessel") suitable for dredging operations in protected (inland) waters, such as the river Ganga from Haldia to Allahabad stretch of National Waterway-1 and Brahmaputra from Bangladesh Border to Sadiya stretch of National Waterway -2 for navigation with least available depth of 1.5 to 3 m, in India. The dredger is to be quickly deployed from one shoal to another for which adequate propulsion capacity to be provided.

1.2.2 In order to construct and supply a dredger suitable for operation with good performance, the builder must carry out a basic design with powering calculation and submit the same along with the technical documents as in clause 1.1 in the technical bids and same shall be one of the criteria for evaluation.

1.2.3 The bidder should mention in the bid whether their offer is for a proven design vessel or a newly design one. In case the offer is of a proven design than only CFD analysis will be required. In case the offer is for a new design dredger, model testing in a reputed towing test tank/laboratory for ascertaining the speed and propulsion power of the SPCSD will be necessary.

1.2.4 The vessel shall be built and classed under the supervision of a classification society that is a member of the International Association of Classification Society (IACS) for protected or sheltered/inland waterway operation. The vessel should also meet the requirement of Inland Vessel Act 1917 under the statutory authority IWT Directorate of West Bengal.

1.3 Approximate Principal dimension and other particulars

The principal dimensions & other particulars as mentioned below are purely indicative

- Length overall : 26 m
- Breadth : 10 m
- Depth : 2.5 m
- Maximum draught : 1.3 loaded draft with full Bunkers
- Air draught with respect to lightship draught : 6 m
- Trial speed (deep water) : 7 knots (calm water)
- Dredge Pump capacity : Mixture capacity of 1250 cub. mt/hr at 20% concentration of solid by volume and mixture density of 1.3 t/cub mt and capable of discharging at 500 m distance using floating pipelines and throw of about 80m with side cast facility on either side (5% variation allowed). Discharge coupling at the aft for pumping to be provided.

- Fuel Oil Bunker Capacity : 5 days of operation of dredger but not less than 10 KL
- Endurance : 5 days
- Accommodation : Day accommodation for four persons with one double bunk for persons to stay at night for security of the vessel. One pantry and one bio toilet cum shower to be provided.

Deviation allowed from specified dimensions (length, breadth and depth) in principal particulars shall be as detailed under only. No deviations allowed for maximum draught and minimum trial speed.

Sl.	heads	Variation permissible
1	Length	+ / - 5 %
2	Breadth	+ / - 5 %
3	Depth	+ / - 5 %
4	Draught	Nil
5	Air draught (max)	Nil
6	Trial speed	- 5%
7	Dredge Pump Capacity	- 5 %

The dredger is to be deployed with the following conditions and accordingly the dredge equipment & machineries be designed for providing the desired performance.

Channel Dimensions : 45 m width and 2.0 to 3.0 m depth
River : The Ganges & Brahmaputra (NW-1 & NW- 2)
River current in lean season : 1.5 to 0.8 m/s (2.92 knots to 1.55 knots)
Minimum dredging depth : 1.5 mt.
Maximum dredging depth : 6.0 mt.
Type of soil to be dredged : Mostly sand, silt, coarse & fine sand and admixture of compact soil at few locations.

1 .4 Classification

The vessel with her equipment and machinery shall be constructed and classed in accordance with the rules of any classification society being a member of IACS (International Association of Classification Society) for inland waterway operation as applicable for inland vessels and classed as + IWL Zone 2, “Cutter Suction Dredger” + IY for Inland Waterways Operation.

The Vessel is to be built under the class survey of the classification society and specification survey of owner's inspectors.

Statutory requirements like lifesaving appliances, firefighting appliances, navigational lights and sound signals shall conform to the rules and regulations under the Inland vessel act 1917 as framed by the state government where the vessel is to be registered. i.e. IWT Directorate of Government of West Bengal.

1.5 Registration

The vessel shall be registered at Kolkata with Inland Water Transport Directorate, Govt. of West Bengal as per relevant rules and regulations of I.V. Act of 1917.

1.6 Trim and Stability

The vessel shall comply with IMO's stability requirements. The vessel shall not have any trim by forward in any of the operating loading conditions. Permanent ballasting will not be allowed.
An inclining experiment is to be conducted by the builder in the presence of the class surveyor(s), IWT surveyors and the Owner. A detailed trim and stability booklet duly approved by Classification Society and IWT surveyor shall be submitted to the Owner.

1.7 Drawings

The Builder will supply the Class approved drawings and other design information as listed below within 8 weeks of placing the order. The list given below is a preliminary list.

Classification charges for approval of drawings shall be borne by the builder.

Class approved drawings / Information

1. Midship section
2. Deck and profile and bottom construction plans
3. Transverse Bulkheads &Typical Transverse Section
4. Rudder and Rudder Stock
5. Main propulsion system
6. Schematic piping arrangements of all the system
7. Single line Electrical Diagram
8. Trim and Stability booklet (Preliminary and Final)
9. Lines Plan
10. General Arrangement
11. Hydrostatic tables & cross curves
12. Electrical load chart
13. General Machinery Layout
14. Weight Estimate
15. Major Equipment list
16. Inclining Experiment Plan
17. Cutter and its operation arrangement Plan
18. Spuds and their operation arrangement Plan (if provided)
19. Spoil Pumping Arrangement
20. Anchor booms and their operating arrangement

Any additional drawings required for construction shall also be prepared by the builder and submitted for the approval of the owner and classification society.

1.8 Materials and Workmanship

The hull shall be constructed of good quality mild steel plates and sections tested and approved by the Classification Society. Test certificates shall be supplied.

Superstructure shall be constructed of good quality Aluminium.

All steel plates and sections shall be shot blasted to SA 2.5 and primed with an approved primer before fabrication.

All wood used in the vessel shall be well seasoned and treated to prevent pest attacks, free from sap, shakes, warps and other defects.

All smith work or fabricated fittings shall be of neat design, strong, smooth and free from defects and to be galvanized as required. All castings shall be of good quality, close grained and free from cracks, blowholes and other defects. The castings shall be manufactured to Classification requirements and approval as applicable.

All cables, fastenings, shackles, rigging, ropes, etc. shall be of materials that have been tested, approved and certificates supplied prior to commencing the work.

Workmanship shall be of good quality and shall be to the satisfaction of the Owner and the Classification Society surveyor.

1.9 Inspection and Supervision

The Owners or the Owner's representative will carry out the inspection of the construction of the dredger. Owner's representatives, the class surveyor and IWT surveyors shall have free access to the yard and the subcontractors' premises where the vessel or parts of it are being constructed during working hours.

The Owner's representative shall inspect and carryout specification surveys during the construction of the vessel. The vessel shall be built under the classification survey of classification society as engaged and specification survey by owner and statutory survey of IWT Directorate.

No major construction alteration or modification shall be permitted without specific written approval from the Owner's or their authorized representative.

Owners' representative/ surveyor for certification of the stage completion shall inspect all stages of work against which stage payments are to be made.

Sufficient notice shall be given before conducting trials for the Owner to inspect or witness trials at Manufacturers' Works. Any defective work pointed out during inspection by the Surveyors or the Owner shall be rectified.

All tests shall be pre-arranged and shall be conducted in the presence of the concerned authorities and a report approved by the authorities shall be submitted to the owner. Any defect found by the surveyors during the tests and trials shall be rectified by the builder at no extra cost.

Two copies of all statutory and test certificates of materials and the equipments, shall be supplied.

1.10 Tests and Trials

All tests and trials shall be performed in accordance with the requirements of the Classification Society and other regulatory bodies concerned and as stipulated in the specifications. The trials shall be conducted in the presence of the Owner's representatives as per the agreed tests and trials plan.

Programme for trials shall be submitted to the Owner at least one month before the trials. Yard shall provide fuel oil, lube oil, fresh water, etc. for the trials. Grades of fuel and lube oil used shall be equivalent to manufacturer's recommendations. Left over stocks of fuel and lube oil shall be taken over by Owner as per contract.

Machinery and equipment shall be tested at the manufacturers' premises as per their normal procedure. These tests shall be witnessed by Class Surveyors as required.

During the trial, the dredger shall be under the command of a Master/Dredge Master nominated by the Builder, who shall also provide the necessary crew.

Dredging trials protocol to be submitted one month in advance to the owner and the final dredging trials are to be carried out in NW-1 or NW-2 as the case may be at specified location by IWAI. The SPCSD for NW-1 to be delivered at Kolkata and SPCSD for NW-2 to be delivered at Pandu- Guwahati after the final dredging trials, speed trials and acceptance trials are done.

1.11 Welding

Welding shall be of high quality, and shall be performed by Classification Society approved personnel. Welding procedures shall be in accordance with the rules and regulations of the Classification Society. Necessary precautions shall be taken to eliminate deformations. Approved manual, semi-automatic or automatic welding techniques should be adopted for the construction.

1.12 Tank Testing

A suitable tank-testing scheme to check for water-tightness is to be prepared and submitted to the Owners and Classification Society for approval. All tanks and watertight or oil tight compartments are to be tested in accordance with the class requirements. The tests must be carried out after the completion of construction and before painting.

1.13 Dock Trials

The Dock Trials shall be conducted in accordance with a programme to be agreed to, by the Owner or their representative to check the operation of the machinery. Main engine and other auxiliary machinery are to be in operation during dock trials. A report on the performance of various machinery and equipment during the dock trials is to be submitted to owner.

1.14 River Trials

River trials shall be carried out as per the recommendations of classification society and Owner. A detailed programme is to be submitted to Owner/classification society for approval, prior to the trials. Trial is to be carried out for the design condition as specified under clause no: 1.10 & 1.13.

1.15. Instruction Manual and Books

Three sets of instruction books, operation and maintenance manuals, spares catalogues given by the original machinery suppliers for all the equipment / machinery and instrumentation installed on board, shall be supplied to the Owners / handed over to the Owner's representative.

Three copies of the list of suppliers of all the fittings and equipments used on board with their addresses and phone / fax numbers shall be supplied to Owners' representative.

1.16 Hull Preservation / Painting

The hull is to be cleaned of mill-scale by blast cleaning and coated with an approved good quality primer prior to fabrication. After installation of engines, auxiliary's etc. damaged paintwork is to be repainted in original colours and quality.

Painting work shall be executed in accordance with paint manufacturers' recommendations. Copper alloy, aluminium, aluminium alloy, stainless steel, non-ferrous materials and galvanized surfaces shall not be painted unless otherwise specifically required.

Painting scheme shall be based on epoxy coating system and is to be guaranteed by the paint manufacturer for a period of 5 years.

Paint specification and scheme are to be approved by the Owners.

Colour scheme is to be approved by Owners. All small parts, which are exposed to climate, such as railings, sheaves, grating, and parts of rigging are to be galvanized.

Galvanized surfaces are to be degreased and coated with a self-etching primer before painting. The paint specifications for galvanized surface are to be the same as for steel.

Prior to launching, Anti-fouling paints are to be applied to the hull outside, up to boot toping area. Nonslip paint is to be applied on the main deck open areas and passages.

Fixed sacrificial Aluminum anodes of sufficient number in accordance with class requirement /IS 8062 shall be provided as cathodic protection. Standard colour coding is to be used for pipes.

2. Hull Structure

2.1 General

The hull shall have the following layout:

- Aft peak / steering gear room
- Engine-room
- Store space / Cofferdam
- Fore peak
- Main Deck arrangement

The steel should be of shipbuilding quality and shall be IRS/LRS Grade A or equivalent. Scantlings of all structural members shall be as per class requirements. Approved shipbuilding

quality material is to be used throughout the construction. Sharp corners are to be avoided. Good continuity of structural members in basic hull structure should be maintained.

Before the steel plates and rolled sections are used for construction, rust and mill-scale must be removed by means of sand/grit-blasting. Immediately after the steel sand/grit-blasting, one coat of epoxy shop primer with a thickness of approximately 25-40 microns is to be applied as a temporary protection.

2.2 Hull Construction

The bottom plating shall have a thickness as per Class requirement. The bottom structure shall be strengthened in way of the propeller units. In way of hawse pipes, deck machinery, mooring fittings, spuds, dredge pump, winch and elsewhere as required insert plates of increased thickness shall be inserted and the structure in way shall be strengthened.

The keel is to be of a flat plate type with thickness as per Class requirements or as considered necessary. Plate floors are to be constructed in accordance with the Rules.

Longitudinal girders shall be fitted in the engine-room in such a way that they form part of the foundations for the main and auxiliary engines, else longitudinal girders to be provided as required by the Class. A sufficient number of drain and air holes to be provided in floors and girders.

2.3 Bulkheads

All watertight bulkheads shall be plated horizontally. Vertical stiffening shall be provided by the stiffeners spaced evenly.

2.4 Decks

The Main deck will have no camber or sheer. The main deck will form the base of the superstructure (about 2.5m above base). Thickness of the deck plating shall be as per classification society requirement.

2.5 Hull Opening and Hatches

All hull openings wherever provided shall be in accordance with classification society rules. Sills on the main deck for all doors are to satisfy rule requirements of Classification Society. Hatches are to be provided wherever necessary and shall comply with the rule requirements. Escape hatches should be operable from either side.

A removable hatch is to be provided above the dredge pump to facilitate handling of dredge pump parts which can be done with the help of the deck crane.

2.6 Mast

A collapsible type of mast on the wheelhouse deck shall be provided.

2.7 Super Structure (Wheel House & Accommodation)

The Super structure shall house the wheelhouse & Accommodation. It shall be of Aluminium construction. The materials, stiffening and deck connections are to be approved by classification society.

2.8 Ladders and Railings on superstructure

In general, all ladders shall- comply with the rule requirements. Ladders shall be placed under each manhole and escape hatch. Chequered Aluminium plate ladders are to be provided in accommodation. Railing of 1.0m height shall be provided wherever required after galvanising.

2.9 Name and Draught Marks

The name of the vessel, the place of registry and the draft marks should be executed in welded characters and the letters and figures should be cut out of 5mm thick steel plate.
The name of the vessel should be executed on bow and stern. In addition, the place of registry should be indicated on the stern.
A 3mm thick brass plate with the name of the vessel and the owner's mark shall be fixed through screws on both sides of the wheelhouse.

2.10 Life Saving Appliances

LSA as per the relevant rules under the Inland Vessel Act shall be supplied and installed on board the vessel.

2.11 Fire Fighting Appliances

FFA as per the relevant rules under the Inland Vessel. Act, shall be supplied and installed on board the vessel.

2.12 Mooring & Towing Arrangement

The required bollards and cleats of appropriate size shall be provided for the mooring and towing arrangement with mooring & towing ropes of appropriate length & strength.

3. Accommodation

3.1 General

Day accommodation for four persons with one double bunk for persons to stay at night for security of the vessel. One pantry and one bio toilet cum shower to be provided.

Above Main deck:

1 cabin with one double berths as mentioned above
1 Bio-Toilet cum shower
1 pantry
Split Air conditioner of appropriate capacity
1 200 litre Refrigerator, 1 big size metal dustbin

1 RO Water purifier of sufficient capacity
One 32" LED TV
One cabin fan per person for bunks. One cabin fan for remaining space.

3.2 Furniture:

The accommodation space shall be equipped as per standard shipbuilder's practices and in compliance with statutory requirements. The same are also to be approved by the Owner.

All wooden furniture shall be made of good marine quality teakwood. All furniture supplied must be of good standard.

Crockery, utensils, compatible to induction heater are to be supplied by the yard.

Provision for hot and cold water is to be provided in bio toilet cum shower. Pillows and mattresses of fire resistant quality to be supplied.

First Aid Box: One First Aid Box shall be provided in wheel house.

Wheel House:

The furniture, as a minimum, shall consist of: Manoeuvring desk with propulsion control, steering wheel, navigational equipment. Dredging desk with controls and monitoring systems display panel for performing dredging operations.

Note: Both controls may be combined in the same console. One helmsman chair
One split type Air Conditioner of suitable capacity one settee Wind screen to be fitted in ford part. The dredging operation is to be centrally controlled from the wheel house and shall be capable of operation by one person.

3.3 Flooring

All floors and deck covering shall be of excellent, approved marine quality and fire resistant and anti-skid nature.

Wheel house:

Steel deck in the wheelhouse shall be covered with 8mm latex cement (or epoxy) and further covered with vinyl tiles.

Toilets/ Showers:

W.C. are to be water efficient type preferably with bio treatment technology. Steel deck in toilets / showers to be covered with 8mm thick latex cement on which unglazed antiskid ceramic tiles to be glued. Glazed ceramic tiles are to be provided on all four walls up to height of 600mm in toilets and 1.5 m in showers.

Engine room:

In Engine room, 4mm steel chequered plate removable flooring shall be fitted with counter shank SS screws, covering piping and other fittings.

3.4 Partition bulkheads, linings and ceilings

The partition lining and ceiling, and insulation work for the crew accommodation space shall be carried out in such a way that the minimum clear height between the floors and ceiling of 1.8 m is maintained.

Partition bulkheads are to be fitted between sleeping rooms, mess rooms, galleys and toilets.

In the crew accommodation and the wheel house, linings and ceilings are to be fitted in easily removable panels. All fixing materials such as screws and bolt are to be of stainless steel.

The materials of the linings, partition bulkheads and ceiling are to be:
Lining: 10mm marine plywood of waterproof and fire retarding quality, both sides covered with plastic laminate (Formica or-similar approved).

Partition bulkhead: 20mm marine plywood of waterproof and fire retarding quality both sides covered with plastic laminate (Formica or similar approved).
Bulkheads separating galley from toilet are to be of steel and to meet statutory requirements.

Ceilings

6mm marine plywood, a waterproof fire retardant, both sides covered with plastic laminate (Formica or similar approved).
Thickness of plastic laminate in general should not be less than 1.5 mm. Borders of linings, around windows, doorframes etc. are to be of Classification Society class tropical hardwood.

3.5 Insulation

Thermal insulation in accommodation spaces is to be provided.

Acoustic insulation in accommodation spaces:
The bulkheads of the accommodation spaces adjacent to the engine room to be provided with acoustic compound insulation and then with perforated Aluminium sheet. A dust proof foil is to be provided between the glass wool and the perforated plate.

Acoustic insulation in engine room:
In the engine room, the forward bulkhead shall be covered with sound absorbing acoustic compound insulation and then with perforated Aluminium sheet. A dust proof foil is to be provided between the glass wool and the perforated plate. Further engine room is to be insulated by A-60 insulation from adjacent spaces.

3.6 Doors, Windows & Scuttles

Doors are to be provided in accordance with the Rules. Wooden doors, if provided, are to be of good quality teak. Other doors in accommodation are to be made of good quality teak board.

Wheelhouse doors shall be sliding / hinged type to provide un-obstructed passage on either side of the wheelhouse.

A suitable dead light / window made of marine toughened glass may be provided on wheelhouse doors.

The hull side bulkheads of the following rooms shall be fitted with suitable opening type windows.

Wheelhouse shall have windows all around and shall provide visibility of cutter ladder, spuds and its winches. Window in front of the helmsman chair shall be fitted with window wipers. All windows shall be of approved marine quality type with steel framing. Curtains shall be provided for all dead lights and windows.

A joiner's plan shall be submitted to owner for approval before construction.

4. Electrical

4.1 General

The complete electrical installation and workmanship on board shall be in accordance with the rules and regulations of the Classification Society and statutory authorities applicable to this class of vessel.

The electrical rotating machinery, transformers and other electrical equipment shall work satisfactory at an ambient temperature of 45°C or to suit the tropical environment.

Electrical motors to be standardized as much as possible to size and type and with isolating class F with the temperature rise for class B.

All the electrical equipment shall be arranged for easy accessibility for repair and replacement. The equipment installed shall work satisfactorily at voltage and frequency variations as specified by classification society.

Each control panel shall be provided with relevant drawing, wherein the fuse ratings of feeders shall be clearly mentioned.
Ingress protection of the Electrical equipment shall be as per the area of installation.

In general all the electrical motors, control panels and generators, unless specified by the supplier, shall be earthed as per the rules.

4.2 Power Supply

A 415 V, 3 Ph, AC 50 Hz electrical systems shall be used for normal power supplies. 24 V DC system shall be used for feeding the following loads.

- Engines and Genset engines starting
- Emergency lighting, Navigational and communicational equipment.

Provision for shore supply connection shall be made for powering the main switchboard through a shore supply box. In general squirrel cage marine type induction motors of direct on line starting type shall be used. The motors shall be drip proof or weather proof as required by the location and shall be of approved type.

4.2.1 Generator

The system shall have as a minimum 50 KVA, 3 pH 415 V.A.C. marine type, and drip proof diesel engine (water-cooled) driven alternator with electrical starting. The capacities are to be finalized subsequent to approval of the electrical load analysis. The generator shall be capable of taking the entire load with 20% reserve. The generator shall be continuously rated and shall have class F insulation, suitable for tropical environment and shall be designed for a temperature rise after continuous full load working not exceeding the temperature limits as specified by classification society. The diesel driven generator is to provide electrical power for the dredger. The Generator set is to be placed in the engine room. One harbour genset of 25 KVA capacity to be provided.

4.2.2 Battery

Lead acid batteries of adequate capacity with suitable charging arrangements, shall be provided for main engine and generator engine starting as per the rules. 2 numbers additional batteries should be provided above the main deck level for emergency lighting purpose and navigational and communicational equipment.
Battery charging arrangement with a tickle charging system is to be provided.

All batteries should be enclosed in well ventilated battery box so as to protect the batteries from the weather.

4.3 Power Distribution

4.3.1 Main Switch Board

One main switchboard of metal clad, drip proof, dead front type, mounted on resilient mountings shall be fitted in engine room. The switchboard shall be completely closed at the rear and is to be serviceable from the front. All the sides of the MSB should be accessible. Two nos. cooling fans to be provided.

The alternator panels shall have meters for the measurement of voltage, current, power factor separately for Auxiliary generator and Harbour generator. The alternator shall be protected through, circuit breakers of adequate capacity and shall have under voltage, over current and short circuit protection. All the out-going feeders and the shore supply shall be protected through suitable circuit breakers. Switchboard Earth leakage indicator shall be provided.

The switchboard shall be installed and designed with ample space for repairs and maintenance.

Remote stop arrangement for vent fans and oil pumps to be as per Rules. All the motors shall be protected through fuse and breaker of adequate capacity. Unless specified by the maker, motors with low starting current shall be of direct online starting type.

4.3.2 Distribution Board

Suitable number of lighting distribution boards and power distribution boards shall be provided. All the panels shall be of drip proof type; galvanized sheet metal enclosed and is to be provided with suitable schematic drawings.

Both the switchboards should be integrated with the PLC system or its equivalent.

Rubber floor matting to be provided.

4.4 Cables

All the cables shall be flame retardant and comply with rules of Classification Society. The voltage rating of the cables is to be as per the specific requirement of the installation and in accordance with the rules of classification society.

Cables passing through decks and bulkheads shall be led through individual watertight glands. The piercing shall be filled with approved filling material for water tightness. The piercing shall be filled with approved filling material for water tightness. Cables passing close to Radio and Navigation equipment shall be properly screened.
The control cables, power cables and communication cables are to be separated from each other.

4.5 Control System

The PLC System or its equivalent shall be designed, manufactured, programmed, and tested prior to installation on board the dredger. The control system shall be a PLC capable of monitoring digital and analog inputs, controlling digital and analog outputs, performing automatic loop control, displaying pertinent information, and recording historical data. The dredge control system shall protect against pump engagement and disengagement at high speed and locks out all hydraulic functions during start-up and control activation. The system shall also alarms on electrical faults, hydraulic problems, etc. All of the alarmed conditions, along with the time and date, are logged; the last sixty-four alarms are retained for review. The dredge control system shall provide electronic operation of the pump engagement, and all hydraulic speeds and directions. The dredge control system shall record and display the operating hours of all major dredge systems including major equipment hours, dredge pump, cutter and winches, Swing and Cutter Speed, Slurry Velocity Control, Predictive Pump Wear, etc.

4.6 Electrical System

- 24 VDC for starting, convenience lighting, navigation and controls

4.7 Lighting

4.7.1 General

The lighting installation consists of two networks - one of 220 V.A.C. and another of 24 V DC.
Light fittings are to be of LED Type. Light fittings inside the accommodation and wheel house are to be of decorative LED.

Illumination levels in various areas shall comply with relevant statutory authorities as applicable to this class of vessel.
Four numbers 40W, 220V portable hand lamps shall be provided with watertight sockets and 8 meters flexible cable.

Sufficient numbers of rechargeable battery lights operating on 220 VAC shall be fitted at the following places.

- Wheel house
- Engine room
- One cabin

Sufficient number of Marine Type switch sockets shall be provided in Engine room, Mess room and wheelhouse as per the Owners requirement.

4.7.2 Navigational and Signal Lights

Signal lights, NUC lights, anchor lights and other equipments shall be fitted as per regulations.

4.7.3 Floodlights and Searchlights

A 1000 W search light of rotating and adjustable type is to be fitted on top of the wheelhouse. The open decks are to be illuminated by sufficient number of LED floodlights for operation at night.

4.8 Navigational Equipment

The following equipments shall be provided

- Magnetic Compass
- Search light -1000 W
- LED Flood lights
- Electric horn-as per class requirement
- Fog Horn-as per class requirement
- Navigational lights
- Thermometer
- Barometer
- Nos. battery operated Clocks
- Remote location tracking device (GPS)
- GPS based navigation device

4.9 Navigational Console

One navigational console shall be erected in the wheelhouse and all the navigational equipment shall be fitted on it.

4.10 Communication Equipment

Following communication equipment shall be provided onboard:

- Internal

Engine room telegraph system. A voice pipe from wheel house to Engine room
- External
VHF radiotelephone Loud Speaker Signals and Alarm as per statutory rules.

5 Machinery & Piping Systems

5.1 General

All the engine room units shall be of marine grade and the installation should be in accordance with the rule and regulations of the Classification Societies and suitable for working in the following condition:

Maximum ambient temperature in engine room	: 50°
Maximum river water temperature	: 32°
Relative humidity (average)	: 95%

In general shop and installation tests shall be conducted as per the rules of the Classification Society and on an agreed program with Owners or their authorized representatives.

5.2 Main Engines

The broad specifications of the engine shall be as follows:
One no 4 stroke Marine quality diesel engine of suitable capacity (minimum 600 kw) shall be provided which shall be coupled to drive the dredge pump through marine reduction gear through suitable coupling made of appropriate material on one end and the other end is connected to drive hydraulic pump to cater to dredging functions while in dredge mode: -

a) Cutter Motors
b) Anchor booms
c) Flush pump
d) Winch
e) Any other dredging equipment / components.

Powering calculations are to be submitted along with the technical bid. Rating of the engine should be such as to ensure continuous dredging operation. The selection of engine is to be based on its smallness in size and lightweight.

Exhaust manifold and scavenging manifold should be provided with drain cock and Pipe.

5.3 Diesel Generator Set

One auxiliary engine of reputed make coupled with alternator set of appropriate capacity shall be provided.

5.4 Hydraulic System

Hydraulic pumps
A hydraulic power pack shall be provided such as to drive two hydraulic double gear pumps with fixed output, by means of a flexible coupling and gearbox, suitable for its functional requirements.

Hydraulic motors
All hydraulic motors used for the winches, as far as practicable, should remain identical.

Hydraulic piping

The hydraulic piping is to be of seamless steel pipe and provided with the necessary fittings, such as valves, non-return valves etc. The hoses and pipes are to be tested for 1.5 times the design pressure. All pipe and hose is supported by rubber bushed isolation mounts. All hydraulic components which are below the water line are to be designed for continued submergence. Pipes used for main hydraulic systems shall be of seamless steel ASTM as per Class requirement or manufacturer's recommendations, whichever is higher. Hydraulic control piping system shall be generally of pipes as per Class requirement or equivalent.

Cooler for hydraulic system

A hydraulic oil cooler is to be incorporated in the return pipeline of the hydraulic system.

5.5 Service Water Pump

The service water pump's primary use is for the dredge pump packing gland. The service water pump will also be used as the source for the raw water wash down system and the dredge pump transmission cooling system. The service water pump is to be of the centrifugal design with a single open-end suction protected by a strainer. The service water pump will be supplied with an apt suction and discharge relevant for the operation.

5.6 Propulsion System

Two nos. 4 stroke marine quality diesel engines of adequate horse power and reputed make each driving a fixed pitch nozzle propeller for propulsion system to achieve the desired speed of 7 knots should be installed. The shop test of the propulsion diesel engines shall be done as per the Class requirement. The specific fuel consumption is to be recorded during the trials.

The dredger should be able to tow at least 200 mtrs of floating pipeline and suitable towing arrangement to be provided.

5.7 Steering Gear

Two Electro Hydraulic operated semi balanced rudders of appropriate size to be provided.

5.8 Exhaust System

Every diesel engine shall have a separate exhaust pipe; the exhaust pipe lay out shall be approved by the engine maker's recommendation. The exhaust pipes shall be of steel. Exhaust pipe layout shall be designed such that, it is detachable at main deck level. A protection against rainwater entry is to be provided at the end. Necessary drains shall be fitted in the pipes to drain any water in the pipes.
Each engine shall be provided with suitable exhaust gas silencer.

5.9 Insulation

In general the surface machinery, equipment, pipes and tanks whose surface temperature is more than 50°C shall be insulated.

Pipe shall be tested and painted (when necessary), before insulation is applied. The exhaust gas piping and silencers are to be insulated with rock wool blankets on wire gauze finished with a glued layer of glass fibre cloth and the whole to be covered with aluminium sheets. The flanges and expansion joints have to be covered, with insulating mattresses filled with glass wool. The application of asbestos as insulating material is not permitted.

In general the insulating materials shall be fire resistant and shall be arranged in such a way that operation and maintenance are not hindered.

5.10 Fuel oil system

The fuel oil shall be stored in two storage tanks provided in the engine room. The capacity is not to be less than 10 KL. In addition, two F.O. day tanks of suitable capacity shall be provided for the engine, such that sufficient head is available for engines. A fuel measuring indicator is to be provided. A display indicating the amount of fuel is to be fitted on one of the consoles in the wheelhouse

Each diesel engine will draw the fuel oil directly from fuel oil day tank. A fuel oil transfer / supply pump 5m3/h is to be installed in the engine room for transferring the fuel oil from storage tanks to day tanks. Piping must be fitted below floor level as far as possible.

Necessary quick closing valves operable from main deck to be provided for fuel oil storage tank/day tanks as per class requirements.

5.11 Lube Oil System

The following installations shall have their own independent lube oil system

- Each diesel engine
- Each reverse reduction gearbox.

As far as possible all systems should use the same lubricant. The yard will be required to furnish a list of lubricants to be used on machinery and equipment installed in the vessel, in accordance with the manufacturers recommendation for Owners reference.

One service tank shall be provided with a tap cock and drip tray for filling oilcan and having a capacity of at least 300 liters.
All piping is to be executed with steel tubes.

5.12 Cooling Water System

The main parts of the cooling water system of the diesel engines are to be built on the respective engines. The oil coolers of the reverse / reduction gearbox shall be connected to the cooling water system of the concerned diesel engine.

5.13 Bilge / Deck wash and Fire-Fighting system

Two Bilge cum General Service pumps driven by main engines shall be installed in the engine room. The pumps shall be of the self-priming centrifugal type and to have a capacity of 25 m^3 /h at 2 bars. Further, two hand operated portable bilge pumps shall be installed, one in the steering gear compartment and one in the fore peak. One double acting head operated pump is to be provided in the suitable place, for emergency fire fighting purpose.

All piping shall be galvanized after fabrication. Pipe sizes shall be as per the requirements of the Classification rules. Over board discharge valves shall be screwed down non-return type (SDNRV) Valves.

Sufficient number of the fire hydrants shall be arranged on deck and in engine room satisfying Classification/statutory regulations.

5.14 Ventilation system

Engine room:

Supply of fresh air and exhaust for the engine room shall be provided through two axial flow fans of suitable capacity, out of which one is of reversible type.
Sufficient ducting has to be provided to ensure the air supply at required locations.

Accommodation:

Supply of air to accommodation spaces shall be provided through one no. Axial flow fan of suitable capacity is to be provided. Exhaust shall be natural. Sufficient ducting has to be provided to ensure the air supply at required locations.

Galley & Toilets:

Galley and two-toilet space shall be provided with one exhaust fan each. Supply is natural. All axial fans shall be mounted on the deck. The capacity of the system is to be calculated on the basis of International Standards and in general to maintain ISO's specified conditions inside the engine room. All fans should have emergency stop facility from the wheelhouse.

Cabin Fans:

Cabin Fans shall be provided as per the following:

- Two persons cabin-one fan per person
- Wheelhouse – 2 fans
- Four persons cabin-1 fan per person
- One split type Air Conditioner to be provided in all cabins.

5.15 Fire Fighting System

In general, fire-fighting system shall be in accordance with class / statutory requirements. Portable foam fire extinguishers in engine room and other places in the vessel, fireman's outfit, dry powder extinguisher in engine room and wheel house and fire main and hydrants complete with hoses and nozzles satisfying various class / statutory requirements shall be provided. A general service /fire fighting pump of capacity 25 cum/hr at 3 bar, as a minimum is to be provided.

5.16 Sanitary Water System

A gravity water tank of 500 lt. shall be installed on the wheelhouse deck. The tank shall be filled by a separate pump. Toilet space shall have a river water flushing system.

5.17 Potable Water System

A gravity water tank (approximate capacity 500 ltrs.) is to be installed on the wheelhouse top. The tank shall be filled by a centrifugal pump of suitable capacity. Necessary connection is to be given to washbasins, galley and toilets.

5.18 Sewage discharge system

Sewage from the toilets and galley shall be collected in two holding tanks located below the toilets. There shall be a pumping arrangement to discharge this sewage to shore reception facilities. One power driven pump of sufficient capacity exclusively for this purpose in addition to hand pump along with necessary piping systems is to be provided. A sewage treatment plant of approved make and capacity shall be installed.

5.19 Vent, Sounding and Filling Pipes

All air sounding and filling pipes for water tanks and void spaces are to be of galvanized steel. For pipes on oil tanks only the parts above open decks to be of galvanized steel.

All structural and loose tanks to be provided with a vent pipe connected to the highest point of the tank. Vent pipes of fuel tanks shall be fitted with flameproof wire gauge. Upper ends of vent pipes to be provided with air pipe hoods. Save tray with drain plug shall be provided at the fuel oil bunkering pipe and vent pipe.

Air vents for fresh water tank shall be provided with insect proof net. Flush and thief proof sounding caps shall be provided on the upper deck. Sleeve joints shall be used for pipes passing through decks.

Tanks in the engine room shall be provided with a short sounding pipe with a self-closing sounding cock. Filling connections to various tanks shall be arranged at least 300 mm above deck. They shall be suitable for coupling to standard supply hoses. Shut off by brass caps with chains should be provided.
Air and sounding pipes shall be arranged near bulkheads and behind stiffeners wherever possible.

5.20 Bow Anchor

Bow Anchor of adequate weight of standard design and approved make along with chain cable of appropriate length & and size as per classification society requirement to be provided.

5.21 Anchor Winch

Bow anchor winch should be electrically operated and installed.

6. Deck Crane

One manually operated deck crane of 2 tonne lifting power with about 3 mt out reach for handling parts of machineries from the engine room to be provided.

7. Dredge Machineries & equipment

7.1 Dredge Pump

The dredge pump should be an in-hull mounted pump and shall be rated to ensure pumping of the dredged material through a 500 m long floating pipeline. The dredge pump must be capable of a flow rate of 1250 cum/hr with 20% concentration and mixture density of 1.3 t/m3 with side casting facility on either side with a throw of about 80 m. The suction and discharge pipeline diameters are not to be less than 300 mm. The pressure pipe line on board to be installed with expansion pipe pieces provided shortly after the sand pump discharge opening. At the aft end, a swivel bend with stuffing box to be mounted for connecting to a floating pipeline is to be provided. The required gland pump, flushing pump and any other accessories as required for the functioning of dredge pump, impeller shall be provided. The separate size

of impeller if considered necessary for discharging the spoil directly through side casting or through pipelines shall be provided. Accordingly, one set of spare impeller and two set of spare wearing plates shall be supplied along with the dredger.

7.2 Dredge Pump Drive and Cutter

The dredge pump is to be driven by one engine and should be efficient in performing the envisaged duties as per the specification.
The cutter will be driven by a hydraulic pump. The cutter head will be basket style cutter or serrated or plain or equivalent with welded heavy duty replaceable teeth.

7.3 Cutter

The cutter size and type shall be installed for type of soil to be dredged. However, the cutter of serrated and plane with removable type of teeth or any equivalent or efficient cutter shall be suggested and installed considering the ease in the repair & maintenance.

7.4 Spoil Discharging Arrangement through nozzle and pipelines

The dredge shall be equipped with a side casting discharge nozzle for jettisoning the dredge slurry and capable of having a throw of about 80 m on either side. The floating dredge pipeline for 200 mt in length and of suitable diameter of HDPE shall be provided along with suitable floaters having opening & closing system, flexible hoses and anchors.

8. Floating Discharge Pipelines

Floating discharge pipeline of 200mtr length to be supplied alongwith the dredger. The pipes to be made of HDPE and duly provided with flanges at both end and enable to easy fitment by use of gaskets and galvanized nuts and bolts. The pipe shall be of 6mtr in length interconnected by 2mtr long rubber hoses. Each length of pipeline to be supported by two nos. high impact polyethylene floating elements made in two halves having length of about 1mtr each. The floating element to be designed for keeping the dredge pipeline afloat when pumping a mixture with a density of 1.6 tonne per cub.mtr with a margin of 15% displacement.

All flange connection to be designed with a rubber sealing ring, a minimum number of bolts and taking into consideration an axial load due to current of atleast 8 KN. Further for anchoring this pipe line all elements to be provided with suitable connections and required number of anchors with each anchor connected with a 30 mtr long wire.

9. Dredge automation & Dredge Controls

Controls for hydraulic motors and engine controls are to be located in the wheelhouse as well as locally, where applicable.

9.1 Suction Depth Indicator

A scale is to be fitted on the ladder for indication of dredging depth

9.2 Swing Angle Measurement

Provision is to be made to calculate and display the swing angle, heading and the same is to be integrated with the PLC.

9.3 Density meter and production calculator

The density meter of non-radioactive material shall be installed with production calculator for measuring for production of the dredger. The density meter should be able to operate in the most hostile and demanding of process conditions and capable of carrying out measurements on all kinds of liquids and bulk materials. They should be able to provide a maintenance free operation as far as possible.

10. Hull inventory and tools

10.1 General

Standard Hull inventories and tools including tools recommended by the manufacturers shall be provided and they will be in accordance with normal shipbuilding practice.

10.2 Tools and Inventory

- Tools and inventory must be of good standard and approved type, where applicable.
- The tools and inventory shall consist of:

Maker's standard tools and special tools necessary for overhauls during the life of the vessel are to be delivered by all the manufacturers with their supply.

10.3 Spare Parts

One set of spare impeller and two set of wearing plates are to be provided along with the dredger.

Spares required for 2000 hrs of operation as recommended by Original Equipment Manufacturers are to be supplied for the following:

- Main engines for propulsion
- Dredge pump engine
- All gearboxes
- All generators
- Dredge pump
- Cutter head and
- All winches & any other major machineries.

These spare parts, suitably packed, will have to be delivered along with the dredger within the delivery period

10.4 Additional items

1. Bilge alarm shall be provided as per requirement of classification society.
2. Oily Bilge Separator (OBS) system shall be provided.
3. Smoke sensors shall be provided in accommodation and in engine room as per requirement of classification society.
4. Battery box shall be kept in separate space on the deck.
5. Vessel vibration and noise level shall be as per requirement of classification society.

10.5 Sales Support Certificate

The bidders to provide certificate from the prospective OEM's of the proposed major equipment's, confirmation after sales service /maintenance support facilities in India.

10.6 Solar Power Backup

Solar panels for charging of batteries to cater to the requirements of accommodation load to be fitted and integrated with power supply (at clause 4.2)