

## SECTION 40000 MACHINERY

**40001**  
**General**  
**Description**

The design and lay-out of the propulsion installation shall be in accordance with Constructor's Standards and with the relevant rules of the Classification Society and shall be such that permanent attendance in the engine room is not required.

Two sets of propulsion units shall be installed. Major parts of each unit shall consist of a main engine, propeller shafts, a hydraulic clutch, reduction gears and 360 degrees steerable propeller.

Two (2) AC generators driven by two (2) diesel engines shall be installed in the engine room for driving various motors and for supplying electric power to the communication system and lighting system.

Main engines, generators and other auxiliary machinery and equipment shall be arranged so that operation and maintenance can be easily performed.

All mechanical systems and equipment proposed by the Supplier shall be of the type approved or accepted by the Classification Society.

**40002**  
**Main Engines**

Type: Vertical in line, single acting, 4-cycle, 4 valves, trunk piston type diesel engine, non-reversible with turbo charger and charged air cooler.

No. of sets: Two

Maximum Continuous Rating (MCR): 1,323 kW (1,800 PS)/set

Rated speed: 720 rpm - 1,000 rpm

Overload rating: 110% MCR for 1 hour in every 12 hours period

Starting system: Compressed air starting

The main engine shall be started and or stopped at the engine side, and other speed control can be done from the wheelhouse.

Cooling system:

Piston: With lub-oil system oil

Turbo charger: Non cooling type

Charged air cooler: With sea water

Lub. oil cooler: With sea water

Fresh water cooler: With sea water

Fuel injection valve: Non cooling type

Cylinder jacket & head: With fresh water

The main engine shall be equipped with a fuel oil feed pump, a lubricant oil pump, a cooling sea water pump and a cooling fresh water pump. These pumps shall be directly driven by the main engine.

**40003  
Shafting and  
Propelling  
System**

**40003.1 General**

The power of the main engine shall be transmitted to the propeller via an elastic coupling intermediate shaft with universal joints at both ends, a multi-disk hydraulic clutch and Z-type two-step reduction gears. The intermediate shaft shall be supported by bearings at suitable locations.

**40003.2 Elastic Couplings**

An elastic coupling shall be fitted at the aft end of the main engine to protect the propelling unit from impact force and torsional vibration caused when the main engine is started and stopped, and also to protect the main engine from fluctuation of the load transmitted from the propelling unit.

**40003.3 Intermediate Shafts**

The intermediate shafts shall be made of carbon steel and have a specified diameter as required by the Classification Society.

**40003.4 Intermediate Shaft Bearings**

Intermediate bearings shall be of cylindrical roller bearing type.

**40003.5 Universal Joints**

The universal joint shall be of double cross joint with spline shaft type and designed as required by the Classification Society.

**40003.6 Bulkhead Packing Boxes**

A bulkhead packing box shall be provided at the aft end bulkhead of the engine room and made of steel plate, split in halves, and shall be provided with a watertight packing box and a gland.

**40003.7 Hydraulic Multi-disk Clutches**

The clutch shall be engaged and disengaged at the minimum revolution of the main engine.

The clutch shall be controlled remotely from the wheelhouse, which is provided with an indicating lamp and a buzzer showing engagement and disengagement of the clutch.

**40003.8 Propelling Units**

(1) Particulars of the unit shall be as follows:

No. of units:	Two
Type:	360 degrees steerable Z-drive type propeller unit
Revolution of propeller:	About 330 rpm (at engine MCR output)
Type of propeller:	4 bladed, fixed pitch, skewed Kaplan Type (with propeller duct)
Diameter of propeller:	About 2,000 mm

Material of propeller: Nickel-Aluminum Bronze

Material of propeller duct: Welded steel construction

(2) Hydraulic oil system for one ship:

a) Hydraulic oil pump (main shaft driven pump for steering): 2 sets

b) Hydraulic oil pump (electric motor driven for clutch operation): 2 sets

c) Fittings:

- Oil cooler, strainer, sump tank

(3) Swiveling system

The power of the oil motor mounted on the strut shall be conveyed through a spur gear to the propeller pod and propeller duct for turning them through 360 degrees in any desired direction.

Turning speed: Approx. 10 seconds/180 degrees  
(at low sailing speed)

**40004**  
**Remote Control**  
**System for**  
**Propelling Unit**

The main engine speed, clutch motion and steering angle shall be controlled by means of an electric pneumatic control device installed on a control stand in the wheelhouse.

In the case of failure of main power (AC) supply to the system, the system shall be run by back-up battery power automatically.

The steering angle can be controlled manually at the propeller unit side.

The wheelhouse control stand shall be equipped with:

- a main engine speed control handle
- a steering control handle
- an indicator and alarm panel, etc.

In addition to the above the following equipment shall be provided next to the control stand.

- Remote control levers for deck machinery
- Remote control device for quick release of tow line hook.

**40005**  
**Auxiliary**  
**Engine for**  
**Generators**

Two (2) auxiliary marine diesel engines driving two (2) generators shall be installed in the engine room. The engine shall be completely equipped with attachments and accessories necessary for its operation.

The engine shall be of single acting, 4-cycle, trunk piston type and started and stopped from a control panel on the engine. The engine shall be started by an electric cell motor. The engine shall be cooled by a closed fresh water cooling system.

Output x revolution: not less than 92 kW (125 PS) x 1,800 rpm/set.

**40006**  
**Engine Room**  
**Auxiliary**

**40006.1 Auxiliaries Driven by the Main Engine**

The following pumps shall be attached to the engine and driven directly by the engine.

The main engine at rated output shall be sufficient to drive the pumps to reach their specific capacities.

- Fuel oil feed pump

- Lubricant oil pump
- Cooling sea water pump
  - Cooling fresh water pump

#### 40006.2 Independent Auxiliaries

The following auxiliaries driven by their own independent electric motors except specially specified shall be installed in the engine room:

	Quantity for 1 vessel	Capacity
Main air compressor	2	25 m <sup>3</sup> /h x 2.94 MPa (30 kgf/cm <sup>2</sup> )
Aux. air compressor	1	Hand operated
Fuel oil transfer pump	2	5 m <sup>3</sup> /h x 0.2 MPa (2 kgf/cm <sup>2</sup> )
M/E S/B lub. oil pump	1	30 m <sup>3</sup> /h x 0.5 MPa (5 kgf/cm <sup>2</sup> )
M/E S/B cool S.W.P.	1	GS/ballast pump may be used
M/E S/B cool F.W.P.	1	50 m <sup>3</sup> /h X 20 m H <sub>2</sub> O
Clutch priming L.O.P.	1	As per the Maker's Standards
Fire pump	1	120 m <sup>3</sup> /h x 120 m driven by a diesel engine of 81 kW (110 Ps) x 3,000 rpm.
Fire, G.S./ballast pump	1	80/40 m <sup>3</sup> /h x 30/50 m H <sub>2</sub> O
Bilge pump	1	20 m <sup>3</sup> /h x 20 m H <sub>2</sub> O
Oil bilge pump	1	0.15 m <sup>3</sup> /h x 20 m H <sub>2</sub> O
Bilge separator	1	0.15 m <sup>3</sup> /h
Hydraulic pump for deck machinery	1	30 kW x 1,500 rpm
- ditto - for brake	1	2.7 kW x 1,500 rpm
Ventilation fan		
Engine room, mechanical	2	300 m <sup>3</sup> /min x 294 Pa
Prop. gear room, mechanical	1	100 m <sup>3</sup> /min x 196 Pa
Domestic F.W.P.	1	4 m <sup>3</sup> /h x 18 m H <sub>2</sub> O
A/C & Hyd. pump cool S.W.P.	1	10 m <sup>3</sup> /h x 20m H <sub>2</sub> O

#### 40007 Engine Room Piping Arrangement

##### 40007.1 General

The design and layout of the piping system, the materials, installation and testing shall be in accordance with the Constructor's Standards and comply furthermore with the relevant rules of the Classification Society.

All pipes shall have bore sufficient to suit the service of the respective pumps and shall be coupled by flanges or screw joints conforming to the Constructor's Standards or equivalent standards, or the regulation of the Classification Society.

In the piping work, extreme bends shall be avoided and bands shall be used for fixing at locations necessary to prevent vibration. Effective expansion joints or bends shall be used for expansion of pipes.

Each pipe shall be painted or color taped for identification in the piping system, and main valves and cocks shall be fitted with name plates.

**40007.2 Valves, Cocks and Sea Chests**

Valves and cocks shall comply with JIS or equivalent standards.

Sea suction valves and/or overboard valves with a nominal size of 50 mm or over shall be made of cast steel and those with a nominal size of less than 50 mm shall be made of bronze.

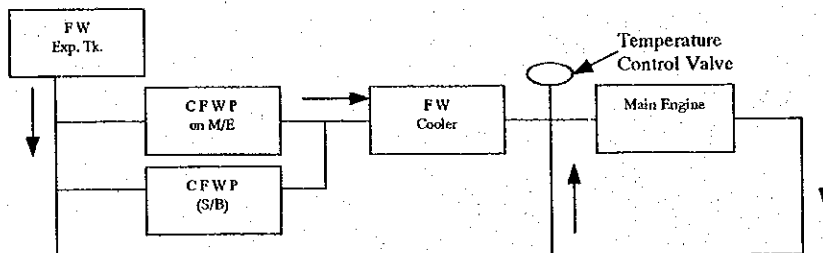
Sea chests shall be fitted with galvanized steel grids to prevent sea wear and foreign matters from entering the piping system.

**40007.3 Main Engine Cooling System**

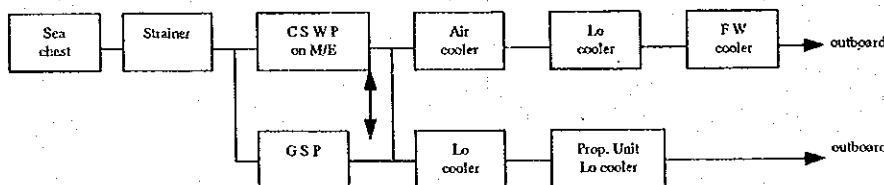
The engine shall be cooled by fresh water primarily and sea water secondarily as shown in the following diagram.

The pipes for cooling fresh water and sea water shall be of galvanized steel.

(1) Fresh water cooling



(2) Sea water cooling



**40007.4 Fresh Water Piping for General Use**

Fresh water shall be taken from a fresh water tank by an electric domestic type pump having its own small pressure tank and supplied to deck parts as specified in the Hull Outfitting specifications in Sub-section 30010.2.

Pipes shall be of galvanized steel.

**40007.5 General Service Sea Water Piping**

Sea water shall be taken from a sea suction valve on the sea chest through a filter by a GS/ballast pump and supplied to the deck wash line, fire hydrants on the upper deck and in the engine room and also to water sprinkling nozzles on the bridge deck and navigation bridge deck.

This pump shall be used for cooling the main engine and auxiliary engine as a stand by pump.

Pipes shall be of galvanized steel.

**40007.6 Bilge Piping System**

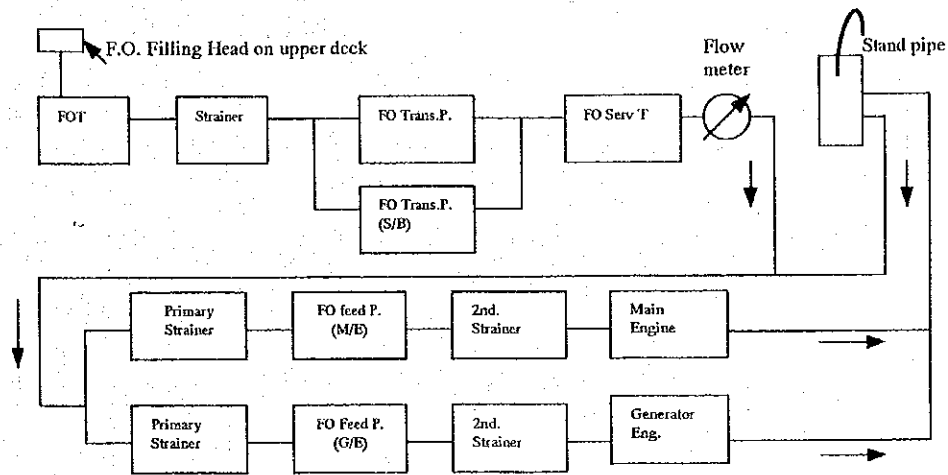
Bilge in the engine room and each division shall be sucked by a bilge pump, eductors or stand by bilge hand pump as specified in the Hull Outfitting specifications in Sub-section 30010.4.

Each suction mouth shall be fitted with a rose box and filter, and a non-return valve shall be provided where necessary. Bilge shall be discharged outboard via a bilge separator.

Pipes shall be of galvanized steel.

**40007.7 Fuel Oil Piping System**

Fuel oil piping shall be arranged as shown in the following diagram.



One F.O. filling head shall be provided on the upper deck and fuel oil is distributed to each F.O. tank through a change-over valve.

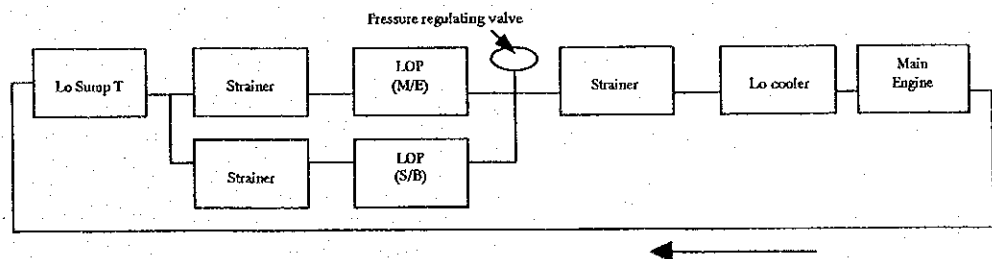
A flow meter and a stand pipe shall be fitted as shown in the diagram.

Pipes shall be of steel and cleaned carefully by pickling.

**40007.8 Lubricant Piping System**

(1) Main Engine

The main engine lubrication shall be done as shown in the following diagram.



- (2) For the propelling gear unit and auxiliary engine, a lubricating oil system shall be provided for each machinery according to the Constructor's Standards.

Pipes shall be of steel and cleaned carefully by pickling.

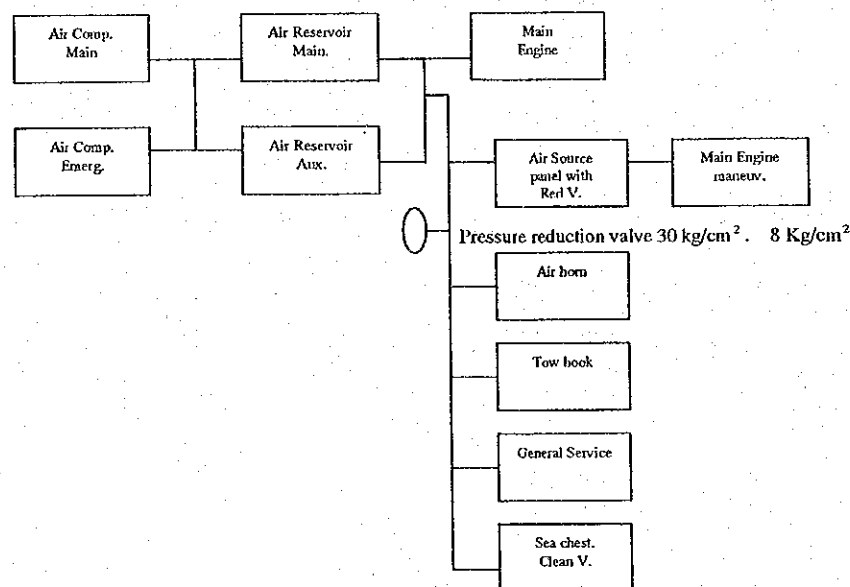
#### 40007.9 Hydraulic Oil Piping System.

Hydraulic oil for the propeller unit and deck machinery shall be designed and provided according to the Constructor's Standards.

Pipes and valves shall be of precision steel pipe type for high pressure use, and cleaned carefully by pickling.

#### 40007.10 Compressed Air Piping System

Compressed air piping shall be arranged as shown in the following diagram.



The air compressor shall be started or stopped automatically by means of pressure in the main air reservoirs.

Pipes shall be of galvanized steel for high pressure use.

### 40008 Engine Room Outfits

#### 40008.1 Floor Plates, Gratings, Ladders, etc.

Ladders and handrails shall be installed at necessary locations in the engine room to facilitate ascending and descending. Floor plates made of 4.5 mm thick checkered steel plate shall be installed so that the machinery, valves, cocks, tanks and other installations can be easily handled.

#### 40008.2 Watch Room

The watch room shall be located in the fore section of the engine room as shown on the General Arrangement Plan. The room shall be constructed with steel walls, insulated with 50 mm thick glass wool and lined with non-inflammable board, and large square windows shall be fitted.

The room shall be air conditioned; cooled air shall be led from an air conditioning

unit through a fire damper and exhausted to the engine room through louvers.

The room shall be equipped with the following items so that the major machinery can be watched therefrom:

- Main switchboard
- Group starter panel
- Alarm panel
- Log desk with chair
- Telephone

#### 40008.3 Firefighting Equipment

The firefighting equipment shall be in accordance with the rules of the Republic of El Salvador. Sea water for firefighting shall be supplied by means of a general service/ballast pump and shall be supplemented with fire hydrants installed at suitable locations.

Portable fire extinguishers shall be provided in the engine room as specified in the Hull specifications in Sub-section 30009.2.

#### 40008.4 Ventilation

The engine room and propelling gear room shall be mechanically ventilated as specified in the Hull specifications in Sub-sections 30011.2 and 30011.3.

#### 40008.5 Lighting

Four side scuttles with a diameter of 300 mm and equipped with blind covers shall be fitted on the engine casing wall for natural lighting.

Electric lighting shall be as specified in Sub-section 50007.2

#### 40008.6 Insulation

Exhaust pipes of the main engine, auxiliary engine and diesel engine of the fire pump shall be insulated with glass wool, 50 mm thick for the main engine and 25 mm thick for others; and glass wool shall be covered with a galvanized steel sheet.

#### 40008.7 Engine Store

The engine store shall be located in the aft section of the engine room and fitted with shelves.

#### 4008.8 Overhauling Device

I-beam tow trolleys shall be fitted under the engine casing top for overhauling the main engine: One on starboard and the other on port side. One 1-ton chain block shall be provided on each beam.

#### 40008.9 Tanks

The following tanks shall be provided in the engine room:

	Q'ty	Capacity	Remark
Fuel oil service tank	1	1,800 liters	Constructed on the hull with float switches
Lubricant oil storage tank	1	1,000 liters	Constructed on the hull
L.O. storage tank for propeller	1	200 liters	Settling tank
Fresh water expansion tank	1	400 liters	Settling tank
Hydraulic oil tank for deck			



machinery	1	400 liters	Settling tank
Light oil tank	1	300 liters	Settling tank
Oil drain tank	1	200 liters	Settling tank

Each tank shall be equipped with a level gauge, air pipe, drain pipe, manhole, etc

#### 40008.10 Air Reservoirs

The following air reservoirs shall be provided in the engine room.

Main	2	200 liters x 2.94 MPa (30 kg/cm <sup>2</sup> )
Auxiliary	1	80 liters x 2.94 MPa (30 kg/cm <sup>2</sup> )

#### 40009 Spare Parts, Tools and Inventory

##### 40009.1 General

Spare parts and tools for machinery shall be supplied for two-year operation. The items listed below shall be provided at least and stowed in suitable boxes.

##### 40009.2 Compulsory Spare Parts

- (1) Main Engines (Quantities are shown for two engines)
 

Fuel valve complete	1 set for 1 cylinder
Suction valve complete	2 set for 1 cylinder
Exhaust valve complete	2 set for 1 cylinder
Spare parts for turbo	1 set
Spare parts for elastic coupling	1 set
Spare parts for protection zinc	1 set
Starting valve	1 pc
Safety valve	1 pc
Thermometer	1 no. for each
Piston rings	1 set for 1 cylinder
Piston pin metal	1 set
Crank pin metal	1 set
- (2) Propelling Unit (Quantities are shown for two units)
 

Oil seal	1 no. for each
Lube oil cooler spare parts	1 set
Swiveling system (hydraulic unit)	1 set
- (3) Generator Engine (Quantities are shown for two engines)
 

Fuel valve complete	1 set for 1 cylinder
Suction valve complete	1 set for 1 cylinder
Exhaust valve complete	1 set for 1 cylinder
Piston ring	1 set for 1 cylinder
Oil ring	1 set for 1 cylinder

Piston pin metal	1 set
Crank pin metal	1 set
Connecting rod bolts & nuts	1 set for 1 joint
Spare parts for fuel pump such as plunger valve and spring	1 set
Fuel injector and coupling metal	1 set
Lube oil pump safety valve and spring	1 set for each
Cooling water pump suction and exhaust valve and spring	1 set for each
 (4) Centrifugal Pump, Gear Pump, Air Compressor and Ventilation Fan As per Maker's Standards.	
 (5) Miscellaneous	
Spring for automatic closing type drain valve	2 nos.
Spring for air reducing valve, 30.0 kg/cm <sup>2</sup> – 9.5 kg/cm <sup>2</sup>	1 no.
Diaphragm and rubber ring for the above valve	1 set
Spring for air safety valve	1 no.
Mesh for water strainer	1 no. for each
Oil level gauge glass	1 no. for each

**40009.3 Tools**

(1) Main Engines (Quantities are shown for two engines)	
Assembling and dismantling tools	1 set
Fuel valve test pump	1 no.
Portable tachometer	1 no.
Deflection gauge (with dial gauge) indicator	1 no.
Lapping-up tool for suction and exhaust valves	1 no. 1
 (2) Propelling Unit (Quantities are shown for two units)	
Tools for propeller drawing out	1 set
Input shaft turning lever	1 no.
Hexagonal bar spanner	1 set
Special tools	1 set
Tools for power unit (Pliers)	1 set
Guide bolt	1 set
Grease gun for universal joint	1 no.
 (3) Generator Engines and Air Compressors	

Tools for dismantling and assembling 1 set  
As per Maker's Standards

(4) Miscellaneous

Special tools necessary for dismantling and assembling of equipment shall be supplied as per Maker's Standards.

**40009.4 Optional Spare Parts**

In addition to the list of spare parts indicated in Sub-section 40009.2 above, the Contractor may propose a list of optional spare parts if, in his opinion, the same are required for proper operation and maintenance of the vessel.

The price of such optional spare parts shall be entered in the Bill of Quantities as a Provisional Sum.

**40010  
Inventory**

The following equipment and instruments shall be furnished by the Supplier:

Square	L 600 mm	1 no.
Inside caliper	200 mm	1 no.
Outside caliper	200 mm	1 no.
Compass	150 mm	1 no.
Steel measure		1 no.
Sounding rod	per oil tank	1 no.
Sounding scale	SUS, 5 mm interval	1 no.
Glass thermometer	100° C & 500° C	1 no. each
Hand boring machine		1 unit
Straight shank drill	3, 5, 6, 7 and 9 mm	1 no. each
Spanner		1 no. each
(General purpose, double ended 6 x 8, 10 x 14, 17 x 19, 19 x 21, 21 x 23, 26 x 29, 32 x 35, 41 x 46)		
Pipe wrench		1 no.
Screw driver (large 200 mm, small 100 mm)		1 each
Pliers (200 mm)		1 pair
Files (coarse, medium flat, half round) 300 mm		1 no. each
File handle		1 no.
Two hand hammers (0.9 kg and 0.45 kg)		1 each
Hacksaw (with 6 blades)		1 set
Vice (with 150 mm jaw face)		1 set
Oil funnel (large and small)		1 no. each

Oiler (mouse shape and trumpet shape)	1 no. each
Whiteboard	1 no.
Thickness gauge	1 no.
Monkey spanner (large 300 mm, small 200 mm)	1 no. each
Valve handle wrench (large & small)	3 no. each
Log table	1 no.
Work bench	1 no.
Electric grinder (both ended, 150 mm)	1 no.

## SECTION 50000 ELECTRICAL INSTALLATIONS

### 50001 Electrical Installations in General

#### 50001.1 General

All electric equipment of the vessel shall be in accordance with the regulations of the Classification Society. The performance and installation of all electric equipment shall meet the Classification requirements.

All electrical appliances shall conform to JIS, JEM or equivalent standards and the Builder's Standards in general.

All electrical systems and equipment shall be of the type approved or accepted by the Classification Society where specified by the Classification rule, otherwise approval of the Engineer shall be required.

#### 50001.2 Voltage, Frequency and Wiring

(1) The voltage, phase and wiring method shall be as follows:

Generator:	AC 450 V, 3-phase
Power system:	AC 440 V, 3-phase
Lighting:	AC 110 V, single phase
Emergency lighting:	DC 24 V
Small and special electrical appliance:	AC 110 V, single phase
Interior communication and radio:	AC 110 V, single phase or DC 24V

(2) Frequency:

60 Hz shall be adopted for AC system.

(3) Wiring method

AC 3-phase circuits shall be of 3-wire insulated type and AC single phases as well as DC circuits shall be of 2-wire insulated type.

### 50002 Generators

#### 50002.1 Main Generators

Two (2) AC diesel engine driven generators shall be installed in the engine room.

The generators shall have the following particulars:

Rated normal output/set:	not less than 100 kVA
Rated voltage:	AC 450 V
Power factor:	80%
No. of phase:	3 phases
Frequency:	60 Hz
Rating:	100% continuous
Revolution:	1,800 rpm
Enclosure:	Drip-proof
Cooling:	Self-ventilated
Exciting system:	Self-excited (brushless)
Insulation:	Class F

**50002.2 Use of Generators**

Generators shall be able to run in parallel. One (1) generator shall have enough capacity to carry the electric load required for either sea going, towing, entering and leaving the port, or anchoring. The other shall be used as standby.

**50003  
Transformers  
and Battery**

**50003.1 Transformers**

The following transformers shall be installed in the engine room.

Purpose:	General service
Type:	Dry, self-ventilated
Output:	15 kVA
Voltage:	450/115 V
Frequency:	60 Hz
Phase:	Single phase
Insulation:	Class B or H
No. of sets:	Three (3)

**50003.2 Battery**

The following battery shall be installed in the battery box.

(1) Battery

Purpose:	For emergency lighting and for communication and navigation equipment
Type:	Lead acid
Voltage:	24 V
Capacity:	200 A h
No. of sets:	Two (sets)

(2) Charging and Discharging

The following shall be provided:

Charging and discharging panel (Automatic charging system)	1 set
Rectifier (30 A silicon) (Incorporated into the charging and discharging panel)	1 set

**50004  
Switchboard**

**50004.1 General**

(1) Construction

The switchboard shall be of floor mounted and dead front type, and shall be fitted with handrail in front of the panel and removable protective cover at the lower part behind the panel.

(2) Air Circuit Breaker (ACB) for Generator

The ACB for generator shall be of 3-pole type and trip free type equipped with a trip device for under voltage, over current, and reverse power relay shall be fitted.

(3) **Circuit Breaker for Feeder Circuit**

A plug-in type circuit breaker with a trip device for over current shall be provided for protection of the feeder circuit.

**50004.2 Switchboard**

The switchboard consisting of the following panels shall be installed in the watch room in the engine room.

AC generator panel	2 units
440 V feeder panel	1 unit
110 V feeder panel	1 unit

**50004.3 Shore Connection Box**

A drip-proof type shore connection box fitted with a circuit breaker with a trip device for overcurrent shall be provided in the engine room to receive electric power of 50 A, AC 440 V, 3-phase, 60 Hz from the shore while the vessel is in port.

A safety lock shall be provided to prevent closing of the shore connection breaker as long as the generator remains on.

A shore supply connection cable of 50 m long with a female plug (ship-side) and a male plug (shore side) shall be supplied.

**50005  
Electric Power  
Distribution**

**50005.1 Electric Power Distribution**

Power motors shall be fed with electricity from a 440 V feeder panel, and other special motors and small electric appliances from 110 V feeder panels directly or through the distribution panel.

**50005.2 Distribution Panel**

The distribution panel shall be made of steel and shall consist of the following.

- (1) A 2-pole circuit breaker with an overcurrent trip device or a cellulite fuse shall be fitted for the 110 V distribution circuit.
- (2) A 2-pole circuit breaker with an overcurrent trip device or a cellulite fuse shall be fitted for the 24 V distribution circuit.

**50005.3 Wheelhouse Group Panel**

The integrated control panel shall be made of steel and shall be installed in the wheelhouse. The panel shall incorporate a navigation light indication panel, a lighting distribution panel and a 24 V terminal panel. An audible and visual alarm system in case of navigation light failure shall be incorporated.

**50006  
Electric Motors**

**50006.1 General**

Motors shall be of single speed, Class B or F insulated, squirrel-cage, induction motor type, and shall have characteristics corresponding to the respective services unless otherwise specified.

In general, motors shall be of enclosed type and fed with 440 V, 3-phase, 60 Hz alternate current.

**50007  
Electric  
Lighting**

**50006.2 Motor Control Equipment**

Each starter shall be equipped with a power supply switch, push button, solenoid contactor, overcurrent relay, ammeter and running indicating pilot lamp.

**50007.1 Lighting Circuit**

110 V electric power for lighting shall be fed from a transformer.

In general, electricity shall be fed to separate circuits for the engine room, propelling gear room, accommodation quarter, etc.

Electricity for emergency lights shall be fed from the battery to separate circuits for the engine room, propelling gear room, and accommodation quarters.

**50007.2 Lighting Fixtures and Electric Circuit Appliances**

In general, waterproof lighting fixtures shall be used for the galley, lavatory and outside lights exposed to weather. Drip-proof lighting fixtures shall be used for the engine room and propelling gear room as necessary. Non waterproof lighting fixtures shall be used for the accommodation quarters.

(1) **Lighting Fixtures**

Lighting fixtures for the wheelhouse and accommodation quarters shall consist of fluorescent lamps, and both fluorescent and incandescent lamps shall be used for the engine room and propelling gear room. Lighting fixtures to be used in other places shall consist of incandescent lamps.

(2) **Lamps for Accommodation Quarters.**

Fluorescent ceiling lamps with globe shall be furnished in the wheelhouse and accommodation quarters. Fluorescent bed lamps (8 W) shall be fitted at the head of the berth and wall mounted type lamps (15 W) shall be fitted on the desk.

(3) **Lamps for Passageway**

The passageway in the accommodation quarters and around the deckhouse shall be provided with passageway lamps at suitable locations.

(4) **Lamps for Engine Room and Propelling Gear Room**

In general, the engine room and propelling gear room shall be provided with both fluorescent and incandescent lamps.

(5) **Working Lights on Deck**

The following working lights shall be provided on the deck.

Searchlight (incandescent)                      1 x 1,000 W  
(Operated from the wheelhouse)

Floodlight (incandescent)                      4 x 500 W

(6) **Portable Lamps**

Five (5) water-proof portable lamps (60 W, incandescent) shall be provided for the following locations, and fitted with rubber insulated chloroprene cabtyre cord of sufficient length together with plug for moving the place.

Engine room    2



Propelling gear room	2
Passageway	1

(7) Emergency Lights

10 W emergency lights fed from 24 V battery shall be fitted in the accommodation quarters staircase/passage, galley, lavatory, engine room, propelling gear room and near the life raft.

In the locations where fluorescent lamps are used, emergency lights shall be incorporated into fluorescent lamps.

(8) Chart Table Light

One light with a dimmer switch shall be provided on the Chart Table.

**50007.3 Navigation Lights and Signal Lights**

(1) Navigation lights

The following navigation lights of two-lamp type shall be provided and controlled from the wheelhouse.

Mast lights:	AC/DC 24 V, 40 W x 3
Side lights:	AC/DC 24 V, 40 W x 1 pair
Stern light:	AC/DC 24 V, 40 W x 1
Towing light:	AC/DC 24 V, 40 W x 1

(2) Signal lights

The following signal lights shall be provided and controlled from the wheelhouse.

Anchor light:	AC/DC 24 V, 40 W (fixed) x 1
N.U.C. light:	AC/DC 24 V, 40 W (red) x 2
Day signal light:	DC 24 V, 60 W portable type x 1
Morse signal light:	AC 110 V, 3 x 20 W (fixed) x 1

**50008  
Communication  
Equipment and  
Navigation  
Instruments**

**50008.1 Alarms**

(1) Engine Room Alarm Panel

An alarm panel shall be installed in the watch room in the engine room. The control stand in the wheelhouse shall be equipped with alarms. Both alarms shall work in the case of failure of the engine, propelling unit, generator, etc. The electric source shall be AC 110 V and DC 24 V.

(2) Emergency Stop Button

Fuel oil system auxiliaries and ventilation fans can be stopped by pushing an emergency stop button in case of fire. One emergency stop button each shall be provided along the way to the engine room door and in the wheelhouse.

(3) General Alarm

One set of general alarm system shall be fitted, with a switch in the wheelhouse to activate a number of signals which can be heard all over the ship.

### 50008.2 Internal Communication

- (1) A common 24 V battery telephone system shall be provided at the following stations:

Wheelhouse

Engine room (watch room)

Propelling gear room

Captain's room

Chief engineer's room

- (2) Public Address System

One 24 V electric public address system shall be provided as follows:

Public address system amplifier with control panel 1  
(30 W radio tune and monitor speaker incorporated,  
in the wheelhouse)

30 W trump speaker (wheelhouse top) 1

2 W Cabin speaker 3  
(watch room, mess & passenger room, passageway)

5 W trump speaker 2  
(engine room, propelling gear room)

Microphone (hand type) 1

- (3) Engine Telegraph

One set of Engine Telegraph shall be provided in between the wheelhouse and the engine room and propelling gear room.

### 50008.3 External Communication

- (1) VHF radio set.

One VHF tranceiver with DSC receiver, DC 24 V power supply, shall be provided.

- (2) Walky-talky

Three sets of walky-talky shall be provided

- (3) NAVTEX Receiver

One NAVTEX receiver with 24 V DC power supply shall be installed.

- (4) Air Horn

One air horn, manually operated from the wheelhouse with timer control, shall be provided.

### 50008.4 Nautical Instruments

- (1) Magnetic Compass (specified in Sub-section 30018)

One set of reflector type magnetic compass shall be installed on the top of the wheelhouse.

(2) Radar

One marine radar of the following particulars shall be provided:

Type:	Daylight
CRT:	12 inches
Range:	48 nautical miles
Frequency:	X-band
Electric source:	AC 110 V or DC 24 V

(3) GPS Navigator

One GPS Navigator shall be installed.

(4) Echo Sounder

One echo sounder with the following features shall be provided

Display:	10 inches color
Range:	0 - 200 m

(5) Ship's Log

One set of ship's speed log shall be installed.

(6) Wind Indicator

One set of wind direction/speed indication instrument (wind - vane and indicator) shall be installed.

(7) Current Indicator

One set of current indicator of Doppler sonar type shall be provided.

(8) Window Wiper

The following window wipers (specified in Sub-section 30001.4) shall be provided on the front window of the wheelhouse. The electric source shall be AC 110 V.

Parallel moving type, dual speed:	1 at centre window
Sewing type, dual speed:	2 at both side windows

**50009**

**Spare Parts and  
Outfits**

**50009.1 General**

Spare parts and tools for electric equipment shall be supplied for two-year operation. The following listed items shall be included at least and stowed in suitable steel boxes.

**50009.2 Compulsory Spare Parts**

Figures in brackets show the maximum numbers.

(1) Generators (with Exciter)

Bearing:	1 for each 4 or less
Hand trimmer:	1 for each

(2)	Electric motors:	
	Bearing (with oil seal):	1 for each
(3)	Starters	
	Magnetic contactor:	1 for each (10)
	Working coil and voltage coil:	1 for each
	Resistor:	1 for each
	Pilot lamp bulb:	Same quantity as for normal use
	Pilot lamp lense:	1 for each (10)
	Fuse case:	1 for each (10)
	Fuse element:	Same quantity as for normal use
(4)	Switchboard	
	ACB arc contact:	Same quantity as for normal use (10)
	ACB aux. switch contact:	Same quantity as for normal use (10)
	ACB spring:	1 for each (4)
	Circuit breaker:	1 for each (10)
	Voltage coil:	1 for each
	Pilot lamp bulb:	Same quantity as for normal use.
	Pilot lamp lense:	1 for each (10)
	Resistor:	1 for each
	Fuse case:	1 for each (10)
	Fuse element:	Same quantity as for normal use.
(5)	Distribution Panel	
	Circuit breaker:	1 for each (10)
	Fuse case:	1 for each (10)
	Fuse element:	Same quantity as normally used.
(6)	Lamps	
	Bulb:	2 for each (20)
	Fluorescent discharge tube:	2 for each (20)
	Fluorescent glow bulb:	2 for (20)
	Fluorescent stabilizer:	2 for each
	Waterproof switch:	2 for each
	Non waterproof switch:	2 for each
	Waterproof plug and receptacle (with switch):	2 for each
	Non waterproof plug and receptacle:	2 for each
	Navigation light bulb:	2 full sets

### 50009.3 Outfits

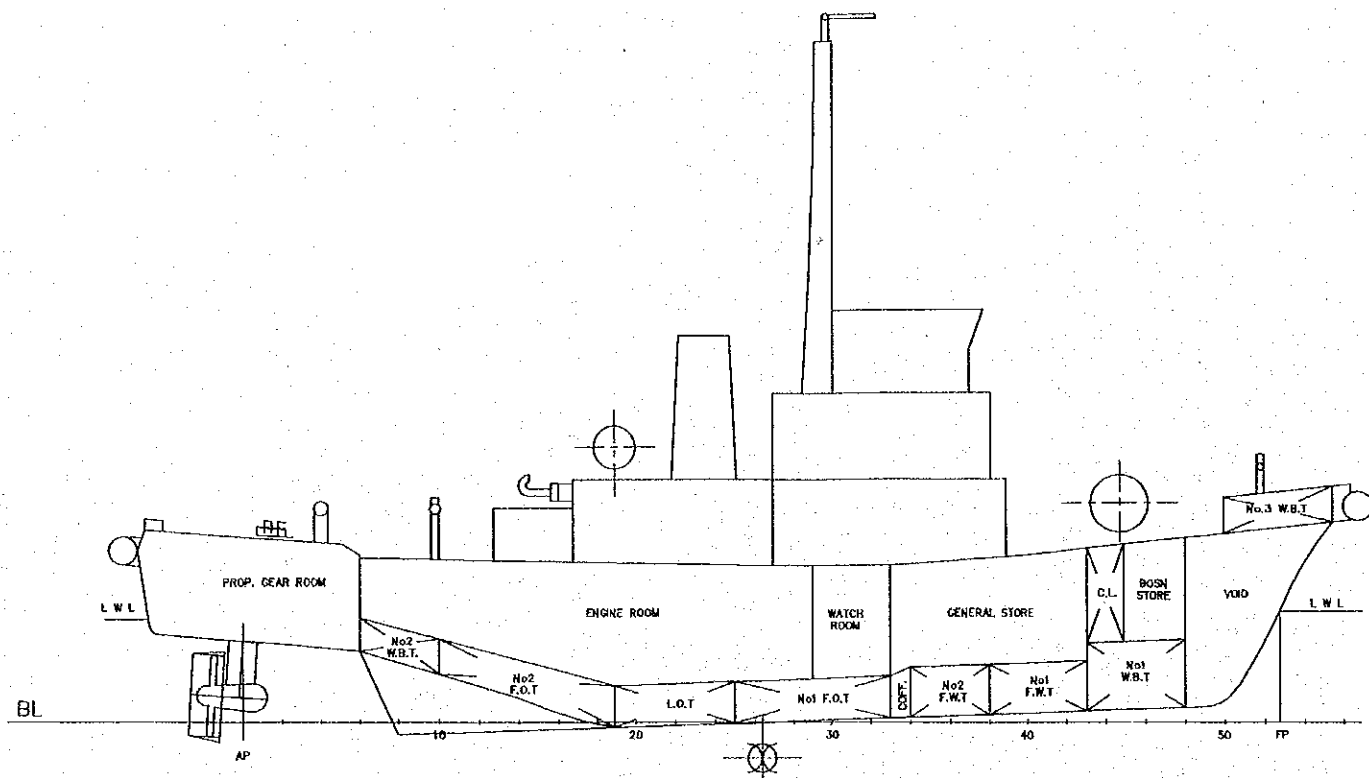
The following outfits shall be supplied:

- |     |                                     |            |
|-----|-------------------------------------|------------|
| (1) | Battery                             |            |
|     | Thermometer:                        | 1          |
|     | Hydrometer:                         | 1          |
|     | DC voltmeter:                       | 1          |
|     | Distilled water (1.8 liters):       | 1 bottle   |
|     | Dilute sulphuric acid (1.8 liters): | 1 bottle   |
|     | Syringe:                            | 1          |
|     | Glass Jar:                          | 1          |
|     | Jug:                                | 1          |
| (2) | Tools                               |            |
|     | Megger:                             | 1          |
|     | Tester:                             | 1          |
|     | Check lamp:                         | 2          |
|     | Screwdriver:                        | 1 for each |
|     | Nipper:                             | 1          |
|     | Pliers:                             | 1          |
|     | Electrician's knife:                | 1          |
|     | Monkey wrench:                      | 1          |
|     | Tool box:                           | 1          |
|     | Hand megaphone (Battery type)       | 1          |

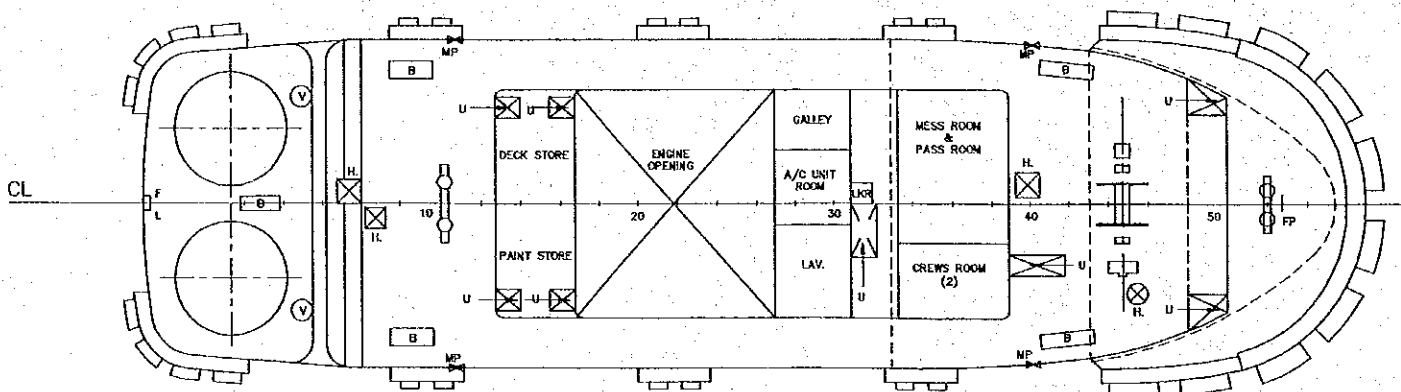
### 50009.4 Optional Spare Parts

In addition to the list of spare parts indicated in Sub-section 50009.2 above the Supplier may propose a list of optional spare parts if, in his opinion, the same are required for proper operation and maintenance of the vessel.

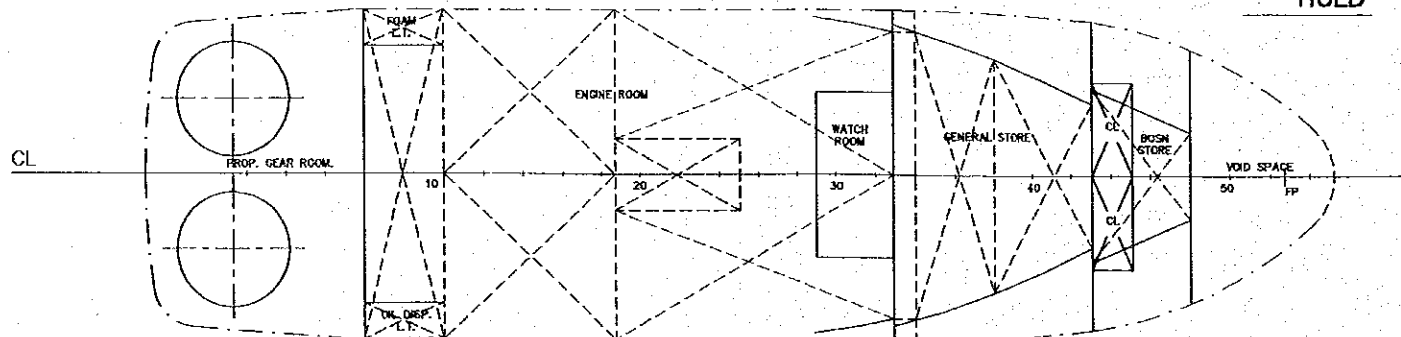
The price of such optional spare parts shall be entered in the Bill of Quantities as a Provisional Sum.



UPPER DECK



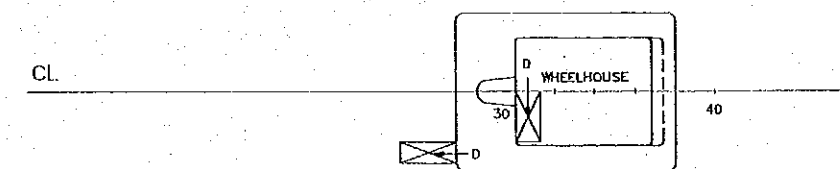
HOLD



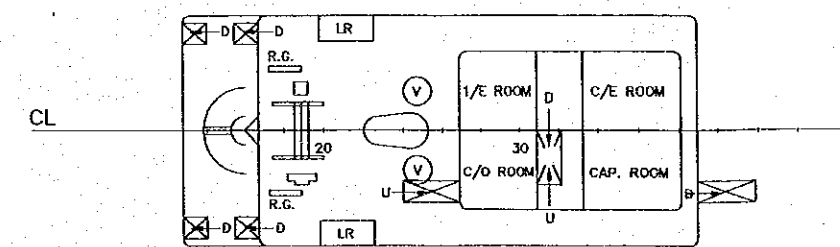
**PRINCIPAL PARTICULARS**

LENGTH (O.A.)	33.50 m
LENGTH (P.P.)	29.00 m
BREADTH (MLD)	9.40 m
DEPTH (MLD)	4.00 m
DRAFT (MLD)	3.10 m
GROSS TON	280 ton
MAIN ENGINE	2 X 1,323 kW (2 X 1,800 = 3,600 PS)
SERVICE AREA	COASTING SERVICE



NAV. BRIDGE DK.




ENGINE CASING TOP & BRIDGE DECK



REV. NO.	DATE	COORDINATE	BY	APPROVED	DATE

 JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
 COMISION EJECUTIVA PORTUARIA AUTONOMA (CEPA)

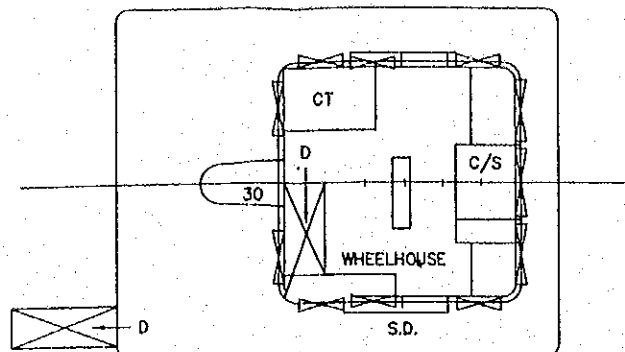
THE DETAILED DESIGN  
 ON PORT REACTIVATION PROJECT  
 IN LA UNION PROVINCE  
 OF THE REPUBLIC OF EL SALVADOR  
 NIPPON KOEI CO., LTD.

DESIGNED BY :  
 CHECKED BY :  
 APPROVED BY :

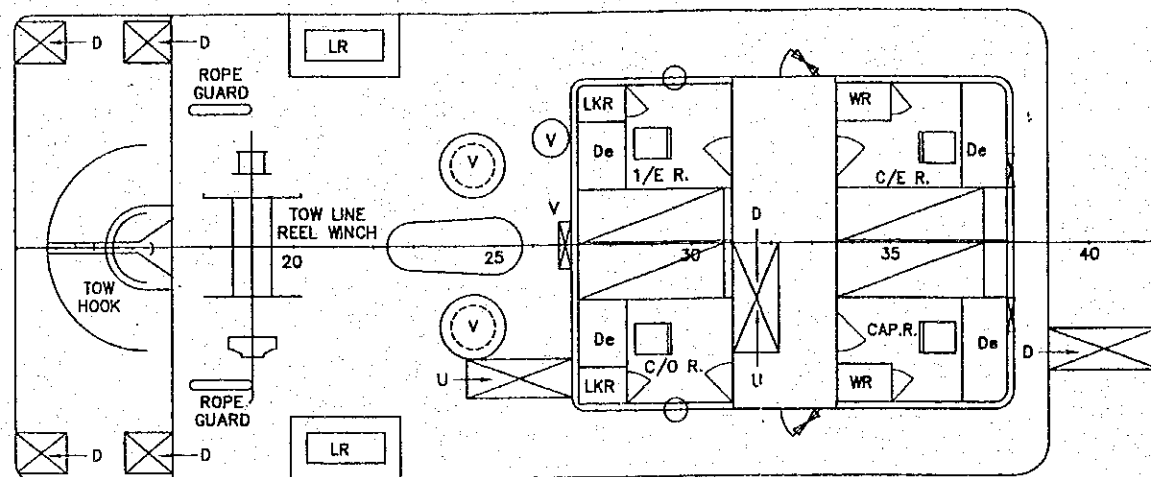
**PACKAGE C**  
**TUGBOAT**  
**GENERAL ARRANGEMENT**

DATE : OCTOBER/2002  
 SCALE : 1:200  
 DRAWING NO: DWC-01

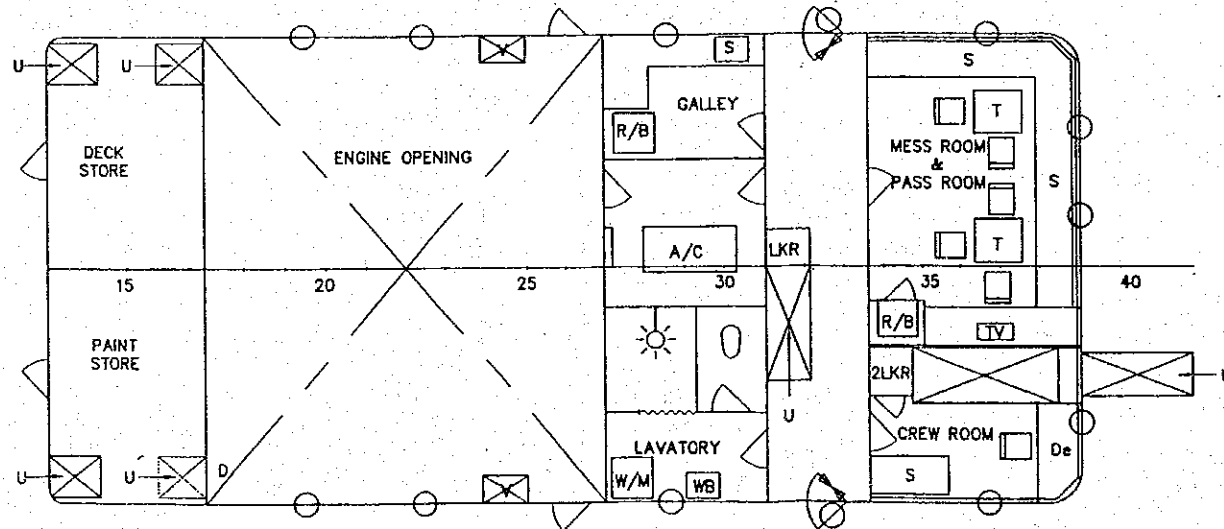
NAVIGATION BRIDGE DECK



ENGINE CASING TOP & BRIDGE DECK



UPPER DECK



REV. NO.	DATE	COORDINATE	BY	APPROVED	DATE

**JICA**  
 JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**Cepa**  
 COMISION EJECUTIVA PORTUARIA AUTONOMA (CEPA)

DETAILED DESIGN ON PORT REACTIVATION PROJECT IN LA UNION PROVINCE OF THE REPUBLIC OF EL SALVADOR

**NK** NIPPON KOEI CO., LTD.

DESIGNED BY :  
 CHECKED BY :  
 APPROVED BY :

SECTION :  
 SUB-SECTION :  
 TITLE : **PACKAGE C TUGBOAT ACCOMMODATION PLAN**

DATE : AUGUST/2002

SCALE : 1:100

DRAWING NO: DWC-02

