TENDER SPECIFICATION OF MAIN ENGINE

1. **Name of the Equipment.** Main Engine.

2. **Purpose.** The Main Engines will be used to propel "Padma Class" Patrol Vessel of Bangladesh Navy. These engines are intended to replace the Ships' existing engines (Model: TBD620V8, originally designed by DEUTZ, manufactured by Henan Diesel Engine Industry Co, Ltd, China under license). No changes/modification of ship's hull and structure will be considered and ship's existing gear box and shaft line must be kept intact. The proposed engines should be configured with the existing engine and machinery control system of the ship. The new engines along with their accessories shall be accommodated in the existing ship's engine room and compartment(s)/ space(s). The engines and propulsion system must be independent and operated safely.

3. **Quantity.** Three (03) in number sets (Counter-Clockwise rotation).

4. **Manufacturer, Principal Supplier & Local Supplier.** Name and full address to be mentioned.

a.	Manufacturer	To be mentioned
b.	Principle Supplier	To be mentioned
c.	Local Supplier	To be mentioned

5. **Year of Manufacturing.** 2020 or later.

6. **Country of Origin.** To be mentioned.

7. **Manufacturing Country.** To be mentioned.

8. **Operating Environment of Engine.** The environment under which the engines will be operated and their performances will be measured is as under:

Ambient Condition.

a.	Air Temperature	05^0 - 45^0C
b.	Sea Water (SW) Temperature	05^0 - 35^0C
c.	Relative Humidity	Up to 95%
d.	Suspended Solids in SW	Up to 20,000 ppm
e.	Salinity	Up to 34 gm/ltr

9. **Maximum Allowable Inclinations.** The main engines and accessories should be able to run when the ship is subjected to following rolling/pitching:

a. **Transient Condition.**

(1)	Front/ rear end down (pitch)	± 10°
(2)	Left/ right side down (roll)	± 30°

b. **Continuous Condition.**

(1)	Front/ rear end down	± 10°
(2)	Left/ right side down (heel)	± 15°

10. **Certificate/Document of Authentication.** The local supplier must provide following original certificate(s)/ document(s) with the offer/quotation of items as regard to the genuinity of source and item(s) in order to establish chain of links from the original source to supply items:

a. One certificate/ document by the manufacturer (of the engines) in favour of the Bidder.

b. Two certificates/ documents, one by the manufacturer to their authorised agent and other by the authorised agent to Bidder.

c. Three certificates/ documents, first one by manufacturer to authorised agent, second one by authorised agent to sub-agent, and third one by sub-agent to Bidder.

11. **Standard**. All Engines are to be tested and certified (class approved) by a classification society who is a member of IACS. Necessary class approval certificate is to be provided for all individual engines before shipping. The detail contact information of local office in Bangladesh (if any) and headquarters of approving class society is to be submitted with the offer. The bidder is required to make a clear statement that the offered propulsion machinery i.e. main engines and their associated equipment are compatible and arrangements are suitable for ship's stability, structural strength, vibration and noise signature point of view.

12. **Site Visit.**

a. **Onboard Inspection/ Study.** The prospective Bidder(s), after procurement of tender schedule from DGDP and on a prior written request (with submission of proof of purchase of tender schedule, and allowing at least 2 weeks days to process the request), will be allowed to visit the Ship (at Chattogram, Bangladesh) to carry out studies about existing engines and relevant technical matters. Exiting parameters mainly draught, displacement and stability should remain unchanged after replacement.

b. **Security Clearance**. Necessary permission/security clearance will be arranged by BN upon request by bidders. Request should be given two weeks prior to such visit in order to enable BN to process necessary permission/security clearance.

c. **Location**. The main engines are intended to be installed on board the ships at Chattogram.

13. **Pre-Bid Meeting.** Pre Bid meeting may be arranged if requested by sufficient numbers of potential bidder(s), who would purchase tender document from DGDP. The date will be preferably 02 weeks before submission of the offer. The date and time of the pre-bid meeting (if requested and arranged) will be notified in advance.

14. **Supply Assurance Certificate.** The bidder should submit necessary governmental license for the concerned components/items are free for sale with obligation for supply of spare parts, technical advice etc. in future.

15. **Scope of Supply.** The scope of supply is to include the following:

Ser	Description
a.	03 x Lot of Supply and installation of marine propulsion diesel engines, new shock and vibration mountings and new torsional vibration damper as per paragraph 20 to 22.
b.	Supply of auxiliaries and accessories and as per paragraph 23
c.	Optional Items as per paragraph 24
d.	Spare parts as per paragraph 25
e.	Supply of tools and special tools as per paragraph 26 and 27

f.	Pre-shipment Inspection (PSI) and Factory Acceptance Test (FAT) above items as per paragraph 29.
g.	Installation and Installation Supervision of engines, Onboard Training, Drawing, Manual, Brochure and Test/Trial Acceptance above items as per paragraph 31 to 36
h.	Warranty as per paragraph 37
j.	Any other issue relevant (if any)

16. **Sales and Record.** Record of sales by the bidder/ agent of engines mentioning year and buyers(s) is to be included with the quotation.

17. **Max Allowable Overall Dimensions of the New Engine**. The allowable dimension of the new engines must not exceed (Similar to existing engines):

a. Length 2500 mm x Breadth 1500 mm x Height (including sump) 2200 mm and Height (from existing foundation) 2300 mm.

18. **Expected General Particulars/ Characteristics of the Ship after Installation of Engines.**

a. No changes of the hull/structure, displacement, and draught will be considered.

b. The new engines and other supplied accessories must be accommodated in the existing engine rooms of the ship.

c. The existing shaft line and gear box will remain intact.

d. Very minor changes in displacement and draught might be considered, only if so is absolutely essential.

e. The proposed engines should be configured with the existing engine and machinery control system of the ship.

19. **Existing Principal Particulars of the Ship**. The existing principal dimensions of the ship are as follows:

a.	LOA/LBP, m	50.40	
b.	Breadth (max), m	7.50 m	
c.	Depth (moulded), m	4.1 m	
d.	Draught (d or T), m	Fwd	1.7 m
		Aft	1.9 m
e.	Height of mast above keel, m	13.7 m	
f.	Displacement, tonne	241.80 tons (light) / 281.30 tons (full)	

20. **Technical Specification.**

a. **Engine**. The new engines should include but not limited to the following:

(1)	Brand	HND/ DUETZ/ Any other brand if licensed/ permitted by DUETZ (necessary documents to be attached)
(2)	Type of engine	High speed engine (1800 rpm)
(3)	Model	TBD 620 V8

(4)	Manufacturer (full name and address)	To be mentioned.
(5)	Nature of Duty	Marine propulsion
(6)	Cycle of Engine	4 Stroke Diesel.
(7)	Aspiration	Turbo charged (with inter-stage cooler).
(8)	Numbers of Cylinder and Arrangement	To be mentioned.
(9)	Cylinder and Arrangement	To be mentioned.
(10)	Bore and Stroke, mm	To be mentioned.
(11)	Fuel Injection	Direct fuel injection.
(12)	Brake Horse Power	To be mentioned.
(13)	Brake Mean Effective Pressure (BMEP)	To be mentioned.
(14)	Idling rpm	To be mentioned.
(15)	Max Continuous Rating (rpm)	To be mentioned.
(16)	Power and Speed, kWb (BHP) @ rpm (a) Idling (b) Economic (c) Cruising (d) Max Continuous (e) Max	To be mentioned separately for following conditions: (a) ISO conditions; and (b) At 52°C air and 38°C SW.
(17)	Cooling	Freshwater (FW) cooling; FW is to be cooled by SW through heat exchanger. (The suspended solid in muddy seawater 20,000 ppm is to be considered for coolers to avoid clogging)
(18)	Preferred Periods (for major maintenance)	Light/Top Overhaul (ie, de-carbonisation) : After 12,000 hours. Major Overhaul : After 24,000 hours
(19)	Fuel oil to be used	NATO F-76 or equivalent
(20)	Lube oil to be used	Grade SAE 30/ equivalent; and the oil/ equivalent must be commercially marketed and available in Bangladesh local market.
(21)	Lub oil cooling system	The suspended solid in muddy seawater 20,000 ppm is to be considered for coolers to avoid clogging. To be mentioned.
(22)	Specific fuel consumption (sfc, kg/kW-hr)	To be mentioned for all ratings, in tabular form.
(23)	Specific oil consumption (soc, kg/kW-hr)	To be mentioned for all ratings, in tabular form.
(24)	Type and No of Turbocharger/engine	To be mentioned.
(25)	Turbocharger Manufacturer's Full particulars	To be mentioned.
(26)	Dimension of Turbocharger (LxBxH, mm)	To be mentioned.
(27)	Dry weight of Turbocharger, kg	To be mentioned.
(28)	Overall Dimension of the Engine (L x B x H, mm)	To be specified. (as per art 17)
(29)	Dry weight of engine (all inclusive), kg	To be specified. Preferably not more than 3,600 kg

(30)	Noise Level, dB	The noise level of the overall engine sets should be as minimum as possible so that the noise level in the machinery space does not exceed 115 dB(A)
(31)	Engine Safety Features	To be mentioned
(32)	Engine starting system	To be mentioned (Existing: Electric (044-2SA)

21. **New Shock and Vibration Mountings.** Shock and vibration mountings according to international standard and duly vetted by international classification society are to be provided to withstand shock. Following should be supplied with each set as per the class standard described:

a. Required number of marine type shock and vibration mounting.

b. Vibration insulators as required.

c. Combined bedplate to match with engine seating.

22. **New Torsional Vibration Damper.** The engines should be fitted with torsional vibration dampers approved by the internationally recognized classification society.

23. **Auxiliaries and Accessories.**

a. The standard accessories and auxiliaries must include every item which is essential to install and operate the engine and control system whether those are mentioned in the specification or not. A list of such essential accessories and auxiliaries along with item wise price must be included in the quotation.

b. Optional auxiliaries/ accessories, if any, are to be separately quoted with item wise indication of price for each item.

c. Lubricating oil for main engine first fill and flushing are to be supplied in separate containers.

d. Cooling water inhibitor is to be supplied in sufficient quantities to run till warranty period of the engine.

24. **Optional Items**. A list of optional items (if any) is to be provided with the quotation indicating item wise price for each engine. Technical details of these items should be given in the offer (price should not be included in total price).

25. **Spare Parts.** A recommended list of spare parts required for 05 years satisfactory operation of main engines are to be provided indicating item wise price. Only the prices of selected items by BN will be added with total price while evaluating the comparative price of the suppliers.

26. **Tools**. 01 (one) set of standard tools for maintenance of main engines are to be provided indicating item wise price. Quantity and size of these tools are to be mentioned in the quotation. That price will be added with total price while evaluating the comparative price of the suppliers.

27. **Special Tools.** A recommended list of special tools required for carrying out maintenance of main engine and gearbox including major overhaul is to be submitted with the quotation indicating item wise price. The purchaser will have option to place order for such special tools. However one set of special tools to be provided with free of cost with the item. Beside, following tools must be quoted:

a.	01 x Set Torque Spanner (to be suitable for fixing the cylinder head and main bearing cover).
b.	01 x Set special Bearing Extractor (if any)

c.	01 x Set of Test Equipment for calibrating the engine control system is to be provided.
d.	01 x Software Programme for the engine control and fault finding with complete accessories (like connectors, dongles, etc) is to be supplied.
e.	01 x Digital Tachometer (portable) to measure the turbocharger rpm is to be supplied.
f.	01 x Digital Thermometer (handheld, non-contact/remote sensing) for measuring temperature.

28. **Factory Acceptance Test (FAT) and Pre-Shipment Inspection (PSI).**

a. Factory Acceptance Test (FAT) and Pre Shipment Inspection (PSI) of all three engines will be carried out by 03 (three) in number officers of BN for a duration of 05 (five) working days (exact date to be confirmed by the supplier depending on FAT facilities available) excluding journey period at the manufacturer factory premises. If the offered main engines are not from same manufacturer/country, then BN FAT/PSI has to be conducted in different locations to complete FAT/PSI for all three engines. The supplier will have to inform the purchaser about the date and schedule of PSI and FAT along with complete documentation for suggested FAT Criteria at least 08 (eight) weeks prior to the commencement of PSI and FAT.

b. FAT procedure shall include all the tests to check the proper functioning/ performance criteria of the engine according to the standard procedure of the engine manufacturer. FAT procedure shall be duly vetted by the classification society (member of IACS) and approved by BN. However, following tests should be included in FAT procedure:

(1) **New Engine Load Testing**. Engine load test and trials for several hours on the water brake/dynamometer (series factory acceptance testing) are to be carried out in the factory premises in presence of buyer's representative. Engine load test records and reports are to be supplied. Acceptance trials should include following:

(a) Starting trials.
(b) Maximum continuous load operation.
(c) Maximum load operation.
(d) 75% of maximum load operation.
(e) 50% of maximum load operation.
(f) No load trial.
(g) Recordings. Following parameters are to be recorded during trial:

i. Power Ratings (kW).
ii. Speed (rpm).
iii. Fuel consumption.
iv. Lub oil consumption.
v. Fuel rack position.
vi. Oil pressure and temperature.
vii. Cooling water temperature.
viii. Exhaust gas temperature per cylinder
ix. Combined exhaust gas temperature.
x. Governor function.
xi. Turbocharger's rpm.
xii. Charge air pressure.
xiii. Noise level.

c. Joint inspection reports for PSI and FAT will be prepared and signed by both the Supplier and Purchaser's representatives.

d. On return from the country of FAT and PSI, BN officers will submit reports to the concerned directorate of Naval Headquarters (NHQ). NHQ's concerned directorate will in turn forward final decision along with PSI and FAT report within 2 weeks basing on which Directorate General Defence Purchase (DGDP) will render clearance to the supplier concerned for shipment of stores. The supplier will not arrange shipment of any item mentioned in the contract without clearance from DGDP.

e. All costs related to PSI and FAT including airfare, accommodation and food for BN Officers will be borne by the purchaser. Local transportation (air/sea/road/rail) for BN officers within the manufacturer /supplier's country, reception and arrangement for entry into country/ concerned area for PSI and FAT are to be arranged by the supplier. However, if FAT/PSI needs to be conducted at different countries/different times {refer to article 22 (a)}, then purchaser will bear the cost mentioned above only for the first team/FAT. All cost for the subsequent FAT is to be borne by the supplier.

29. **Engine Preservation.** Engine internal preservation is to be carried out on completion of acceptance testing. In conjunction with suitable packing, the internal preservation should suffice for transportation and/ or storage for a period of up to one year.

30. **Painting**. The manufacturer will apply suitable paint coat for the main engines as per standard practice (light white alkyd resin paint is preferred).

31. **Installation and Installation Supervision**.

a. The main engines and other associated fittings will be installed by the purchaser on board the ship at purchaser's cost. However, the supplier will have to provide technical support/supervision by qualified engineer(s) at least for the installation of 2 X engines. The schedule of installation work will be settled by both the parties amicably but will mostly depend on available schedule of the shipyard/ dockyard owned/operated by the purchaser.

b. Supervision of installation works of main engines and other associated fittings will have to be provided by the Supplier engineer in local dockyard/shipyard as per supplied drawings and instructions. The duration of such supervision will be as per actual requirement.

c. Required numbers of OEM machinery installation experts are to be attached in BN ship. Numbers of OEM experts with their probable duration are to be specified. All related costs of such experts including airfare, accommodation, food etc. are to be borne by the manufacturer/supplier.

d. Machinery installation OEM expert team should bring necessary installation kits/ items for the installation.

32. **Onboard Training.** The manufacturer is to send one engineer who will provide onboard operation and maintenance training in Bangladesh to Bangladesh Navy personnel for duration of 05 days after test, trail and commissioning of the first engine set. During training, emphasis is to be given on operation, maintenance and fault finding of engine, governor, control circuit etc. Cost of airfare, accommodation and food of the manufacturer's engineer are to borne by the supplier.

33. **Production and Supply of Drawing and Technical Information**. The Bidder will prepare and supply the installation drawings and instructions to BN. These will include a general arrangement drawing of the main engines, gearbox and couplings, final seating plans of main engines and working drawings in this respect. The Bidder is to prepare and supply the installation drawings for the exhaust and propulsion control system. The drawings are to be submitted to BN for approval prior installation.

34. **Brochure and Drawings to be submitted with the Offer**. Following brochures/ drawings are to be submitted with the offer for evaluation and assessment (free of cost):

a. One set brochure/ booklets having details of the offered main engines.

b. One set of installation Plan (Phase wise).

35. **Manuals, Drawings and Document.** The following manuals and drawings in English (hard and soft copy), two (02) sets (01 set for ships and 01 set for dockyard) for main engine as applicable are to be supplied at the time of delivery (free of cost):

a. Operation and maintenance manuals.

b. Maintenance schedules (if not provided with the operation manual).

c. Workshop level repair manual.

d. Parts identification List (parts catalogue) with internationally recognized pattern no.

e. Factory test and pre-delivery inspection certificate.

36. **Test/ Trial and Acceptance.**

a. On completion of installation of supplied engines on board ship, vessels trim, stability, light load and full weight etc will be checked by a joint team of purchaser and supplier.

b. Test/ trials will be carried out by BN in harbour and at sea during which the manufacturer's representative will be present. The propulsion plant will be tested at various operating conditions to ascertain performance.

c. Engine manufacturer will provide the services of at least one engineer for the supervision of test, trial and acceptance for the duration of harbour/sea trial. The manufacturer's engineer(s) will be responsible to demonstrate and ensure that the tests, trials and acceptance of main engines and accessories are satisfactory as per the contract requirements. The duration of his/their stay for test and trial is to be specified.

d. Cost of airfare, accommodation and food of the manufacturer's engineer (s) is to be borne by the bidder.

e. After satisfactory test, trial, an acceptance certificate will be signed between the buyer and the bidder.

f. If the purchaser cannot arrange installation and test trial of any individual engine within 12 months from the date of supply of all items (required for operation), the engine(s) will be considered accepted.

37. **Warranty**.

a. Warranty for trouble free operation is to be given by the Supplier for the supplied engines for a period of 12 months from the date of acceptance by the Purchaser.

b. During the warranty period, if any engine remains non-operational for any action pending by the Supplier, the warranty period will be extended for the same period.

c. The warranty should cover all parts, accessories and labour (including service engineer's cost, if any) throughout the warranty period.

d. For warranty repair/replacement, the supplier will collect the defective item from NSD Chattogram /NSSD Dhaka (as applicable) and re-supply the same to collecting place after warranty repair or for replacement.

38. **Shipment**.

a. The Supplier will arrange transportation of all items by sea to Chittagong sea port, Bangladesh.

b. All items are to be delivered in seaworthy packing/container to ensure safe transportation by sea.

c. All packages are to have packing notes showing their contents in detail and all packages shall be marked with the name and address of the consignee and gross weight.

d. The Supplier will arrange transportation of all supplied items from Chattogram sea port to the site of installation.

e. **Port of Shipment.** Any port of the manufacturing country. If port of shipment is other than manufacturing country due to some unavoidable reason, then a certificate from OEM is to be provided to prove genuinity of the engines.

39 **Delivery.**

a. The items are to be delivered within **09 (Nine) months** from the date of signing the contract to the following consignee:

The Commanding Officer
Naval Stores Depot Chattogram
New Mooring, Chattogram, Bangladesh

b. **Place of delivery**. NSD Chattogram.

c. Incase of CFR, the supplier will carry the items from Chittagong sea port to NSD Chattogram at the cost and risk of supplier.

40. **Validity of Offer.** The offer must remain valid up to 30 June 2023.

41. **Terms of Payment.** L/C for full purchase amount will be opened in favour of the principal supplier under the following payment terms:

a. 80% of total CFR value will be paid on delivery of the items described under the scope of supply and on production of necessary shipping documents.

b. Remaining 20% of CFR value will be paid on producing 'Acceptance Certificate' after satisfactory test and trial jointly carried out by the buyer's and supplier's representatives.

42. **Condition for Acceptance of Quotation.** Quotation must have supporting documents (booklets, leaflet, catalogue, brochure, drawing, etc) with detailed particulars of the offered engines, without which the quotation might not be accepted.

43. **Compliance Statement.** A compliance statement fulfilling all the requirement of the tender is to be submitted for evaluation of the offer. Stating mere 'Yes' or 'No' will not suffice, and detailed description/information as required is to be given. An incomplete compliance statement may attribute to cancellation of the offer. If any clause of this specification does not commensurate with offered items, the deviation must be spelt out clearly.

Enclosures:

1. Ship General Description - 01 (one) pages.
2. Existing Propulsion System Particulars - 04 (four) pages.
3. General Arrangement Drawing - 01 (one) sheet.
4. Stability Information of Ship - 01 (one) pages.

23/8/22
M MOAZZEM HOSSAIN
Member/ Secy
Date:

DNS (Rep)
S M IMRAN
Member
Date:

MD. ASIB RAIHAN
DNP (Rep)
Member
Date: 23.8.22

AHAMED AMIN ABDULLAH
DNAIS
Member
Date:

M MISBAH UDDIN
DNIT
Member
Date: 25/8/22

M MOHIDUL HASAN
DNE
Member
Date: 23/8/22

28/8/2022
M RUHUL MINHAZ
DNW&EE
President
Date:

Enclosure: 1

SHIP'S GENERAL DESCRIPTION

Principal Particulars:

1.	Name	BNS PADMA, BNS SURMA, BNS ATONDRO, BNS ADOMYA. BNS APARAJEYA
2.	Class	PADMA Class Patrol Boat
3.	Name & address of builder	KHULNA SHIPYARD LTD.
4.	Launched on (date)	2012-2013

Principal Dimensions.

1.	Length overall, LOA	50.40 M
2.	Length between perpendiculars,	45.40 M
3.	Breadth Maximum	7.50 M
4.	Depth molded	4.1 M
5.	Draught	FWD-1.7 M, AFT-1.9 M
6.	Height of mast above keel	13.7 M

Tonnage.

1.	Gross tonnage	270
2.	Net tonnage	255

Displacement.

1.	Lt weight	235.45 Tons
2.	Standard	258.5 Tons
3.	Full load	270 Tons
4.	Max	290.64 Tons

Enclosure: 2

EXISTING PROPULSION SYSTEM PARTICULARS

Main Engine Features: The crafts are equipped with 04 sets of TBD 620 V8 diesel engine (originally designed by DEUTZ, manufactured by Henan Diesel Engine Industry Co Ltd, China under license). Each propulsion system comprises one set of diesel engine, resilient coupling, gearbox, shafting, fixed pitch propeller and relevant accessories. The engine rooms are properly arranged to make easy operation and maintenance of equipment, and designed to have a good accessibility for inspection and routine service. The main engine can be controlled remotely from wheelhouse, MCR and locally from engine room. The important parameters of speed, pressure and temperature etc will be displayed and monitored in wheelhouse, MCR and locally.

Ser	Characteristics/Parameter	Description/Value
1.	No fitted	04 in no
2.	Maker's name and address	Henan diesel engine industry co ltd, china
3.	Direction of rotation	Anti-Clockwise (From flywheel end)
4.	Model	TBD620V8
5.	No of cylinder and configuration	08 in no, V Type.
6.	Valves per cylinder	04 in no
7.	Cylinder bore x Stroke length	170 mm X 195 mm
8.	Mean piston speed	11.7 m/s
9.	No of strokes per cycle	04 Strokes
10.	Compression ratio	13.5:1
11.	Type of aspiration	Turbo Super Charged And After Cooling
12.	After cooling/Inter cooling(if any)	Inter Cooling
13.	**RPM.**	
	Idle	700
	Econ	1200
	Cruising	1500
	Max cont	1600
	Boost (or sprint) power	1016 KW
14.	Dry wt	3600 kg
15.	**Running Hours.**	
	Before top Overhaul	8,000 hrs
	Before major Overhaul	16,000 hrs
	Before oil change	500 hrs
16.	**Fuel.**	
	Grade/Type prescribed by maker	HSDO
	Grade/Type currently used	HSDO
	Sp oil consumption, gm/Kw-hr	200 gm/kw /hrs
17.	**Lube Oil.**	
	Grade/Type prescribed by maker	SAE15W40/ equivalent
	Grade/Type currently used	SAE15W40
	Sp. oil consumption, gm/kw/hrs	1.3gm/kw/ hrs

18.	**Sump.**		
	Type of sump		Wet Sump
	Oil capacity		115 ltrs.
19.	**Temperature.**		
	Oil	Max, °C	95^0C
		Min, °C	45^0C
	Cooling water	Max, °C	90^0C
		Min, °C	45^0C
	Exhaust	Max, °C	625^0C
		Min, °C	NA
20.	**Engine Control System.**		
	Type of system		Electro Hydraulic Control System
	Maker's Name and Address		CSOC Shanghai Marine Diesel Engine Research Institute. China
			Computer Monitor: SAMSUNG, Made in China **Computer:** ADVANTECH, Made in China **Cruise Command Processor:** ZF Marine Electronics. Mukilteo WA USA **Throttle Lever**: ZF Marine Electronics. Mukilteo WA, USA **Auxiliary Telegraph, Safety System Panel, M/E Status Indication, Control panel and other accessories** Shanghai Marine Diesel Engine Research Institute, China **Engine Telegraph Transmitter & Receiver**: Jinghou North Nautical Instrument Co. Ltd, China
	Control positions		
	Primary/Local		ENGINE ROOM
	Secondary		MCR
	Tertiary/Remote		Bridge
21.	**Governor.**		
	Type/Model		Electro Hydraulic
	Maker's name and address		Henan diesel engine industry co ltd, china
22.	**Fuel Boost Pump/ Injector.**		
	No fitted per engine		01 (Eight in no)
	Drive arrangement		Camshaft drive
	Maker's name and address		BOSCH, made in Austria
23.	**LubOil Pump.**		
	No fitted per engine		02 (Two)
	Drive arrangement		Engine driven by gear
24.	**FW (Cooling Water) Pump.**		
	No fitted per engine		01 (One)
	Drive arrangement		Engine driven by gear
25.	**SW Pump.**		
	No fitted per engine		01 (One)

	Drive arrangement	Engine driven by gear
26.	**Starter.**	
	Type of starter	Electric starter
	No fitted per engine	01 (One)
	Starting Voltage	24 V DC using batteries
27.	**Turbo-super-charger/Blower.**	
	No fitted per engine	01
	Maker's name and address	Henan Diesel Engine Industry Co Ltd, China
	Working rpm/ Max RPM	Max- 20,000

Gear Box Features: Details of gear box is as follows:

a. Each main engine drives one propeller via a reverse reduction gearbox of ZF/Germany. Engine, gearbox and propeller shafts are mounted in line. The gearbox is flanged to the engine and takes the axial thrust.

b. The ZF 4600 of gearbox with reverse reduction system as per CS standard.

c. The gearboxes havea provision for unlimited trailing operation.

d. **Clutch Control:** Each clutch will be operated remotely and emergency clutch control mechanism is also be provided in the gearbox.

e. **Turning Device**: Arrangement is be made to turn propeller shaft:

f. **Monitoring:** Following monitoring systems is provided:

Ser	Characteristic/Parameter		Description/ Value
1.	Maker's name and address		ZF marine GmbH, 88038 Friedrichshafen Deutschland.
2.	No fitted		04 in nos
3.	Type		ZF 4600 (Reverse & Reduction)
4.	Gear ratio		2.030:1.
5.	Dry weight		790 kg
6.	Temperature	Max.°C	90^0C
		Min.°C	30^0C
7.	Oil Pressure (bar)	Max.Bar	4.5 bar
		Min.Bar	0.4 bar
8.	Type of lubricant		SAE15W40
9.	Oil Reqr. per filling		60 Ltrs
10.	Lub oil pressure		Local and remotely from MCR
11.	Luboil temperature		Local and remotely from MCR
12.	Clutch engage/disengage status		Local and remotely from MCR
13.	Bearing temperature		Local.

Propellers/Shafting:

1.	Makers name and address	Henan Diesel Engine Industry Co Ltd, china.	
2.	No fitted	04 in no (Four)	
3.	Type	Fixed Pitch Propeller	
4.	No of blades	05 (Five)	
5.	Diameter	1000 mm	
6.	Pitch (P/D)	1.12	
7.	Direction of rotation	STBD Two Clockwise &PORT Two Anticlockwise.	
8.	Material	$ZcuAl9Fe_4Ni_4Mn2$	
9.	Weight of each propeller	163 Kg	
10.	Overall Length	Fwd-15.7 mtr	Aft-11.2 mtr

'A' or 'P' Bracket.

1.	No fitted	06 (SIX) 'P' BRACKET
2.	Location	OUT BOARD OF THE HULL
3.	Type of bearing	Rubber Bush Bearing.

Stern Tube.

1.	Type of bearing	Rubber bush bearing
2.	Number of bushes per shaft	02
3.	Type of cooling	Sea Water Cooling
4.	Type of sealing	Water Lubricated seal
5.	Type and spec. of lubricant	Sea water.

Plummer Block.

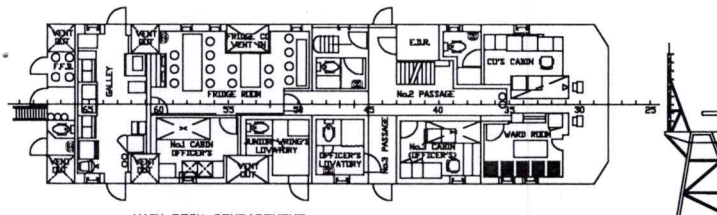
1.	Total number fitted	02
2.	Type and spec. of lubricant	Flashing from the shaft. 15w40.

Bulkhead Gland.

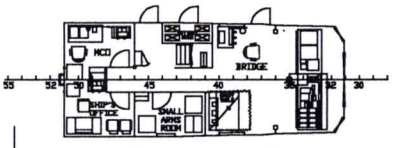
1.	Total number fitted	02
2.	Type and spec. of lubricant	Flash type and 15w40

Enclosure-3

GENERAL ARRANGEMENT DRAWING



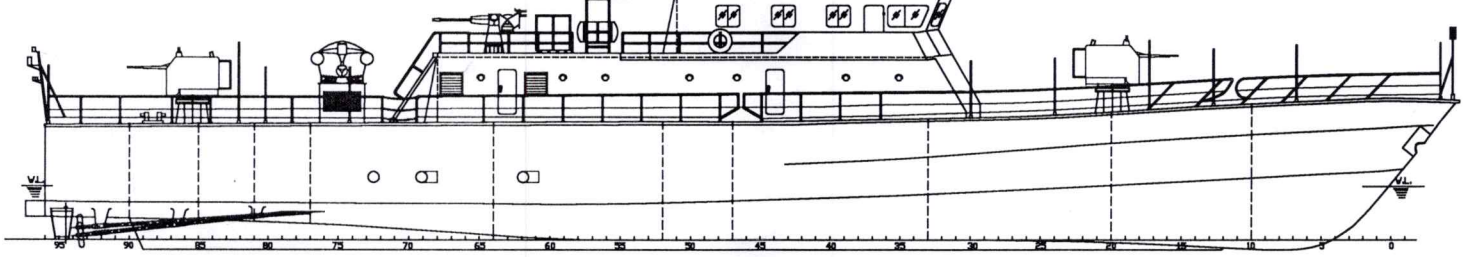
MAIN DECK COMPARTMENT



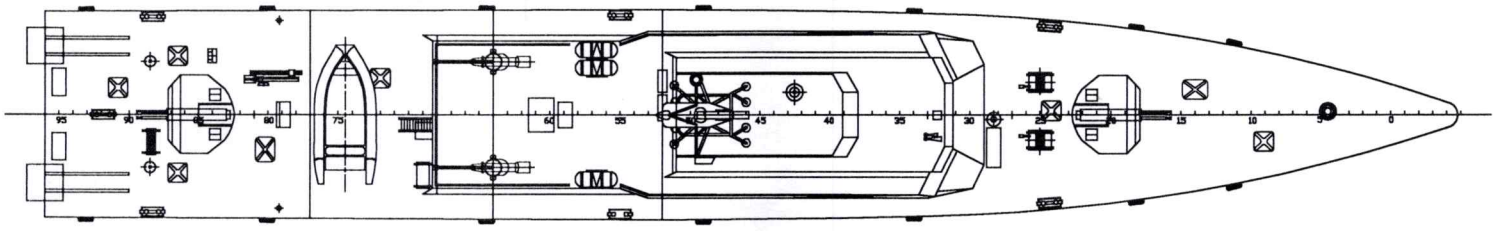
WHEELHOUSE DECK COMPARTMENT

PRINCIPAL DIMENSIONS

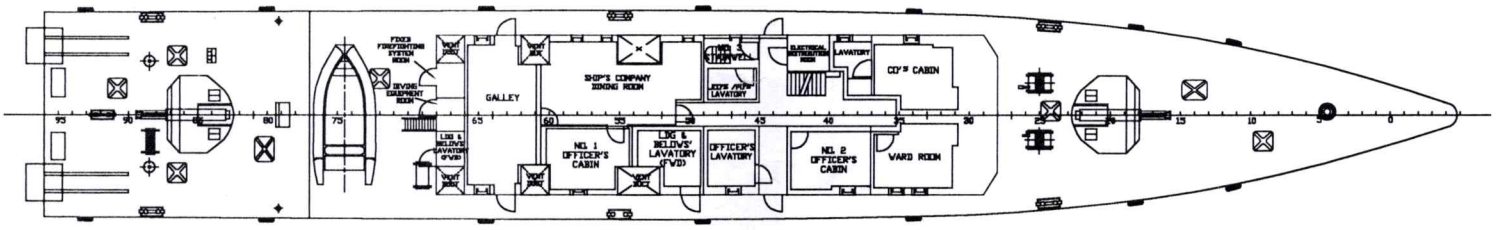
LENGTH OVERALL	50.40 M
LENGTH B.P.	48.00 M
BREADTH MOLDED	7.50 M
DEPTH MOLDED	4.10 M
FRAME SPACING	500 MM
CAMBER	150mm
DRAFT MARK	1.90m
DISPLACEMENT	265TONS



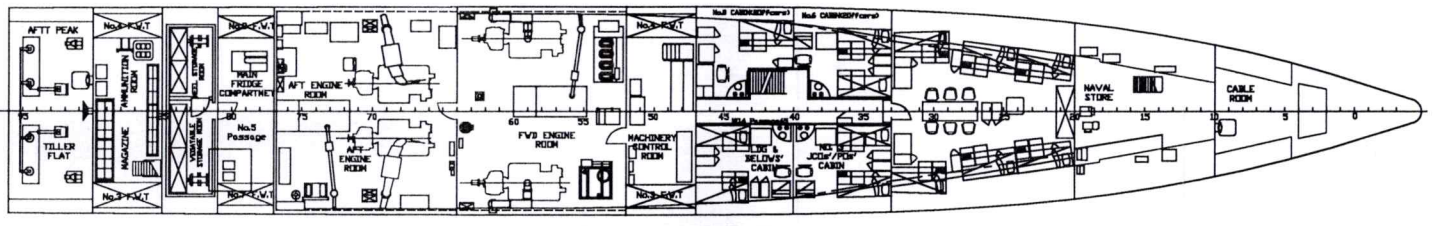
PROFILE (BIRD VIEW)



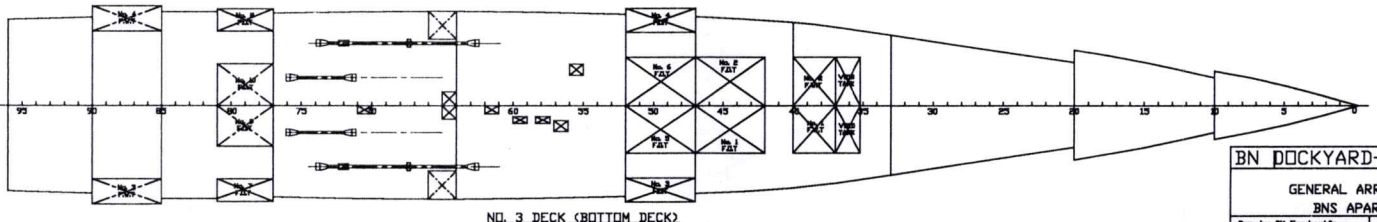
MAIN DECK (BIRD VIEW)



NO. 1 DECK (WEATHER DECK)



NO. 2 DECK(MAIN HULL COMPARTMENT DECK)



NO. 3 DECK (BOTTOM DECK)

BN DOCKYARD-CHITTAGON

GENERAL ARRANGEMENT
BNS APARAJEYA

Dwn. by-SK Emad uddin	
Chcnd. by-S A Salim	
Scale- 1:75	
Date-	
ADN GA/con-2	

Enclosure: 4

STABILITY INFORMATION OF THE SHIP

As Built Particular (Normal Load Condition)	LWL (m)	Displacement (Ton)	KM_T (m)	GM_T (m)	KG (m)	LCF (m)	LCG (m)	TPC (Ton/ cm)	MCT 1cm	d_f (m)	d_a (m)	Trim (m)	Ø
	47.84	265	4.395	1.417	2.978	4.412 (aft)	4.484 (aft)	2.610	7.36	1.637	1.970	0.333	0.07^0 (s)
Existing Particular	LWL (m)	A (Ton)	KMT (m)	GMT (m)	KG (m)	LCF (m)	LCG (m)	TPC (Ton/cm)	MCT 1cm	df (m)	da (m)	Trim (m)	Ø
	47.84	265.869	4.395	1.418175	2.976825	4.412 (aft)	4.474777 (aft)	2.610	7.36	1.642237	1.971990	0.329753	1.66974 (p)