TENDER SPECIFICATION OF MARINE DIESEL GENERATOR(400KW) WITH MCAM SENSOR-BNS KHALID BIN WALID

1. **Name of the Equipment**. Marine Diesel Generator (400KW) with MCAM sensor.

2. **Purpose**. The Generator sets will be used to generate main electric power of the ship. The Generator sets will replace two in no generator set fitted onboard a naval ship. The Generator sets should be able to operate independently or in continuous parallel operation with other two existing generators onboard. The new generators are to be operated, controlled and monitored in similar or better manner than the existing system.

3	**Quantity**	:	02 (Two) complete sets.
4.	**Type**	:	Marine Type.
5.	**Brand**	:	To be mentioned.
6.	**Model**	:	To be mentioned.
7	**Original Equipment Manufacturer (OEM)**	:	Name and full address with e-mail of OEM is to be mentioned.
8.	**Year of Manufacturing**	:	2026 or later.
9.	**Supplier/ Principal/ Bidder**	:	Name and full address with e-mail of Supplier/ Principal is to be mentioned.
10.	**Local Agent**	:	Name and full address with e-mail of Local Agent is to be mentioned.

11. **Standard**. The Marine AC Generator sets (Prime Mover and Alternator) and associated accessories, items supplied under the scope of the supply are to be designed, constructed / manufactured as per the recognized marine clarification society. The generators are to be tested by a marine surveyor after the production and the Unit certificate for these products in English are to be provided by the supplier during delivery.

12. **Qualification for Bidder**. Manufacturers of Marine Diesel Generator or their authorized distributor/ agent can submit quotations through their authorized local agent enlisted in DGDP. In case of offer from distributor/ agent, certificate of dealership/ agency ship from OEM is to be submitted with the offer. In this regard the following certificates are to be submitted with the offer (if not OEM):

13. **Manufacturer Requirement**. The items should be brand new, unused and of recent model, proven reliability in the field of operation. The supplier will ensure the continuity of the operation and availability of necessary spares for at least 15 years each in case of obsolete model over time. In case of absence of spare parts, the OEM is to be propose appropriate/ alternate solution's to ensure handle free operation of the equipment for the said period.

14. **User List**. List of users of the offered Marine Diesel Generator is to be mentioned with full address. The list should provide the name of various navies/ coastguards/ merchant marines with respective model and brand of offered Marine Diesel Generator. The Marine Diesel Generator should be widely used. The user list will be evaluated for the assessment of the offer.

15. **Condition for Acceptance of Quotation**. The quotation should have supporting colourd documents (booklets, leaflets, catalogues, brochures etc) with details about the offered Marine Diesel Generators, If detailed information regarding specifications, manufacturer's manuals and catalogue for the quoted model of the Marine Diesel Generators, spare parts, accessories, scope of supply, etc are not provided the quotation may not be accepted.

16. **Acceptance/ Rejection of Bid**. DGDP/ BN reserves the right to accept or reject any bid or to terminate the bidding process and reject all bids at any time prior to the contract award (without thereby incurring any liability to the BIDDER).

17. **Scope of Supply**. The Marine AC Diesel Generator sets are to be supplied as per the specifications enumerated in the subsequent paragraphs. The Generator sets and associated accessories should be complete with all standard accessories, ready in all respect for operation after installation onboard. The scope of supply shall include:

a. 02 X Complete Generator sets and associated accessories for immediate operation.

b. Necessary Cables (Power cable and Control cable) between Central Control Station (CCS), Local Control Panel and Engine room.

c. Interfacing with the Existing MCAM System in coordination with Init (Former Logimatic – OEM of MCAM System).

d. Software, firmware and necessary software/ firmware installation hardware.

e. Factory Acceptance Test (FAT).

f. Installation, supervision & STW and Test Trial & Acceptance.

g. Local Training.

h. Spares (Optional Item).

j. Documentation.

k. Certification.

18. **Operating Environment of Generator Sets**.

a. **Ambient Condition**. The Generator sets and associated accessories and items are to be designed to operate in the following ambient condition:

Air temperature	5^0C to 55^0 C.
Sea Water (SW) temperature	5^0C to 32^0 C.
Relative humidity	Up to 95 % Non-condensing.
Salinity	Up to 34 gm/ltr.
Quality of Sea Water (SW)	High Mud (Suspended solids in SW 2000 ppm) content SW in Coastal Areas.

b. **Maximum Allowable Inclinations**. The Generator sets and associated accessories and items should be able to run when the ship (on which they will be installed) is subjected to following rolling/ pitching:

(1) Roll : $\pm 30^0$.
(2) Pitch : $\pm 10^0$.

c. **Standard**. The Generators should be also meet the following standards:

a. For Mechanical shock: MIL-STD-901D.
b. For Electromagnetic compatibility (EMC): MIL-STD-461.
c. For Environment ruggedness: MIL-STD-810.

19. **General Particulars of Generator Sets**.

Description of the Diesel Generator.		
1.	Complete Generator Sets	a. Country of Origin and Manufacturer: Finland/ France/ Germany/ Sweden/ USA/ UK (To be mentioned).
		b. Type: Marine Type.
		c. Brand: Wartsilla/ Scania / Caterpillar/ SEMT Pielstick/ MAN Diesel/ MTU/ Moteurs Baudouin (To be mentioned).
		d. Model: To be mentioned.
		e. Power Ratings: 400 KW (Minimum).
		f. KVA Ratings: 500 KVA (Minimum).
		g. Overall dimension of the Generator sets (prime mover and alternator combined): (1) Length: To be mentioned. (2) Breadth: To be mentioned. (3) Height: To be mentioned. (4) Weight: To be mentioned. (5) HP fuel line Inner diameter: To be mentioned. (6) Dimension of the offered Genset is to be mentioned. **Note**: Existing Each generator dimension L x B x H (3290 x 1400 x 2015) mm (approx.) and weight without water and oil 4930 Kg. The new generators should be within, and as close

		as practicable to the size and weight limits of the existing unit in order to ensure compatibility with all associated systems and maintain overall weight and stability requirement. The existing inner diameter of the HP fuel line is 28 mm. The proposed system is to match the existing setup.
2.	Prime Mover	a. Country of Origin and Manufacture: Finland/ France/ Germany/ Sweden/ USA/ UK (To be mentioned).
		b. Type: Marine Type.
		c. Manufacturer (OEM): Wartsilla/ Scania/ Caterpillar/ SEMT Pielstick/ MAN Diesel/ MTU/ MoteursBaudouin (To be mentioned)
		d. Brand: Wartsilla/ Scania/ Caterpillar/ SEMT Pielstick/ MAN Diesel/ MTU/ MoteursBaudouin (To be mentioned).
		e. Model: To be mentioned.
		f. Year of Manufacture: 2026 or later.
		g. Aspiration: Turbo-charged and Heat-Exchanger.
		h. Maximum Continuous Rating: To be mentioned.
		j. Overload, Rating: 10% Over load for one (1) hour in every 12 hours.
		k. Minimum allowable Continuous Load: Minimum allowable continuous load is 120KW or 25% whichever is lower
		l. Number of Cylinders and arrangement: To be mentioned
		m. Bore and Stroke: To be mentioned.
		n. Compression Ratio: To be mentioned.
		p. Combustion: Direct Fuel Injection.
		q. RPM: 1500.
		r. Specific Fuel Consumption (According to load liter per hr): To be mentioned.
		s. Specific lube oil Consumption (According to load liter per hr): To be mentioned.
		t. Combustion air requirement: To be mentioned (should commensurate with existing air supply system and air pressure of E/R-2).
		u. Governor: Electronic (Details to be mentioned)
		v. Turbo Charger (Maker): To be mentioned.
		w. Fuel oil to be used: High speed Diesel (HSD) (Sulphur content less than 500 PPM).
		x. Lube oil to be used: SAE-40/SRD-40.
		y. Lube oil priming pump: The required power supply for lub oil priming pump is to be mentioned. The existing supply of ship is 24V DC.
		z. Starting System: Electrical Starting system. (1) Battery Quantity: 02 X 12V DC Deep Cycle Maintenance free Battery for each generator. (2) Battery Capacity: 200 AH (Minimum). (3) Brand: To be mentioned (Must be renowned Brand).
		aa. Dynamo: The offered generators shall have dynamo for changing the starting system battery. Details to be mentioned.
		ab. **Engine Local Control and Monitoring Panel**: The Local Control Panel (LCP) should be of marine standard and flexibly mounted on the generator sets to meet the required inclination conditions. All necessary arrangement should be provided by the supplier so that the generators can be started from this panel. The panel for each generator should also be equipped with the following digital/ analog meters, gauges and facilities (but not limited to): (1) Meters. a. RPM tachometer. b. Hour counter.

		(2) Gauges. a. Lube oil pressure gauge. b. Seawater pressure gauge. c. Lube oil temperature gauge. d. Fresh water temperature gauge. e. Exhaust temperature gauges (Combined). f. Lube oil filter differential pressure gauge. g. Fuel filter differential pressure gauge. (3) Safety Devices. Following safety devices should be provided for each Generator: (a) Low lube oil pressure alarm- audio and visual. (b) High cooling water temperature shutdown device with audio and visual alarm. (c) High lube oil temperature alarm- audio and visual. (d) Low lube oil pressure shut down device with audio and visual alarm. (e) Prime Mover over speed alarm and auto shut down device/over speed trip gear (with manual resets). (4) Each LCP must comprise a local operation switch for selection of local or remote control. With the local operation switch, main switchboard control as well as remote control can every time be disabled and overridden, except for the EMERGENCY STOP.
3.	Control Power Supply	The required power supply for control system is to be mentioned. The existing supply of ship is 24V DC.
4.	Alternator	a. Country of Origin and Manufacture: USA, UK, Switzerland, Norway and EU Countries (To be mentioned).
		b. Type: Self excited (To be mentioned).
		c. Manufacturer (OEM): To be mentioned.
		d. Brand: To be mentioned.
		e. Model: To be mentioned.
		f. Year of Manufacture: 2026 or later.
		g. Classification Standard: To be mentioned.
		h. Number of Poles: 4 Poles.
		j. Maximum continuous rating: Sufficient to cater for operational (MCR) load plus 10% reserve.
		k. Overload rating: 110% for 1 hour.
		l. Power Factor: 0.8 lagging.
		m. Rated Terminal Voltage: 415V AC.
		n. Frequency: 50Hz.
		p. No of Phases: 3 (three) Phase.
		q. Output: 400KW minimum (To be mentioned).
		r. RPM: 1500.
		s. Field type: Brushless revolving (field type).
		t. Rotor: Dynamically balanced.
		u. Stator: Double layer concentric winding.
		v. Connection: 3 Phase, star connected, neutral un-earthed.
		w. Excitation: AREP (Auxiliary Winding Regulation Excitation Principal) or better.
		x. Ventilation: Self air ventilated.
		y. Insulation class: H.
		z. Maximum Temperature rise: H/125°C.
		aa. Enclosure: To be mentioned.
		ab. Number of Bearing: Single bearing.
		ac. Anti-condensation heaters shall be incorporated (existing DG space heater supply 115V AC).

		ad. Stator Temperature Detector: Stator winding temperature sensor shall be incorporated.
		ae. AVR: Details of the AVR is to be mentioned, Brand: Leroy Somer/ Stamford (To be mentioned).
		af. The alternator voltage variation at the rated power factor shall be maintained within ±1%.
		ag. Temperature Sensor: At least two embedded temperature sensors for each phase for protection.
		ah. Protection: Normal overload and single phasing protection.
5.	Parallel Operation and Low Load operation	a. The offered generators shall have the arrangement to run in continuous parallel condition with automatic load sharing.
		b. The each generator shall be capable of continuous operation at loads as low as 120 kW or 25%, whichever is lower.
6.	AVR, Local control panel and Generator control panel	a. Country of Origin and Manufacturer: USA, UK, Switzerland, Norway and EU Countries (To be mentioned).
		b. Details to be mentioned.
		c. All safety warning and fault warning are to be shown in the each Generator control panel (as per Para 27).
		d. Marine type Engine and generator set controller (To be mentioned).
		e. AVR should have facility for remote voltage adjust potentiometer. Existing generators AVR remote potentiometer for voltage adjustment situated at main switchboard.
		f. Regulation Features: (1) Voltage Equalization (2) Droop Management (3) Cross Current compensation (4) LAM (Load Acceptance Module) (5) Negative Field Forcing
		g. Existing AVR has LAM (Load acceptance module) function. Offered generator AVR should have similar function like LAM.
7.	Loading Condition	The Generators and AVR system must be highly responsive. However the generators should meet the following transient condition as per Mil-STD 1399-300B: a. **Voltage**. (1) Voltage transient tolerance: Within ±16% (To be mentioned). (2) Voltage transient recovery time: Max 2 sec (To be mentioned). (3) Voltage Regulation: Within ±0.5% (To be mentioned). b. **Frequency**. (1) Frequency transient tolerance: Within ±5.5% (To be mentioned). (2) Frequency transient recovery time: Max 2 sec (To be mentioned). c. The above transient Conditions must be maintained under following load change: (1) Load increases from 0% to 25%, 25% to 50%, 50% to 75%, 75% to 100%. (2) Load Changes from 100 to 0%. (3) Sudden addition of largest 3-phase induction motor available onboard ship while generator running at 50% load. The Ship largest motor is of 75 KW (AC Motor).

		Note: Graphs showing various characteristics and response of transient voltage and frequency variation are to be submitted with the FAT Report.
8	CCS/ Machinery Control and Monitoring panel	Following visual and audio alarm indication shall be incorporated with each CCS Monitoring Panel: **<u>Electric Plant Control Console (EPCC)</u>**: a. Low lube oil pressure alarm- audio and visual. b. High cooling water temperature shutdown device with audio and visual alarm. c. High lube oil temperature alarm- audio and visual. d. Low lube oil pressure shut down device with audio and visual alarm. e. Over speed alarm and auto shut down alarm. f. Generator running status (ON/OFF) indication light. g. Power factor alarm. h. Over Voltage alarm. j. Under Voltage Alarm. k. Over Current Alarm. l. Over Load Alarm. m. Reverse Power. n. Winding Temperature alarm. o. Over Speed Running, Start/ Stop Failure Alarm. p. Fuel Oil leakage alarm. q. Phase Failure Alarm. r. Generator Ready for Start.
		<u>Switchboard</u> a. Generator running status (ON/OFF) indication light. b. Generator Ready for Start. c. Winding Temperature alarm. d. Reverse Power. For installation of CCS Monitoring Panel required site survey shall be done before installation by the supplier (to understand about cable requirement, cable layout, fixing position at CCS and other arrangements as required.
9.	Generator Protection & Power Management System (PMS)	All the existing controllers to the PMS are PPM-3 (Brand-DEIF Model: PPM-3 DG, Options: H2 (Modbus RTU-RS485)). The existing controllers are to be able to communicate with all the new generators. In case, if the new Generators are not compatible with existing PPM-3 controllers, the bidder is to propose a suitable solution in respect of the controllers to be used. **Note**: The Power Management System (PMS) is installed to provide facilities for manual and automatic control of the power plant consisting of 04 Diesel Generators and two main switchboards. The PMS is embedded as a part of the MCAM system, but is realized as a standalone system using DEIF PPM-3 units. The proposed generators should be able to operate and be monitored at least as the existing generators. The necessary interfacing of existing system should be done by the supplier with assistance from MCAM OEM. Method and items required for loading the software and firmware are also to be provided. The existing system description and diagram is attached with this document. Necessary site survey needs to be carried out to understand the current system.
10.	Performance	The Generator sets should be suitable to run simultaneously and continuously in parallel condition with the other existing generators of the ship.
11.	General Features	a. Time between Overhauls: To be mentioned. b. Dimension and Weight: To be mentioned.

12.	Standard and Classification	To be mentioned.
13.	Mode of Operations	a. Automatic mode of individual generators: Fully automatic power management controlled by the Generator Set Controller. b. Semi Automatic mode of individual generators: Operator manual control of generator start/stop and breaker open/close (with auto synchronization) from OWS (MCAM Operator Console) and/or EPCC operator panel. c. Diagnosis mode of individual generators (diesel engine diagnostic mode): Operator manual control of generator speed d. Manual control of both generators and Bus Tie Breaker: Manual main switchboard control of generators start/stop and manual synchronizing. e. Local control of individual generators: Generator start/stop from LCP.
14	Interfacing with the Existing MCAM System	a. The MCAM Operator Workstations (OWS) includes mimic with remote control features of the existing PPM-3. Control commands to the existing PPM3 units for the generators and bus ties are given by activating the appropriate icon (generator icon or breaker icon) that brings a faceplate on display. The control buttons are active only when operator commands are allowed in accordance with the actual controllability. b. Generator set control in MCAM includes (Existing system): **Control buttons**. (1) Semi mode (2) Auto mode (3) Ack alarms in PPM3 (4) Semi Start DG (5) Semi Stop DG (6) Semi Open CB (7) Semi Close CB (8) Mode "OWS diagnostic" (manual speed control) (9) "1st Prior": Select corresponding generator to first priority (equivalent to "1st Prior" button on PPM3) **Alarms**. (1) Control Unit Fault: Complete failure of PPM3 unit. (2) Common Alarm: One or more alarms active in PPM3 unit. (3) Alarm Suppression Active: the PPM3-unit provides a signal to the MCAM alarm system to suppress relevant generator alarms. The alarm suppression is active when the generator is not running. (4) DG Controller Alarms: No of active alarms in PPM3 unit. (5) DG Controller Unacknowledged Alarms: No of unacknowledged alarms in PPM3 unit c. Supplier will ensure the above features and functionality are available in MCAM system after installation of new generator sets with assistance MCAM OEM.

20. **Remote Control and Monitoring Panel**. Existing circuit breaker, meters, indication lights, selection switches and any other device available at Switch Board for control and monitoring, may be used and interfaced with new generators. New items are not required to be supplied, however, if minor

adjustment or repair of existing system (concerning with new generators) is necessary, that should be done by the Supplier.

21. **Air Circuit Breaker**. Air Circuit Breaker for each generator of appropriate ratings. (Ratings to be mentioned) are to be supplied if required. Actual requirement of Supply Breakers are to be assessed by the supplier on site visit. If existing Supply Breakers are useable and appropriate then separate Supply Breaker not to be quoted.

22. **Synchronizing Panel**. The existing synchronizing panel of switchboard should be used for new gensets. The generators should run parallel with existing generators. Necessary arrangement should be done by supplier.

23. **Coupling**. Each Alternator is to be flanged to the Prime Mover (Engine) through SAE standard, bell housing via flexible coupling. The flexible coupling will be according to the final Torsional Vibration Calculation (TVC). The details shall be mentioned.

24. **Base Frame**. Each Generator sets are to be elastically mounted on a base frame to be rigidly fixed to the generator seating. Lifting eyes are to be provided for lifting the complete Generator sets as a whole, and also the Prime Mover and the Alternator separately. The supplier is to supply standard shock and anti-vibration mountings along with holding-down bolts.

25. **Fuel Oil System**. Fuel oil system should consist of the followings but not limited to:

Ser	Description	Remarks
a.	Prime Mover driven fuel oil feed pump including a Ready Use (RU) tank mounted on or beside the prime mover. If the existing feed pump and RU tank is suitable for the offered Gensets, then these are not to be included in the offer.	To be mentioned.
b.	Duplex type fuel filter with changeover valve. Filter elements are to be replaceable during operation.	To be mentioned.
c.	Pressure regulating valve.	To be mentioned.
d.	Leak oil fuel system.	To be mentioned.
e.	Flame proof hose lines for fuel pipe work to and from Prime Mover.	To be mentioned.
f.	Details of arrangement including those for pumps and fittings to be specified.	To be mentioned.

Note: The fuel system of the replacement generators shall be commensurate with, and fully compatible with, the existing diesel fuel system onboard. The design shall ensure proper interfacing with all associated components and piping arrangements. In case any interfacing or modifications are required, they shall be carried out by the supplier. A survey onboard may be conducted in this regard.

26. **Lubricating Oil System**. The lube oil system should consist of the followings:

Ser	Description	Remarks
a.	Prime Mover driven lube oil pump (gear type) with relief valve on pump discharge.	To be mentioned.
b.	LO priming Pump.	To be mentioned.
c.	Lube oil pump for extracting oil from wet sump.	To be mentioned.
d.	Duplex type lube oil filter with cartridges. Filter cartridges are to be changeable during running.	To be mentioned.
e.	Pressure gauges.	To be mentioned.
f.	Flexible connections/ hoses.	To be mentioned.
g.	Details arrangement including pumps and fittings are to be specified.	To be mentioned.

Note: The lubricating oil system of the replacement generators shall be compatible with the existing lubricating oil arrangement. The system shall be designed to match the existing configuration as closely as practicable. In case any interfacing or modifications are required, they shall be carried out by the supplier. An onboard survey may be conducted to verify existing conditions and confirm suitability prior to installation.

27. **Cooling Water System**. Prime Mover internal cooling is to be done by fresh water. Fresh water-cooling is to be done by seawater. Seawater is muddy in the harbor, where the ships will usually be berthed and operated. The Prime Mover cooling water system for each generator should include the following:

Ser	Description	Remarks
a.	Engine driven self priming seawater and fresh water circulating pumps with discharge pressure gauges. (Water pumps with rubber impellers will not be acceptable).	Impeller material is to be mentioned.
b.	Any type of fresh water cooler, external to the Prime Mover.	To be mentioned.
c.	Fresh water and seawater pressure gauges.	To be mentioned.
d.	Galvanized steel fresh water pipe external to the Prime Mover with flexible pipe connection.	To be mentioned.

Note: The cooling water system of the replacement generators shall be designed to match and integrate with the existing cooling water arrangement as closely as practicable. The system shall ensure full compatibility with current piping, flow rates, heat exchanger capacity, and connection points. In case any interfacing or modifications are required, they shall be carried out by the supplier. An onboard survey may be conducted to verify existing conditions and confirm proper interfacing prior to installation. .

28. **Exhaust System**. The existing exhaust system is attached as enclosure may be used for the new Generator sets. The exhaust system of the offered Generator sets should match with the existing exhaust system of the ship from Generator outlet to ships outlet through funnel. If cannot be matched, exhaust pipes from Generator outlet to ship's outlet will have to be supplied by the supplier. However, following may be included in the exhaust system:

Ser	Description	Remarks
a.	Combined exhaust temperature gauge for both bank.	To be mentioned.
b.	Stainless steel expansion bellows with flange between the Turbo charger/Engine exhaust manifold outlet and the main exhaust pipe.	To be mentioned.
c.	Exhaust silencers.	To be mentioned.

Note: The exhaust system of the replacement generators shall be designed to align with the existing exhaust arrangement as closely as practicable, ensuring compatibility with current piping, back pressure limits, supporting structures, and outlet configuration. In case any interfacing or modifications are required, they shall be carried out by the supplier. An onboard survey may be conducted to verify existing conditions and confirm proper integration prior to installation.

29. **Safety Devices**. Following safety devices are to be provided for each Generator set:

Ser	Description	Remarks
a.	Low lube oil pressure alarm - audio and visual.	To be mentioned.
b.	High cooling water temperature shutdown device with audio and visual alarm.	To be mentioned.
c.	High lube oil temperature alarm - audio and visual.	To be mentioned.
d.	Low lube oil pressure shutdown device with audio visual alarm.	To be mentioned.
e.	Prime Mover over speed alarm and auto shut down device/ over speed trip gear (with manual resets).	To be mentioned.
f.	Manual emergency shut off device.	To be mentioned.
g.	Reverse power protection system.	To be mentioned.
h.	Over current protection system.	To be mentioned.
j.	Over voltage/under voltage protection system.	To be mentioned.
k.	Over speed protection system.	To be mentioned.

30. **Shutdown System**. Prime Mover shutdown system should include the following:

Ser	Description	Remarks
a.	Normal shutdown.	To be mentioned.
b.	Local/emergency shutdown (push button to be protected with removable/ open able cover).	To be mentioned.

Note: The generators should be capable of being shut down remotely (CCS – Central Control Station). A survey onboard may be conducted in this regard.

31. **Cables**. The supplier is to provide necessary high quality Power and Control cables for Generator sets (as per IEC 60092-352, IEC 60092-350 standard and marine type) to connect with switchboard. Actual requirement of cable are to be assessed by the supplier on site visit and to be submitted with the offer (if existing power supply cable from generator to switchboard are useable then separate power supply cable not be quoted). Details of various cable specification and unit price (per meter) is to be quoted separately.

switchboard. Actual requirement of cable are to be assessed by the supplier on site visit and to be submitted with the offer (if existing power supply cable from generator to switchboard are useable then separate power supply cable not be quoted). Details of various cable specification and unit price (per meter) is to be quoted separately.

32. **Software and Firmware**. All necessary software and firmware of Generator sets controller, Engine speed controller, AVR and other control circuit are to be provided. Method (step-by-step procedure), tools and items required for loading the software and firmware are also to be provided.

33. **Factory Acceptance Test (FAT)**. Following FAT(s) criteria to be carryout in OEM premises for the offered System:

a. FAT will be carried out by a team of 02 (two) BN members for duration of 04 (four) working days in OEM premises (Detail address should be mentioned) at the buyer's expense. Both way air fare, accommodation and food for the FAT team will be borne by BN. All types of movement/ transportation (air/sea/road) of the team within the manufacturer's country, reception and arrangement for entry into the country/ concerned area for the FAT are to be arranged by the supplier. The supplier should inform the buyer about the date of FAT (schedule) and FAT criteria at least 08 (eight) weeks prior to the date of FAT. FAT procedure shall be forwarded to the buyer 6 (six) weeks prior to the date of commencement of the FAT to the concerned directorate for approval of BN. Serial No of Prime Movers and Alternators are to be provided along with the FAT procedure. The cost of FAT in this respect is to be quoted in the offer.

b. On return from the country of manufacturer, the FAT team will submit the report to concerned Directorate at Naval Headquarters. Naval Headquarters will, in turn, forward final decision along with FAT report, basing on which DGDP will render clearance for shipment of Generator sets and accessories to the supplier concerned. The supplier will not make shipment of any item of the contract without clearance from DGDP.

c. The FAT will be carried out at manufacture's factory premises following approved FAT protocols. In this regard, the FAT protocol is to be approved by BN well in advance.

d. During FAT, tests will be carried out to fulfill the required condition mentioned in technical specification of the offered system. Various tests for checking performance are to be carried out and recorded. After FAT, a joint test report will be prepared and signed by both the seller and buyer's representative.

e. The FAT criteria in details is to be submitted, which should include the following:

(1) **Generator Load Tests**. Generators load test will be carried out to fulfill the required condition mentioned at Para 17 (7). Recording of voltage, frequency, transient voltage and frequency variation and recovery time will be made to ascertain the specified condition.

(2) **Prime-Mover Test**. Factory Test Reports of prime movers are to be provided.

(3) **Tests of Alarm and Safety Devices**. Various test for checking temperature, pressure, fuel oil consumption etc. with recording of alarm and shutdown steps are to be carried out.

(4) **Test Report**. Test reports are to be prepared in English which will include all test results and other relevant information. Test report is to be submitted to BN before shipment.

34. **Interfacing**. The offered items needs to be interfaced by the supplier with following system:

a. PMCS (Process Monitoring and Control Station), designed and installed by logimatic, Denmark (Now part of INIT)

b. PMS (Power management System), designed and installed by logimatic, Denmark (Now part of INIT) and DIEF, Denmark.

c. All responsibility for the third party communication and contact to bring these two OEMs should remain with the supplier.

35. **Installation, Supervision & STW (Setting to Work).**

a. The new generator sets should be installed at the existing location, maintaining dimensions as close as practicable to the current unit to preserve system accessibility. The arrangement of the new generator sets should permit direct integration with existing fuel, lubricating oil, air intake, and

exhaust systems without major modification. In case any modifications are required, that shall be carried out by the Supplier without any additional cost. Adequate clearance should be ensured for safe operation, monitoring, and maintenance.

b. Modification of main switchboards and EPCC Panels should be done at the existing location within same dimensions. Adequate clearance should be ensured for safe operation, monitoring, and maintenance.

c. The Supplier shall supervise the complete removal of the existing generator sets, cables (if necessary) and LCPs from the ship, without damaging any equipment or existing design factors of the ship. BN will provide necessary manpower/ workforce, relevant assistance and facilities for the said removal work. The Supplier is to bear the complete responsibility of the damage and provide the rectification of that damage at their expense occurred (if any) of any equipment/system of BN ship while installation/ interfacing work.

d. All panels, cabinets, racks and junction boxes should be made of chromium plating or similar and painted sea water resistant aluminium to prevent corrosion.

e. Qualified OEM Engineers shall be employed for the installation, STW and commissioning. Welding, cutting and lifting assistance for installation shall be provided by BN under the direct supervision of OEM Engineer. All other works shall be done by the Supplier. For interfacing with MCAM system, supplier will arrange MCAM OEM as necessary. Interfacing with MCAM should only be done by MCAM OEM Engineer. An Assurance letter of assistance for this project from Init Group (Former Logimatic) needs to be provided with the offer. All types of expenses related with both-way airfare (to and from Bangladesh (installation site)), food, accommodation and internal travel of the OEM engineer during installation shall be borne by the Supplier.

f. All tools, installation materials, cables, cable gland, and other necessary items required for the installation and interfacing works shall be provided by the Supplier. The Supplier shall ensure the watertight integrity of the compartments on completion of the installation work.

36. **Test, Trial & Acceptance**.

a. The OEM Engineer shall ensure satisfactory tests, trial and functioning of the generator sets after all necessary modification in main switchboards and EPCC Panel, and integration/ interfacing with MCAM system (with assistance of MCAM OEM) as per contract. All instruments and consumables for Harbour Acceptance Test (HAT), Sea Acceptance Test (SAT) and acceptance shall be provided by the Supplier. The Supplier is also to provide necessary test equipment for measurement/ recording of transient variations, recovery time etc.

b. The OEM recommended HAT and SAT protocol/ procedures shall be forwarded to NHQ at least 06 (Six) weeks prior to the date HAT and SAT for approval of BN.

c. During HAT, tests will be carried out to fulfill the required condition mentioned in technical specification of the offered system. Various tests for checking performance (generator load test, prime mover test and alarm and safety device test) are to be carried out. HAT shall be carried out at harbour on completion of successful STW and commissioning. SAT shall be carried out at sea on completion of satisfactory HAT. On completion of satisfactory Test and Trial (HAT and SAT), an acceptance certificate shall be signed by both BN and Supplier.

37. **Local Training**.

a. The Supplier is to send one appropriate OEM Engineer who will provide onboard operation and maintenance training in Bangladesh to BN personnel for duration of 02 (two) weeks after test, trial and commissioning. Emphasis is to be given on operation, maintenance, faultfinding and troubleshooting of Prime Mover, Governor, Alternator, AVR, Engine and Generator set Controller including software/ firmware installation procedure and Control Circuit etc. Cost of airfare (to and from Bangladesh), accommodation, food and internal transportation (to and from work site and hotel) of the OEM Engineer is to be borne by the Supplier.

b. On completion of successful training, each trainee shall be given with a completion certificate including their level expertise.

c. The mode of instruction shall be in English. All documents shall be written in English, and training aids and materials (both hard copy and soft copy) shall be provided by the Supplier. Duration of training shall be approximately for 40 hours a week (not exceeding 08 hours per day) considering 05 working days per week.

38. **Labeling**. Circuit breakers, control switches, instruments, indicating light and terminal blocks etc are to be clearly labeled to identity their purpose and function.

39. **Standard Accessories.** Standard Accessories including housing materials, installation materials which are essential to install and operate the Generator sets with required functionalities shall be provided whether or not those are mentioned in the specification. One set of filters for each generator shall also be provided for later use. A list of such items/ accessories will have to be provided inclusive of main equipment price.

40. **Spares (Optional item)**. List of essential spares, and necessary spares for future maintenance and cost should be mentioned in the offer as per following list (but not limited to):

Ser	Description of Spares	Reference/ Part no	Qty	Unit Price	Maintenance Schedule/ Hour
1.	Oil Filter		24		
2.	Fuel Filter		08		
3.	Air Filter		08		
4.	Belt (all types)		04		
5.	Seawater pump		01		
6.	Fresh Water Pump		01		
7.	Fuel High Pressure Line		02		
8.	Fresh Water Pump Repair Kit		04		
9.	Sea Water Pump Repair Kit		04		
10.	AVR		01		

41. **Interface Requirement**: Required interface information is given in the attached document. Interfacing work with MCAM system shall be done by the Supplier (with MCAM OEM). Supplier will do necessary third party contract in this regard. An Assurance letter of assistance for this project from Init Group (Former Logimatic) needs to be provided with the offer.

42. **Documentation**. Following documents and manuals in English (both soft and printed copies, 02 printed copies each) are to be provided in free of cost at the time of item delivery:

a. Drawings and instructions manual for installation of the Generator sets.

b. Drawings and instructions manual for Main Switchboard modification and EPCC Panel (after modification).

c. Electrical wiring diagrams and faultfinding flow charts of the alternator, main switchboards, EPCC Panel and LCPs.

d. Drawing and diagrams of Power Management System (PMS) (after modification).

e. Instruction and operation manual of the prime mover.

f. Maintenance manual and workshop level repair manual of the prime mover.

g. Parts catalogue of the prime mover, alternator and LCP.

h. Instruction and operation manual of the alternator.

j. Maintenance manual and workshop level repair manual of the alternator.

k. Instruction and maintenance manual and circuit diagram of the Generator Set Controller, AVR and Electronic Governor.

Note: Maintenance manual must contain circuit diagram, design block diagram, data flow, maintenance schedule, overhaul time, faultfinding flow chart, mechanical diagram, spares list and etc. which will be necessary to troubleshoot and repair.

43. **Brochure**. 01 (one) set of brochure/ booklet, line diagram, paralleling arrangement circuit diagram, technical information, etc. of the offered Generator sets (Prime Mover, Alternator, AVR, Governor, etc.) shall be provided with the quotation for evaluation and assessment. The brochure should contain in addition to other behaviors of the Generator sets including characteristics/ performance curves, behavior when various loads are added or taken-off.

44. **Technical Support.** Technical support is to be provided to solve any maintenance and operational problem arising with the item within the warranty period. An assurance agreement in this respect is to be submitted with the offer.

45. **Certificate**. Following certificates are to be provided by the supplier of the Generator sets and associated equipment/ accessories:

a. Manufacturer's Authorization Certificate with the offer.
b. Inspection (FAT) Certificate (in English) are to be provided at the time of item delivery.
c. Necessary unit certification as per Para 13.
d. Quality assurance certificates for the Generator sets and their associated equipment and instruments in regard to its manufacturer and performance is to be provided at the time of items delivery.

46. **Price**. Price of the each item of the total offer is to be shown separately (e.g. price of the main items, additional and optional items, spares, installation and STW, FAT, training, Warranty/ Guarantee etc) and then grand total of the foreign currency to be shown on the original offer submitted by the bidder.

47. **Warranty**.

a. Manufacturer's warranty for repair/ replacement at supplier's cost for the supplied Generator sets (Prime Movers, Alternators and other accessories) for a period of minimum 12 months after final acceptance by BN on completion of installation and necessary test/ trial onboard the ship is to be provided. The warranty shall cover all parts and service costs/ charges throughout the warranty period. Certificate from OEM regarding warranty is to provided with the offer.

b. If for defect of any unit or sub unit of the supplied items, the Generator sets or any supplied items remain non-operational for a certain period within warranty, the warranty will be extended by the same period.

c. For warranty repair/ replacement, the supplier will collect the defective item (portable) from NSD, Chittagong/ NSSD, Dhaka (as applicable) and re-supply the same to collecting place after warranty repair or for replacement within 90 (ninety) days from the date of defect at no cost to the purchaser.

48. **Guarantee**.

a. The supplier will guarantee to supply the spares (from manufacturer) for at least 10 years with reasonable price. Yearly increase of price of spares should not be more than 5% of the list of spares with price to be supplied with the quotation.

b. The suppler is to provide technical support up to the service life of the supplied items in consideration of suitable payment.

49. **Shipment & Delivery**.

a. The supplied items are to be delivered within 09 (nine) months after signing the contract to the following Consignee:

The Commanding Officer
Naval Stores Depot
New Mooring, Chittagong,
Bangladesh
BIN-002349278-0503

or

Officer In Charge
Naval Stores Sub Depot Dhaka
Naval Unit Khilkhet
Namapara,Dhaka-1229,
Bangladesh

b. **Place of Delivery**: NSD, Chittagong.

c. In case of CFR, the supplier will carry the items from sea port/ airport (as applicable) to NSD Chittagong at the cost and risk of supplier.

d. **Port of Shipment**. To be mentioned. Port of shipment shall be from country of manufacturer or country of origin of the generator.

50. **Site Visit**. The generators are to be operated with at least the existing capabilities. To ensure that, the bidder may visit the installation site (BNS KHALID BIN WALID) of Generator sets before submission of tender to avoid any difficulties/ confusion after placing order.

51. **Site Survey**. A detailed site survey will be conducted by the Supplier right after the contract signing for installation of new generator sets, modification in the PMS, modification of main switchboards and EPCC panels, and interfacing with MCAM system for ascertaining the final design and timeline of the project. The site survey report is to be submitted to BN for final approval. The cost of transportation, accommodation, food, etc. of the visiting team will be borne by the Supplier. However, necessary security clearance, permission, and other administrative support will be given by BN.

52. **Validity**. The offer should remain valid up to 30 June 2026.

53. **Lead Time**. The supplier will install and commission the items on board BN ship within 3 (three) months after delivery in Bangladesh. Liquidated Damage (LD) will also be applied in this respect as per DGDP rule for the delay beyond lead time.

54. **Source of supply**. Source of supply of offered Generator sets are to be mentioned.

55. **Terms of Payment**. Letter of Credit will be opened for full amount of contract price in favour of the supplier/ Principal for the complete scope of supply with the following terms of payment:

a. 80% of contract price (excluding training, FAT and installation cost) will be released after shipment of all items and on submission of necessary documents as per DGDP rules.

b. The remaining 20% of contract price (excluding training, FAT and installation cost) will be released after successful test/ trial, jointly carried out by the buyer's representative and supplier's representative and final acceptance of the Generator sets by the purchaser.

c. 100% cost of each training, FAT and installation will be released upon completion of respective activities and upon submission of each completion certificate.

56. **Compliance Statement**. A compliance statement fulfilling all the requirement of the tender is to be submitted for evaluation of the quotations. Stating mere 'Yes or No' will not suffice and detailed evidences with description/ information, brochures/ booklet, drawing and diagram 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 Generator set, the deviation has to be spelt out clearly.

Enclosures:

1. Power Management System of BNS KHALID BIN WALID - 02 (Two) pages.
2. MCAM System Architecture - 01 (One) page.

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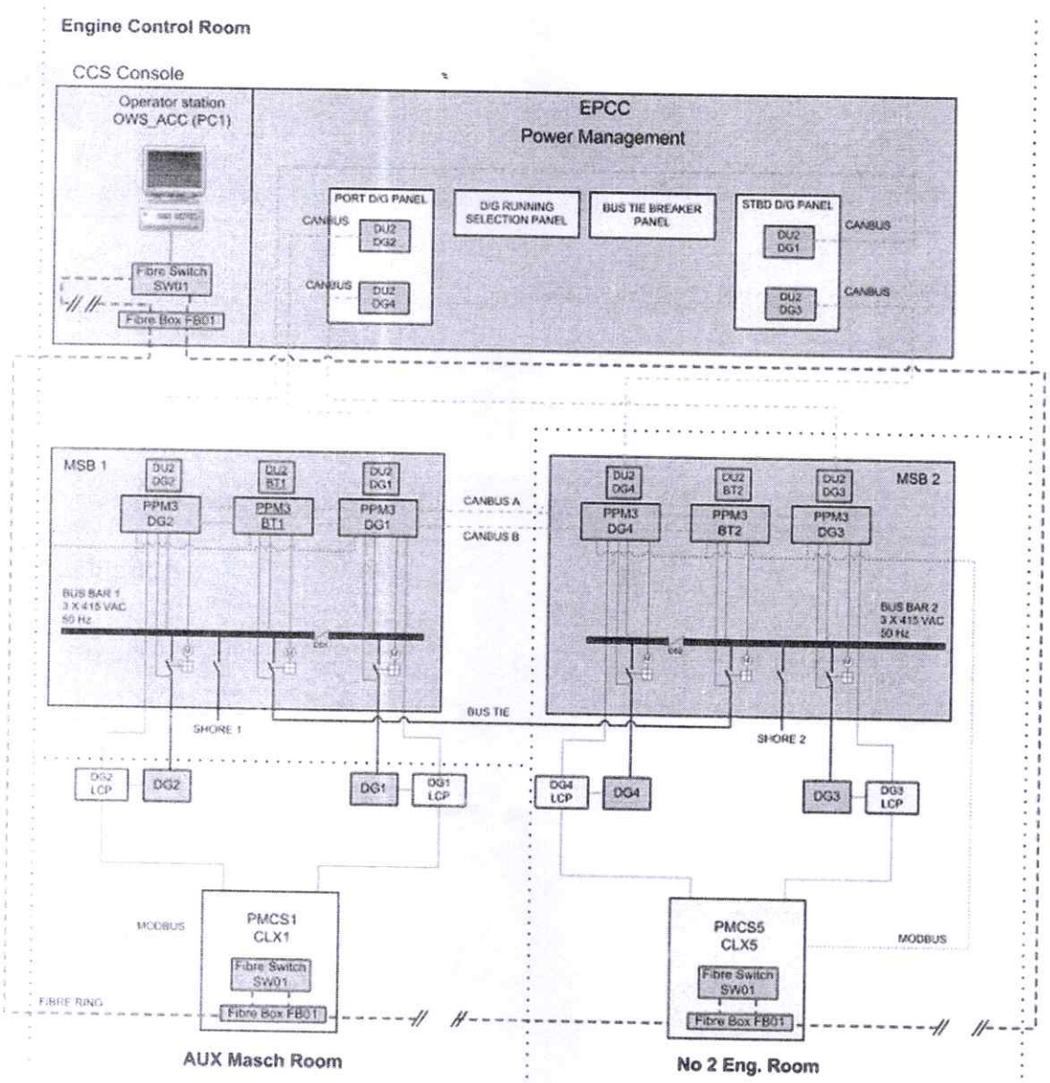
POWER MANAGEMENT SYSTEM OF BNS KHALID BIN WALID

System Architecture



The power management system architecture is illustrated above. Generator DG1 and DG2 are connected to main switchboard MSB 1. Generator DG3 and DG4 are connected to main switchboard MSB 2. The two main switchboards can be operated individually (split) or connected via a bus tie with two bus tie breakers. Each MSB can be supplied from a shore connection.

The PMS is realized with Deif PPM3 equipment, and operates as a standalone system in relation to MCAM. A total of six PPM3 units are installed in MSB1 and MSB2, one for each D/G and one for each bus tie. In addition, remote operator panels for the four D/Gs are installed in the EPCC console, where each remote panel is connected to the associated PPM3 unit in MSB with CANBUS. The PPM3 units in MSB are directly connected to the D/G Local Control Panels (LCP) and the Air Circuit Breakers (ACB) for monitoring and control. All functionality and operator facilities are available in the PPM3 system and are independent of the state of the MCAM system. The MCAM operator workstations includes mimic with remote control features of the Deif PMS. The data connection between MCAM and PPM3 is via serial MODBUS.

The MCAM system comprises a total of 6 PMCS cabinets, but only the two units involved in PMS is shown in the above figure. PMCS 1 controls the MSB 1 equipment and PMCS 5 controls the MSB 2 equipment. The MCAM operator facilities consist of two workstations in the CCS console and one workstation on bridge. All three workstations have identical capabilities, but only one is shown in the above figure for convenience. The MCAM components communicate over a fiber ring.

The PPM3 units are able to control the power plant in combined MSB mode via a redundant CANBUS connection between MSB1 and MSB2. The PPM3 units can operate independently of the other units, so in any failure situations it is possible to operate the MSBs in split mode with automatic PMS.

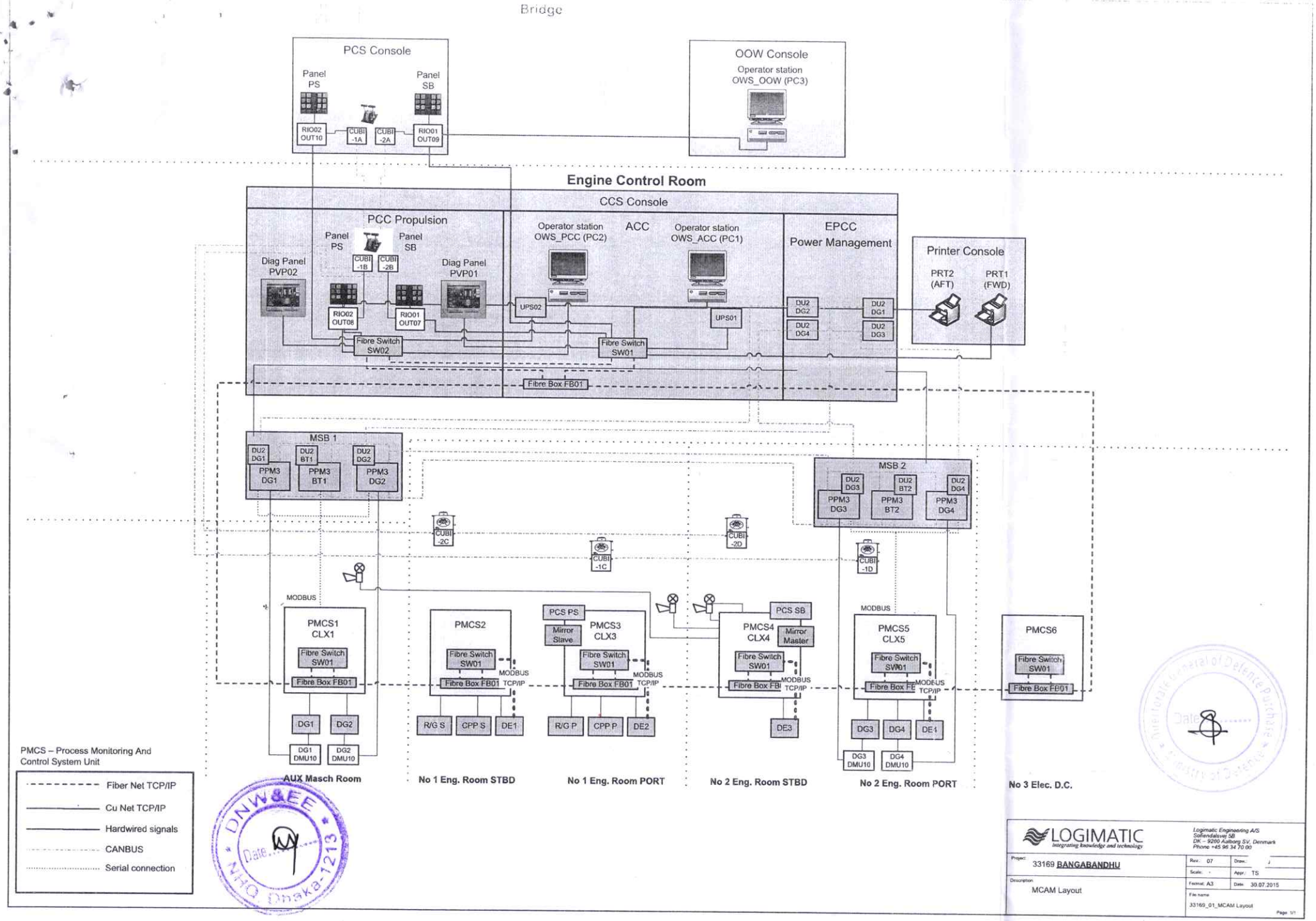
D/G MODES OF OPERATION

The system configuration comprises the following control levels that can be selected individually for each D/G:

1. **AUTO mode of individual D/G:** Fully automatic power management controlled by the Deif PPM3 system. Requires the following conditions:
   a. D/G LCP to be in "REMOTE"
   b. MSB mode to be in "EPCC"
   c. PPM3 mode to be "AUTO" for appropriate D/G
   d. D/G is READY
2. **SEMI-AUTO mode of individual D/G:** Operator manual control of D/G start/stop and breaker open/close (with auto synchronization) from OWS and/or EPCC operator panel. Requires the following conditions:
   a. D/G LCP to be in "REMOTE"
   b. MSB mode to be in "EPCC"
   c. PPM3 mode to be "SEMI-AUTO" for appropriate D/G
   d. D/G is READY
3. **MSB MANUAL control of both D/Gs and Bus Tie Breaker (all three PPM3 units are in "SWBD" mode):** Manual MSB control of D/G start/stop and manual synchronizing. Requires the following conditions:
   a. D/G LCP to be in "REMOTE"
   b. MSB mode to be in "MSB"
   c. D/G is READY
4. **E/R local control of individual D/G (individual PPM3 unit is in "SWBD" mode):** D/G start/stop from LCP. Requires the following condition:
   a. D/G LCP to be in "LOCAL"
   b. D/G is READY

LCP "LOCAL" and MSB mode "MSB" has precedence over the higher level control modes.

The selection between PPM3 "AUTO" and "SEMI-AUTO" can be done either from OWS, from the PPM3 unit in the appropriate MSB section or from the remote panel in EPCC.


Bridge
PCS Console
Panel PS
Panel SB
RIO02 OUT10
CUBI -1A
CUBI -2A
RIO01 OUT09
OOW Console
Operator station
OWS_OOW (PC3)
Engine Control Room
CCS Console
PCC Propulsion
Panel PS
Panel SB
Diag Panel PVP02
Diag Panel PVP01
CUBI -1B
CUBI -2B
RIO02 OUT08
RIO01 OUT07
Fibre Switch SW02
Operator station OWS_PCC (PC2)
ACC
Operator station OWS_ACC (PC1)
UPS02
UPS01
Fibre Switch SW01
Fibre Box FB01
EPCC Power Management
DU2 DG2
DU2 DG4
DU2 DG1
DU2 DG3
Printer Console
PRT2 (AFT)
PRT1 (FWD)
MSB 1
DU2 DG1
DU2 BT1
DU2 DG2
PPM3 DG1
PPM3 BT1
PPM3 DG2
MSB 2
DU2 DG3
DU2 BT2
DU2 DG4
PPM3 DG3
PPM3 BT2
PPM3 DG4
CUBI -2C
CUBI -1C
CUBI -2D
CUBI -1D
MODBUS
PMCS1 CLX1
Fibre Switch SW01
Fibre Box FB01
DG1
DG2
DG1 DMU10
DG2 DMU10
PMCS2
Fibre Switch SW01
Fibre Box FB01
TCP/IP
R/G S
CPP S
DE1
PCS PS
Mirror Slave
PMCS3 CLX3
Fibre Switch SW01
Fibre Box FB01
R/G P
CPP P
DE2
PCS SB
PMCS4 CLX4
Mirror Master
Fibre Switch SW01
Fibre Box FB01
DE3
PMCS5 CLX5
Fibre Switch SW01
Fibre Box FB01
DG3
DG4
DE4
DG3 DMU10
DG4 DMU10
PMCS6
Fibre Switch SW01
Fibre Box FB01
PMCS – Process Monitoring And Control System Unit
Fiber Net TCP/IP
Cu Net TCP/IP
Hardwired signals
CANBUS
Serial connection
AUX Masch Room
No 1 Eng. Room STBD
No 1 Eng. Room PORT
No 2 Eng. Room STBD
No 2 Eng. Room PORT
No 3 Elec. D.C.
DNW&EE
NHQ Dhaka-1213
Date
LOGIMATIC
Integrating knowledge and technology
Logimatic Engineering A/S
Solvandsvej 5B
DK – 9200 Aalborg SV, Denmark
Phone +45 96 34 70 00
Project: 33169 BANGABANDHU
Rev.: 07
Draw.:
Scale: -
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Page 1/1