

Procurement of 1.25MW Gas Turbine Generators for IN Ships

1. Ministry of Defence, Government of India is desirous of procuring, from Indian Suppliers, 1.25MW Gas Turbine Generator for Power Generation application onboard three ships as a retro-fittment of existing Power Generator. The indigenous equipment would further be considered for installation in additional new construction warship projects towards product standardization.

2. Accordingly, the Defence Acquisition Council (DAC) has accorded Acceptance of Necessity (AoN) for procurement of 1.25MW Gas Turbine Generator, as per the details given below:-

(a) **Quantity & Deliverables.** 12 complete sets of 1.25 MW Marine Gas Turbine Generators (comprising of Prime mover, Gearbox and Alternator), Documentation and Spares. The supplier will also be required to undertake installation, interfacing & setting to work and provide maintenance facilities for the said equipment onboard ships of Indian Navy.

(b) **Category.** Buy (Indian), with reference to Para 9 & 21 of Chapter 1 of DAP 2020.

(c) **Major Technical Details:-** Major technical details for the 1.25MW Gas Turbine Generator is as follows:-

(i)	Maximum Continuous Rating (MCR)	- 1.25MW at 35 deg C ambient air temperature and sea water temperature.
(ii)	Electrical Output	- 380V, 3 phase and 50 Hz
(iii)	Thermal Efficiency	- More than or equal to 21%
(iv)	Specific Fuel Consumption at peak load condition	- Less than 450 g/kW-Hr
(v)	Limiting dimension	- 6110(L) x 2210 (B) x 2905(H) in mm
(vi)	Control System	- IEC/FADEC control system with VME 64 based VITA compliant cards for overall GTG and VME 64/microprocessor based control system for individual major components.
(vii)	Weight	- Max dry weight < 16 Tons
(viii)	Intake and Exhaust	- Intake Duct Length of not less than 12.4m with initial cross section on upper deck of 750mm X 1150mm reducing to 400mm X 800mm as per requirement of retro fitment. - Pressure loss in ducting including filters/ diffusers in the intake and exhaust to a max value of 300 mm and

		400 mm of Water Column respectively, as per requirement of retro fitment.
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- (d) **Environmental Conditions**. Placed at Encl 1
- (e) **Reference Standards**. Placed at Encl 2
- (f) **SBN & ABN**. The Structure Borne Noise and Air Borne Noise are to be i.a.w MIL-STD 740-2 and MIL-STD-1474E (available on request) respectively.
- (g) **Vibration**. As per ISO 10816-3-99, not exceeding 4.5mm/s (rms) iaw Classification of Vibration Severity Zones for Machine Group 1, 3 & 4, with measurement location (vertical and horizontal) on each bearing cap/ housing.
- (h) **Shock**. Shock standards as per IN shock grade 'A' iaw IHQ MoD(N) letter EG/5522/Policy dated 11 May 07 would be applicable (available on request). The shock specification of the equipment, auxiliaries, control panels etc have to be proven separately, if not mounted on the same skid/ base frame of the engine and the same to be proven with engine, if mounted on the same skid/ base frame. Shock qualification through physical testing is mandatory, if weight is below 2.5T and for units above 2.5T, the shock analysis/ qualification calculations would be required for evaluation.
3. With a view to identify probable vendors who can undertake the said project, the OEMs/ Vendors are requested to forward information on the product which they can offer within four weeks from date of publication of details on MoD/Indian Navy website for seeking Request for Proposal (RFP) and submission of bid. This is as per para 35 of Chapter 2 of DAP 2020.
4. The response to the information may please be forwarded at the following address within four weeks from date of publication of details on MoD/Indian Navy website:-

Directorate of Marine Engineering
Room No 129, 'A' Wing
Sena Bhawan
New Delhi 110011

Fax No – 011-23011352
Ph no – 011-23010335
Email – dme-navy@nic.in

Environmental Conditions

1. Environmental conditions are as follows:-

(a)

<u>SNo.</u>	<u>Condition</u>	<u>Value</u>
(i)	Temperature (aa) Ambient Air (ab) Sea Water	-10 °C to +40 °C -2 °C to +35 °C
(ii)	Relative Humidity at 35 °C	95%
(iii)	Engine room air temperature	+0 °C to +55 °C
(iv)	Salinity of Fresh Water used for cooling in primary circuit (as applicable)	Up to 1000 ppm
(v)	Salinity of Sea Water used for cooling in primary/ secondary circuit (as applicable)	≤ 37000 ppm

(b) The GTG shall be capable of operation from (-) 10 deg C to +40 deg C, apart from the conditions defined in NES 1004.

(c) The GTG comprising of TC, RG, Alternator, its auxiliaries and the control panels as mounted on a single skid/ frame shall be capable of operating with floodwater to the level of the underside of the GTG skid, without loss of performance, for a period of 60 minutes. Operating restriction or degradation in performance post operation of the GTG in this flooded condition shall be stated by the GT Designer.

(d) The GTG shall be capable of operating with floodwater fuel contamination with:-

(i) 200 ppm total water

(ii) 2.5 mg/L dirt after having passed through a nominal 10 micron filter

(e) Fire. In the event of a machinery compartment fire, the GTG must be capable of remaining operational for 30 minutes within defined limits.

(f) Fungus Resistance. The engine components shall be resistant to fungus as determined by selection of non-nutrient materials which are resistant to fungus and by satisfactory completion of component qualification.

(g) All auxiliaries housed in the same enclosures as the GTG are subject to the same environmental conditions, including those specified for material tolerance to contamination, fire, shock and containment in the event of failure.

2. **Conditions of Inclination.** The GTG shall be capable of operation at rated performance under the different ship attitudes, while subject to ship motions as defined in NES 1004. Also, GTG shall operate satisfactorily under the following conditions of inclination:-

- (a) Static trim of 5 degrees without any limitation on time.
- (b) Dynamic trim of 15 degrees by Aft and 20 degrees by forward.
- (c) Static heel of 15 degrees (± 7.5 degrees) without any limitation on time.
- (d) Dynamic Roll of 45 degrees (± 22.5 degrees).
- (e) Following factors need consideration while meeting requirements of this Clause:-
 - (i) Athwartships and fore-and-aft inclination may occur simultaneously.
 - (ii) Up to an angle of inclination of 45 degrees (± 22.5 degrees) of roll no undesired switching operations or operational changes should occur.

3. In deciding whether the performance of a particular GTG meets that specified at para 2 above, the orientation (longitudinally or athwartships) of the GTG, and hence the effect of detailed inclinations, shall be considered.

4. **Operating Environment for GTG Integrated Electronic Control System (IEC).**

- (a) The typical environment conditions for the IEC to meet the Life Cycle Environmental Profile (LCEP) as per MIL-STD-810G are specified below:-
 - (i) Humidity. 95 % relative humidity at 35 deg C.
 - (ii) Ship Motion.
 - (aa) Static trim of 5 degrees without any limitation on time.
 - (ab) Dynamic trim of 15 degrees by Aft and 20 degrees by forward.
 - (ac) Static heel of 15 degrees (± 7.5 degrees) without any limitation on time.
 - (ad) Dynamic Roll of 45 degrees (± 22.5 degrees).
 - (iii) Salt Spray. As per MIL-STD-883H (Method 1009.8) or equivalent

(iv) Engine Room Temperature Applicable

(aa) Extreme Conditions

Storage : 0 – 70 deg C
Operating : 0 – 55 deg C

(ab) Normal Conditions

Storage : 50- 55 deg C
Operating : 50- 55 deg C

(v) Control Room Temperature. Applicable for control panels except when alternate location specified by the Integrator or IN.

(aa) Storage : 15 - 55 deg C

(ab) Operating : 15 - 55 deg C

(b) Environmental conditions as specified at para 1 to 3 above.

REFERENCE STANDARDS

Standards/ specifications as per their latest issues/versions applicable are as follows:-

<u>Sl</u>	<u>Standards/Specification</u>	<u>Title</u>
1.	Def Stan 02-309	Requirements for Gas Turbines
2.	Def Stan 02-362	Type and Production Testing of Mechanical Equipment
3.	DME Specification 303D	Guidelines for Acceptance Trials for Main and Auxiliary Machinery of New Construction ships
4.	Naval Engineering Standard (NES) 1004	Requirements for the design and testing of equipment to meet environmental conditions
5.	Defence Standard 02-302	Requirements for maintenance envelopes and removal routes
6.	/N Shock grade 'A' as per IHQ MoD(N)/ DME policy letters EG/5522/POLICY dated 11 May 07	Requirements for high impact shock qualification, shipboard equipment and systems
7.	MIL-STD 1474-E	Airborne Noise Measurements and Acceptance Criteria of Shipboard Equipment
8.	MIL-STD-740-2(SH)	Structure Borne Noise Measurements and Acceptance Criteria of Shipboard Equipment
9.	MIL-STD-167-1 & ISO 10816-3-99	Mechanical Vibrations of Shipboard Equipment
10.	EED-P-23	Interactive Electronic Technical Manuals (IETM) Class 4
11.	MIL-STD-461E	Requirements for control of Electromagnetic Interference characteristics of sub systems and equipment
12.	JSS 55555 (R3)	Environmental Test methods for Electronic & Electrical Equipment
13.	MIL-STD-883H	Salt Spray
14.	EED-Q-071(R4)	Electrical specifications for AC Motors and Control Panels
15.	EED-Q-242 (R3)	Requirements for the Alternators

<u>Sl</u>	<u>Standards/Specification</u>	<u>Title</u>
16.	Def Stan 08-142	Governing Systems, Speed and Load Sensing : Naval Shipboard Use
17.	NES 312	Requirement for Gas Turbine Intakes and Uptakes
18.	MIL-STD-810G	Test Method Standard: Environmental Engineering Considerations and Laboratory Tests
19.	MIL-STD-2073-1E	Standard Practice For Military Packaging
20.	DEFSTAN 02-329	Requirements for Heat Exchangers
21.	DME 463	Specifications on Manually Operated Ship's System Valves for Low Pressure Fluids
22.	ISO 14159	Safety of Machinery – Hygiene Requirements for the design of Machinery
23.	MIL 1472G	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
24.	MoD/DGQA Policy Letter 66303/Policy/DQA(N)/QA dated 25 Jan 18	Type Testing of Naval Electrical/ Electronic Equipment
25.	DQA(WP) Policy Letter 12575/Policy/DGQA/WP-TC dated 17 Mar 21	Type Testing of Naval Engineering, Hull and NBCD Equipment