

**REQUEST FOR INFORMATION (RFI) FOR
INDIGENOUS DEVELOPMENT OF 5MW PROPULSION MOTOR FOR SUBMARINES**

1. The Ministry of Defence, Government of India, intends to undertake Indigenous Development of 5MW Propulsion Motor for Submarines.
2. This Request for Information (RFI) consists of three parts as indicated below:-
 - (a) **Part I.** The first part of the RFI incorporates operational characteristics and features that should be met by the vendor. A few important technical parameters of the proposed repair facility are also mentioned.
 - (b) **Part II.** The second part of the RFI states the methodology of seeking response of vendors. Submission of incomplete response format will render the vendor liable for rejection.
 - (c) **Part III.** Guidelines for Framing Criteria for Vendor Selection / Pre Qualification in Buy Indian (IDDM), Buy (Indian) and Buy & Make (Indian) Cases (details available at Annexure IV to Appendix A of DAP-20).

PART- I

3. **Intended Use of Equipment (Operational Requirements).** The Motor is required to be developed for fitment onboard Submarines.
4. **Quantity Required and Anticipated Delivery Timeframes.** Once proved, the 5MW Propulsion Motor for fitment onboard existing/ future conventional submarines. Anticipated Quantity – 06.
5. **Important Technical Parameters.** The details of the Technical Parameters are placed at **Appendix 'A'**.
6. Vendors should confirm that following conditions are acceptable:-
 - (a) The solicitation of offers will be as per 'Single Stage-Two Bid System'. It would imply that a 'Request for Proposal' would be issued soliciting the technical and commercial offers together, but in two separate sealed envelopes. The validity of commercial offers would be at least 18 months from the last date of submission of offers.
 - (b) The technical offers would be evaluated by a Technical Evaluation Committee (TEC) to check its compliance with RFP.
 - (c) The equipment of all TEC cleared vendors would be put through a trial evaluation in India on a 'No Cost No Commitment' basis. A staff evaluation would be carried out by SHQ to analyse the result of field evaluation and shortlist the equipment for introduction into service.
 - (d) Amongst the vendors cleared by TEC, a Contract Negotiations Committee would decide the lowest cost bidder (L1) and conclude the appropriate contract.

- (e) Vendor would be bound to provide product support for time period specified in the RFP, which includes spares and maintenance tools/jigs/fixtures for field and component level repairs.
- (f) The vendor would be required to accept the general conditions of contract given in the Standard Contract Document at Chapter VI of DAP.
- (g) Offset (if applicable). The vendor has to undertake offset contracts amounting to ____% of the value of commercial proposals (Refer Appendix D to Chapter II of DAP-20).
- (h) **Integrity Pact (if applicable)**. An Integrity Pact along with appropriate IPBG is a mandatory requirement in the instant case (refer Annexure I to Appendix M of Schedule I of DAP-20).
- (i) **Performance-cum-Warranty Bond**. Performance-cum-Warranty Bond both equal to 5% value of the contract inclusive of taxes and duties is required to be submitted after signing of contract.
- (j) **ToT (if applicable)**. GOI is desirous of license production of equipment after acquiring ToT in the case.

PART-II

6. Procedure for Response.

- (a) The firm must fill the form of response, as given in **Appendix B of this document**. Apart from filling details about the firm, details about the exact equipment meeting the mentioned operational / technical specifications (**Appendix A and Appendix C of this document**) should also be carefully filled. Additional literature on the equipment can also be attached with the form.
- (b) The filled form should be dispatched to the under mentioned address:- -
- The Commodore (Electrical Engineering)
Directorate of Electrical Engineering
IHQ-MoD(N)/DEE, D-2 wing, Sena Bhavan,
New Delhi 110011. India.
Tele: 0091-11-2301 0236
Fax : 0091-11-2301 1212
E-Mail: dee@navy.gov.in
- (c) The last date of acceptance of filled form is 08 weeks from the issue of the RFI. The vendors short listed for issue of RFP would be intimated.

7. The Government of India invites responses to this request only from Original Equipment Manufacturers (OEM)/Authorised Vendors/Government Sponsored Export Agencies (applicable in the case of countries where domestic laws do not permit direct export by OEMs). The end user of the equipment is the Indian Navy.

8. This information is being issued with no financial commitment and the Ministry of Defence reserves the right to change or vary any part thereof at any stage. The Government of India also reserves the right to withdraw it should it be so necessary at any stage. The acquisition process would be carried out under the provisions of DAP-20.

**OPERATIONAL / TECHNICAL SPECIFICATIONS FOR
INDIGENOUS DEVELOPMENT OF 5MW PROPULSION MOTOR FOR SUBMARINES**

1. **Introduction.** Electric Propulsion motor is intended to be used in propulsion system for submarine providing mobility to the platform on the surface/underwater operations.

1.1 **Scope of Project** This document provides the technical specifications of the Electrical Propulsion Motor for submarines.

- (a) Design and development of the technology for a 5MWh Propulsion Motor for submarines.
- (b) Completion and Validation of Design.
- (c) Development of Prototype for Land Based Trials.
- (d) Acceptance Test Protocols for the Propulsion Motor.
- (e) Study report on retro fitment onboard conventional submarines.

1.2 **List of Abbreviations used**

Abbreviations	Description
PWM	Pulse width Modulation
IGBT	Insulated Gate Bipolar transistor
RPM	Revolutions per minute
CE	Conducted Emissions
RE	Radiated Emissions

1.3 **Applicable standards**

Standard	Description
NES 534 & NES 501	General Requirement for the design of electro-technical equipment
NES 514	Cable glands, water tight, integral and attachable electrical equipment
NES 632	Requirements of DC Motor
IS4691	Degree of protection provided by enclosures for rotating Electrical machines
NES 511	Requirements of Electrical Testing
P24/TA/GEN/0001	Environmental Specifications
NES 723	Tally plates, Danger plates, caution plates
DND/SDG/24/EMC-1	EMI/EMC Test-Mil Std 461 C specifications
JSS 55555	Environmental Test
NES 627	Requirements for general application to rotating electrical machinery
NES 629	Requirements for testing of rotating electrical machinery
IS 2147	Enclosures/size of Motors
SDG/9001/ENV/001	Environmental specifications & Voltage variations

2 Specifications

2.1 Electrical Data

SI	Specifications	Rating	Remarks
(a)	Power Source	Main Batteries 180-365 V DC	Power supply to the Motor will be provided through the Main Batteries
(b)	Motor Nominal Power Rating	5MW	Shaft Output of 5MW
(c)	Rated Voltage	720VRms	At this voltage motor deliver rated power
(d)	Minimum Voltage	260Vrms	
(e)	Rated Motor RPM	150	Negative tolerance are not accepted.
(f)	Max. Motor RPM	15% in excess of rated Motor RPM	For a duration of 15 Minutes without excessive noise and damage
(g)	Overload Capacity	110% of the Rated value	Duty of 2 Mins
(h)	Efficiency	85-90%	
(i)	Thermal class	H or F	
(j)	Direction of rotation	Motor has to operated in both directions	
(k)	Air borne Noise	< 70dB(A)	
(l)	Starting currents	To be less than 3 times the rated current	
(m)	Duty Cycle	Continuous rating	
(n)	Earthing protection	External Earthing terminal to be provided	
(o)	Speed Variation/Control	Motor able to run at different operating speeds over entire operating range in both directions	
(p)	Redundancy	High availability of motor to be ensured by maintaining proper redundancy inverters, cooling mechanism etc.	
(q)	Protection	Proper measures has to be taken in the event of short circuit and overload conditions, to protect the motor form failures.	
(r)	Starting Torque	Required Torque to be maintained as per load requirements	
(s)	Space Heater	Inbuilt heater to be provided meeting the requirement with suitable control. Heater is off when motor is started and on when motor is switched off	
(t)	Cable / Cable gland details	Cable / Cable gland details (Type/Size/no. of cores)	

2.2 Mechanical Data

Sl	Specifications	Rating	Remarks
(a)	Overall Radius	2700mm	
(b)	Stator housing diameter	4000mm	
(c)	Motor Width	2800mm	
(d)	Maximum weight	71 tons	
(e)	Enclosure Protection	IP 44 IP 55	Motor Terminal Box Enclosure
(f)	Orientation and Mounting	Horizontal	Installed on suitable shock absorbent
(g)	Enclosure	Drip proof screen protected	
(h)	Bearings	Suitable bearings to be selected	
(i)	Insulation class	Thermal class H or F	
(j)	Motor Orientation and Mounting	To be mounted on suitable shock absorbents as per the platform requirements	
(k)	Lifting Arrangement	Appropriate Eye bolts to be provided for lifting	
(l)	Cooling System	Chilled water will be supplied and required flow rate for the motor to be specified during detail design stage	
(m)	Coupling arrangement	Details to be shared during design stage to cater for the associated shaft	
(n)	Airborne noise	Average level of sound pressure of combined assembly of pump and motor measured in the test bed in accordance with ISO 3744 on conformed surface at a measuring distance of 1m, in 70dB(A) with respect to reference threshold level of 2×10^{-5} N/m ² should not exceed 70dB(A).	

2.3 Shock, Noise & Vibration Aspects

2.3.1 **Shock Strength.** The electric propulsion motor able to withstand shock loads of full sine wave in all three directions and it is capable of trouble free operation during and after being, subjected to shock.

2.3.2 **Vibration level.** Vibration levels of pump motor assembly in 1/3 octave frequency range from 5 Hz to 10 KHz with a reference to 1×10^5 m/secz, when measured above shock absorbers in accordance with NTD .1212.360050.011 and it do not exceed the straight line joining the values as specified below:

- (a) 5Hz - 58dB
- (b) 10kHz – 91 dB

2.3.3 **Vibration Resistance** – The equipment capable of trouble free operation under the influence of vibration caused by propeller. The Vibration resistance tested in accordance with Standard – B03 by following three tests:-

- (a) Test for detection of Resonance. The test is carried out by mounting equipment on vibration test stand and\subjecting the equipment to vibrations of frequencies ranging from 3-33 Hz with amplitude of platform 0.1 to 0.15mm at sweep rate <5Hz/min to identify the resonant frequencies.

(b) Vibration Resistance at Resonance. The equipment has to be operated for 02 hours on given below: 3-5 Hz-1.0 mm 5-33 Hz – 0.23mm +/- 0.05mm.

(c) Vibration Resistance. The equipment made to perform its function while mounted on a vibro-test stand gradually increasing the frequency of oscillations from lower to higher and vice-versa as given below: In case of resonance the vibration amplitude had to be reduced to half of above mentioned values in range 0.7-1.4 times of the resonant frequency.

Frequency Sub-Range	Amplitude of Test stand Platform(mm)	Duration (min)
Up to 10 Hz	2.5	>2
>10-20Hz	0.63	>2
>20-25Hz	0.4	>2
>25-30Hz	0.28	>2
>30-33Hz	0.23	>2

The equipment is considered to have passed the above tests if no mechanical failure, damages, slackening of joints, false operation and parameters of equipment measured during and after the tests lie in range of specified allowance.

2.4 Climatic and environmental conditions

The system is able to work under following environmental conditions

SI	Environment	Condition
(a)	Ambient Air temperature	-15°C to +55°C
(b)	Humidity	Upto 100%
(c)	Sea Water temperature	-2°C to 35°C
(d)	Sea water density	1.006 to 1.030 t/m ³
(e)	Internal pressure	900-2200mbar
(f)	Heel/List	Constant heel ±15°
(g)	Trim	Constant trim ±15°
(h)	Roll	Upto ±45° (period 6-9 seconds)
(i)	Pitch	Upto ±15° (duration not less than 5 seconds)
(j)	Hull Distortion	Max 10.1 mm relevant only for equipment which are directly attached to the pressure hull and having alignment requirement

2.5 EMI/EMC Specifications

SI	Type of Test	Description	Frequency Range	Remarks
(a)	CE101	Power Leads	25Hz to 10kHz	Lower frequency limit revised form MIL STD 461 E
(b)	CE102	Power Leads	10Khz to 1MHz	As per STD MIL461E
(c)	RE101	Magnetic Fields (cables and equipment)	25Hz to 100kHz	Lower frequency limit revised form MIL STD 461E
(d)	RE102	Electric Field	10kHz to 18Ghz	As per STD MIL STD461E
(e)	RS06	DC Magnetic Field	1200A/m	Additional Test

2.6 Service Life

(a) Continuous period of failure free operation at all regimes without any special maintenance has to be 10,000 hrs. Total service life to be 30 years. Storage life under the following conditions will be minimum of 5 Years:-

- (i) Ambient Air Temperature $<50^{\circ}\text{C}$
- (ii) Relative Humidity 95%

2.7 Reliability

Equipment has to be capable of reliable and stable operation under all operating regimes. Minimum reliability of the motor and its components is to be 0.99 for the period of continuous fail free operation.

3 Timelines for the Project

The project is envisaged to be completed within 30 months from award of contract. With 'D' as the date of signing of contract, the following timelines are envisaged:-

- | | | |
|-----|---------------------------------------------------|-----------------|
| (a) | Finalisation of system Design and configuration - | D + 15 months |
| (b) | Prototype System development | - D + 26 months |
| (c) | Testing and Validation | - D + 36 months |

VENDOR INFORMATION PROFORMA

1. **Name of the Vendor/Company/Firm.** _____

(Company profile including Share Holding pattern, in brief, to be attached)

2. **Type (Tick the relevant category).**

Original Equipment Manufacturer (OEM)

Yes/No

Authorised Vendor of foreign Firm

Yes/No (attach details, if yes)

Others (give specific details)

3. **Contact Details.**

Postal Address:

City: _____ **State:** _____

Pin Code: _____ **Tele:** _____

Fax: _____ **URL/Web Site** _____

Email: _____

4. **Local Branch/Liaison Office/Agent (if any).**

Name & Address: _____

Pin code: _____ **Tel:** _____

Fax: _____ **Email:** _____

5. **Financial Details. Category of Industry (Large/Medium/Small Scale):**

6. **Certification by Quality Assurance Organisation.**

Name of Agency	Certification	Applicable from (Date &Year)	Valid till (Date & Year

7. **Details of Registration.**

Agency	Registration No.	Validity (Date)	Equipment
GeM			
DGQA/DGAQA/DGNAI			

OFB			
DRDO			
Any other Government Agency			

8. **Membership of FICCI/ASSOCHAM/CII or other Industrial Associations.**

Name of Organisation

Membership Number

9. **Equipment/Product Profile (to be submitted for each product separately)**

(a) Name of Product: _____

(IDDM Capability be indicated against the product)
(Should be given category wise for e.g. all products under night vision devices to be mentioned together)

(b) Description (attach technical literature):

(c) Whether OEM or Integrator:

(d) Name and address of Foreign collaborator (if any):

(e) Industrial Licence Number:

(f) Indigenous component of the product (in percentage):

(g) Status (in service/design & development stage):

(h) Production capacity per annum:

(i) Countries/agencies where equipment supplied earlier (give details of quantity supplied):

(j) Estimated price of the equipment

10. Alternatives for meeting the objectives of the equipment set forth in the RFI.

11. Any other relevant information: _____

12. **Declaration.** It is certified that the above information is true and any changes will be intimated at the earliest.

Note: Paragraph 44 and Appendix F to Chapter II may be referred.

(Authorised Signatory)

**QUESTIONNAIRE FOR INDIGENOUS DEVELOPMENT OF 5MW PROPULSION
MOTOR FOR SUBMARINES**

1. What are the comments on proposed Delivery Schedule of the equipment?
2. What is the capacity/ infrastructure of the firm to meet the delivery schedule?
3. What would be the approximate cost of the equipment and the financial capability of the firm to undertake the project?
4. What is the past experience of firm in similar projects?
5. Details to be submitted for generating/ refining/ rationalizing the QRs prior issuance of RFP (Appendix A).
6. Furnish details that go into determining the cost of the scheme, including factors such as Annual maintenance Contract (AMC), Life Cycle Cost, Maintenance Requirements, Product Support Package, Training, etc.
7. Furnish details of capability clearance certificate to indigenously design and develop the required equipment.
8. What are the applicable key technologies and materials required for manufacturing of the equipment/ system and the extent of their availability or accessibility in case they are not available in India?
9. What is the approximate cost estimation and suggestions for alternatives to meet the same objective as mentioned in RFI?
10. What are the capabilities of Indian firm to Indigenously Design, Develop and Manufacture (IDDM) the required equipment?
11. Availability of the equipment/system in the Indian market, level of indigenization, delivery capability, maintenance support, life time support etc.