

TENDER ENQUIRY

Appendix-I

(1/5)

TECHNICAL SPECIFICATION OF THE 8 KW PMS MOTOR

1.8 ELECTRICAL SPECIFICATION OF 8KW PMS MOTOR

Sl.	Parameters	Values
1.	Type of motor	Permanent magnet synchronous motor (PMS) motor
2.	Power source for the motor	Inverter drive
3.	Input dc voltage to the drive from the battery	120 - 200VDC
4.	Number of motor shafts	Single shaft
5.	Number of shaft ends	One (for drive end only)
6.	Rated power output	8 kW (minimum) at the output shaft at 150VDC bus to Inverter drive
7.	Rated output torque	219 Nm at 350 rpm
8.	Peak torque	255 Nm
9.	Duration of operation	Continuous operation
10.	Rated shaft speed of the motor	350 rpm when 150 VDC (min) is fed to the Power Electronic Drive and under full speed command
11.	Coupling to the load	Direct coupling
12.	Nature of load	Propeller
13.	No. Of operational / service cycles	15 minimum
14.	Starting of motor	The motor is to be started based on START command from OBC. Current must be kept within tolerable limit.
15.	Running of the motor	The motor has to be controlled by speed and torque loops in closed loop control
16.	Acceleration of the motor	Motor should accelerate to 8kW Shaft power from 0kW within a time span of 5 -6 seconds when fed with 150V DC to the Inverter Drive.
17.	Speed variation	Step-less
18.	Stability of set speed	+/- 5 RPM
19.	Rated motor efficiency	92 % (minimum)
20.	Number of phases	3 (minimum)
21.	Insulation resistance between any live point of the motor with respect to the motor body by a 500V Megger.	100 Meg. Ohm (minimum)
22.	Break down voltage for insulation	1.5 kV (minimum) for 30 sec (<10 ma)
23.	Insulation class	Class C (min)
24.	Configuration	Permanent Magnet rotor inside and wound stator outside
25.	Terminals	Fixed male terminals on the non-drive end of the motor with matching female sockets on the Inverter Drive side
26.	Demagnetization	Should not happen during over load or start up or during accelerating phases. Demagnetization should not happen in any specified operational circumstances.
27.	Stator winding connection	Star
28.	Magnets	High energy rare earth magnets embedded in the rotor for smooth surface.
29.	Direction of rotation	CW or CCW as required (when viewed from drive end)
30.	Winding impregnation	Vacuum Pressure impregnation as per standards
31.	Motor speed control	By voltage control using pulse width modulation and using torque & speed loops in closed loop mode.
32.	Motor cooling	Natural cooling



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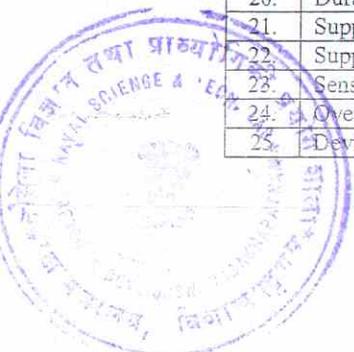
Appendix-I

2.0 MECHANICAL SPECIFICATION OF 8 KW PMS MOTOR

Sl.	Parameters	Values
1.	Motor mounting	By horizontal mounting lugs in the end shields
2.	Rotor mounting	Bearing supported
3.	Maximum length of the motor	As per guidance drg. HEAUV/EE/8K/GA/01
4.	Maximum diameter of the motor	As per guidance drg. HEAUV/EE/8K/GA/01
5.	Shaft end configuration	Involute spline (internal)
6.	Spline configuration	As per NSTL drg. HEAUV/EE/8K/GA/01
7.	Maximum weight of the motor	50kg (excluding the motor shell)
8.	Level of dynamic balancing for	G1.0 (for rotor)
9.	Location of the center of gravity of the motor	To be indicated by the firm
10.	Type of bearings	Double-shielded life lubricated bearings of ultra low-noise type (bearing service life to be indicated by the firm)
11.	Storage condition	To be specified by the firm
12.	Space for routing of signal cables	Provision for three 15mm diameter cables have to be provided along the motor outer periphery from NDE to DE of the motor
13.	Motor shell	As per Dwg. HEAUV/EE/8K/GA/01

3.0 ELECTRICAL SPECIFICATION OF THE INVERTER DRIVE

Sl.	Parameters	Values
1.	Control strategy	Close loop control with PWM technique (with torque & speed loops)
2.	Power source for the power electronic drive	Battery
3.	Rated input voltage to the power electronic drive	120 – 200 VDC
4.	Power electronic drive power output	As required to drive the above 8 kW motor
5.	Current that the battery is required to supply to the power electronic drive for getting motor output of 8 kW	To be specified by the firm. However, the current must not exceed 80A (max.) For 5 sec. At 150 VDC
6.	O/P voltage variation (low to high & high to low)	0 – 100 % & 100 % to 0 by PWM
7.	Nature of control	DSP based power electronic drive
8.	Nature of load	Above PMS motor
9.	Type of devices	Case insulated IGBTs
10.	Number of power electronic drive phases	Three
11.	Quadrant of operation	Forward motoring
12.	Auxiliary supply for the power electronic drive electronics	65VDC Nominal battery tapping with operating range of 50VDC to 110VDC
13.	Insulation resistance between any live point and shell body	100 mega ohm at RH : 85 %, Temperature 40 deg. C
14.	Electronics assembly	Modular type using SMDs or SOCs
15.	Speed commands from on-board computer	MIL1553B communication using std. DDC
16.	Running of motor	During or after the initial start-up phase, speed command may be issued to the power electronic drive over 1553B Bus. Once received, the corresponding speed value is to be maintained by the power electronic drive. A programmable option to implement a predefined running sequence post the initial start-up phase also has to be provided as part of an optional logic.
17.	Deceleration time of the motor	To be specified for by the firm. But reverse voltage generation into the DC bus is not acceptable.
18.	Condition for shutdown	Power electronic drive needs to shut down with alarm indication on 1553B Bus or internal fault.
19.	Power electronic drive efficiency at all load condition	94-96 %
20.	Duration of operation	Continuous operation
21.	Suppression of harmonics in input current	By using suitable filter capacitors
22.	Suppression of harmonics in input current	By using suitable filter capacitors
23.	Sensing of motor current, voltage	By non-contact hall-effect sensors
24.	Overload capacity	Not more than 110% of FL for 5 sec
25.	Device heat sinking	Shell integrated



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3.0 ELECTRICAL SPECIFICATION OF THE INVERTER DRIVE (CONTINUED...)

Sl.	Parameters	Values
26.	Allowable temperature rise of the device case	To be designed considering sea-water temperature as 27 ⁰ C
27.	Shielding against emission	To be provided for radiated and conducted noises.
28.	Class of insulation	Class- H
29.	Internal connection	To be provided with proper routing, securing and with identification numbers. Power connections are to be made with durable material with proper protective & long-lasting coating. Bi-metallic connections must be avoided.
30.	Insulation resistance between any live point and shell body	> 100 mega ohms with a 500 v megger under normal local climatic condition prevailing at the tropical coastal area of India
31.	Electronic assembly	Modular type using SMDs
32.	Switching frequency	To be chosen suitably not exceeding 16 kHz to achieve: -high overall efficiency -low switching loss
33.	Signal communication within the power electronic drive	By opto-coupled signals
34.	DC link capacitors	To be provided for filtering in the input.
35.	Self diagnostic test	Diagnostic mode option shall be provided for conducting diagnostics and NVRAM data download
36.	Recording for off-line analysis	Input voltage, input current, duty cycle in %age, speed of the motor, on-board computer command echo, alarm conditions, contactor status have to be sent on MIL1553B BUS for recording. The same data has to be recorded internally by the power electronic drive by its NVRAM. The data sampling rate has to be 100msec minimum.
37.	Watchdog timer	To be provided in the control logic
38.	Flash memory	To be provided for the DSP programming
39.	Test programme /simulator	To be supplied by the firm with VB based GUI interface. The information in connection with this has be provided
40.	Provision of a). 750VDC, 150 ADC latching contactor b). 20A, 100VDC non-latching relay	To be provided by the firm in the power electronic drive. Item (a) will be used for main DC bus battery braking and making and item (b) will be used for braking and making of electronics current
41.	Conditions against which the system should be tolerant and issue alarms in out of range conditions	1. Di/dt & short circuit by vce(sat) monitoring 2. Dv/dt by snubber 3. DC under voltage 4. DC over voltage 5. Over current 6. Over temperature of winding and IGBTs
42.	Type of commands from OBC A) power electronic drive 'START' by OBC B) power electronic drive 'STOP' by OBC C) Speed command by OBC	Actions of power electronic drive Power electronic drive will start the motor and controls its speed as per the speed command from OBC Power electronic drive remains ON but does not execute speed command Power electronic drive executes speed variation as per commands if (b) is not present
43.	Modes of power electronic drive operation A) power electronic drive in normal mode B) power electronic drive's internal fault	A) as explained at sl. 42 above B) shutdown and 'fault' intimation to OBC
	Connection to the external systems	By MIL grade circular connectors and BJ77 connectors.
44.	Shielding	Mu-metal shielding as required

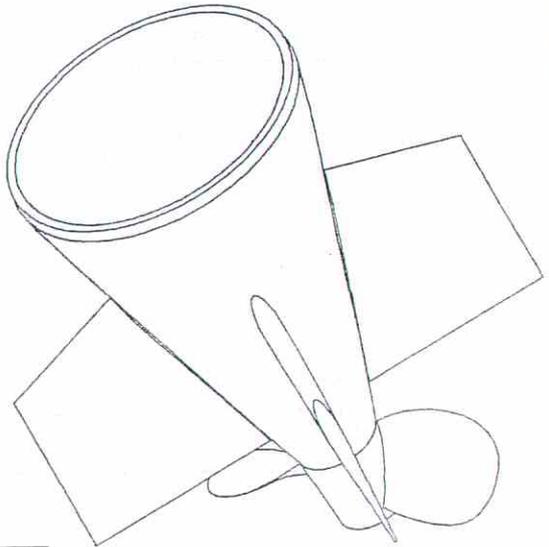
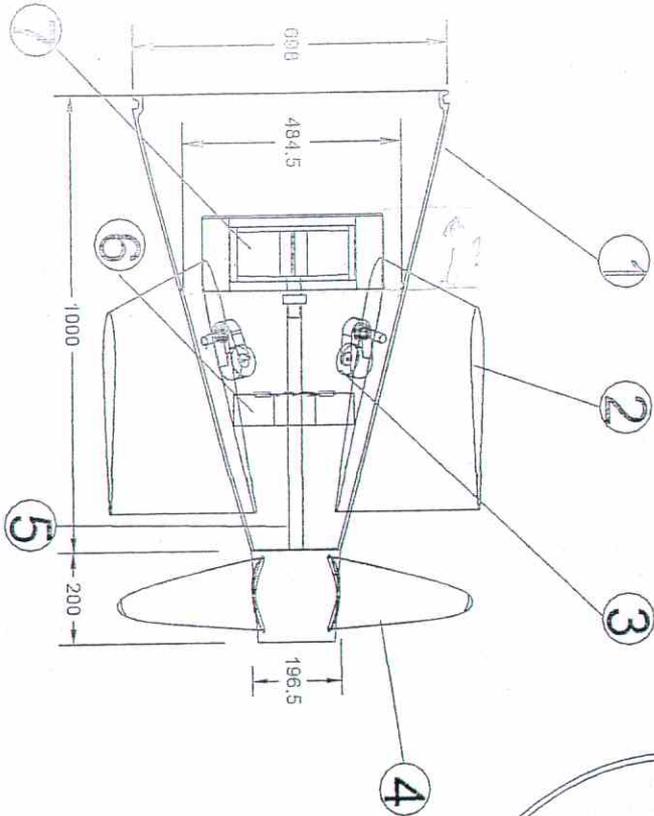


TENDER ENQUIRY

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DRG.No. HEAVY/EE/BK/GA/01

ALL DIMENSIONS ARE IN MM



Details	
1	Propulsion Comp. shell
2	All Movable Fins
3	Actuators
4	Propeller
5	Propulsion Shaft
6	Servo Controller
7	PMS Motor

PERTAINS TO:

R.No.	DATE	ZONE	BRIEF RECORD	INITIALS

P. No.	DRG.No.	DESCRIPTION	QTY	REMARKS

ALL SHARP EDGES AND CORNERS TO BE ROUGHED OFF
THREADS TO CONFORM TO IS:4218

DGN	DATE	NAME	MATERIAL:
14/10/2024	14/10/2024	Ambar K.	
14/10/2024	14/10/2024	Shilpa K.	

CHD: 14/10/2024 Shilpa K.
TRD:
COMP:

SCALE :- 1:10

DRG. NOT TO BE SCALED
APPD. DATE

DRG.No. HEAVY/EE/BK/GA/01

N S J L
VISAKHAPATHAKI



TENDER ENQUIRY

Appendix-IV

COMMERCIAL / TECHNO-COMMERCIAL TERMS

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1.0 LIST OF DELIVERABLES

1.1 The contractor will supply the following items to NSTL:

Sl. no.	Description of Item	Qty.
1.	8kW PMS Motor with Inverter Drive	07 nos.
2.	Manufacturing drawings	01 set.

1.2 Free issue of material, if any: Nil

2.0 DELIVERY SCHEDULE

Delivery schedule is planned tentatively as given below.

Sl.No.	Detailed of activities	Duration of each activities	Total duration
1	Supply order / contract	---	Start
2	Fabrication of Motor	4 Months	4 Months
3	Fabrication of Controller	4 Month	
4	Assembly of Motor and controller	1 Month	5 Months
5	Functional test, load test and acceptance as per ATP	1 Month	6 Months

07 systems shall be supplied in staggered manner and payment will be made on pro-rata.

Note:

- Firm should have prior proven experience of making MIL application grade similar kind of Motors
- Firm should be an Indian OEM and have prior proven experience of developing high power BLDC/PMS Motors of >200Nm torque minimum
- Firm should have a prior proven experience of developing high power vector control drives
- Firm should be able to deliver Motors in 6 Months
- The firm shall have in-house design know-how. Documentary evidence in support of such claim shall be attached with techno-commercial bid.
- Pre-bid meeting will be arranged at NSTL one week before due date for the submission of quotation
- ETs and ESS will be firm's scope
- Non-compliance to the any of above terms, firm's offers will not be considered.

3.0 Miscellaneous (Technical)

Sl. No.	Description	Details
1.	Test equipments and facilities	The firm shall furnish and maintain all necessary test equipments and facilities and shall provide personnel for performing necessary tests at firm's premises. The test equipments shall be of sufficient accuracy and calibrated by a reputed authority approved by the Government
2.	Compliance	Each of the specifications along with the parametric values as indicated in Appendix-I must be commented upon categorically in respect of acceptance / deviation. <u>Incomplete quotation will not be considered.</u> Compliance once confirmed becomes binding on part of the firm and no request for dilution / deviation of any of the specified parametric values will be entertained. Non-compliance in respect of any of the parametric values as indicated in appendix-I, II & III, if found existing in the first set of Electrical 8kW PMS Motor with Inverter Drive during conduct of FAT, and if the contract fails to rectify the same, NSTL will reserve the right to cancel the order.
3.	Supply of spares	The contractor has to support and supply necessary spare components after warranty period on payment as and when required by NSTL for maintenance of the motor and drive.
4.	FAT intimation	The contractor has to send intimation to NSTL regarding readiness for FAT at least one week in advance.
5.	Identification number	The contractor has to assign part no. / model no. for the Electrical 8kW PMS Motor with Inverter Drive and all the components used in them. A detailed bill of materials is to be furnished as part of the documentation. This is mandatory for future procurement.
6.	Application-	The contractor is required to supply all the application-specific tooling, dies etc.

