Date 27-Aug-11

EXPRESSION OF INTEREST FOR

DESIGN VETTING OF A 5MW HIGH TEMPERATURE SUPERCONDUCTING MOTOR

1. Introduction

M/s Bharat Heavy Electricals Limited (BHEL) is one of the leading Navratna Public Sector Undertakings of Government of India. The company has an annual turnover of US$ 7.8 billion having outstanding order book of US$ 33 billion. We have developed low temperature superconducting generators and HTSC transformer earlier and presently we are carrying out the development of a 200kW high temperature superconducting motor. In this expression of interest we seek to get the design vetting done for a 5MW HTSC motor.

2. Purpose

The purpose of this Expression of Interest is to seek engineering services for vetting of electrical and thermal design of a 5MW variable speed superconducting motor for the application in ship propulsion. The motor is to be operated with a power electronic converter at the rated capacity of 5 MW, 250 rpm, 4160 V at 12.5 Hz. The variable speed superconducting motor is proposed for development which will be equipped with high temperature superconducting winding in the rotor. The stator will be provided with three phase indirect water cooled winding with copper conductors. The rotor windings will be encased in a cryogenic environment with a vacuum jacket around the enclosure. A helium gas cooling will be provided for maintaining the rotor windings at a temperature of around 20 to 30 K at an approximate pressure of 2 kg/cm^2. The cold helium gas will be circulated through the cryogenic environment and recovered through a helium transfer coupling. The amount of heat leak and losses occurring in the cryogenic system will be removed by a helium cryo-refrigerator. A high vacuum of the order of 10^{-6} mili-bar will be created in the sealed vacuum space surrounding the cryogenic pole-coils. A set of field leads connecting the superconducting winding with the brushless exciter will be developed for optimum heat leak. Torque tubes will be developed for supporting the superconducting windings. A radiation shield will be provided to shield the low temperature region from the thermal radiation effect. The shaft system will be at room temperature and will be made of non-magnetic material. All parts which are at cryogenic temperature will be made of special stainless steel. Special welding process will be utilized for manufacture of the cryogenic

parts to avoid any cold-leaks. High quality helium leak tightness, of the order of 10^{-10} mili-bar-liter-per-second, will be maintained. A special type of brushless exciter will be developed to supply excitation current to the superconducting winding at low voltage.

3. Scope of work

The scope of work for the vetting agency shall be as follows:

a. Study of the specification for the following above mentioned systems:
   These specifications shall be provided during execution of the contract.
b. Checking the suitability of the electrical design of the 5MW HTSC motor for meeting the performance.
c. Checking the suitability of thermal design with respect to the specified conditions.
d. Checking the compatibility of motor with respect to the converter supply to be used.
e. Suggest modifications in the HTSC motor design with respect to all the above factors so that the final motor becomes electrically and thermally suitable for the above applications.
f. Preparing a detailed report covering the above details.

4. Association of BHEL engineers

The agency for design vetting should associate BHEL engineers during the vetting process and explain the reasons for suitability/unsuitability of the design under vetting as the case may be and then jointly work out the final design meeting the specification requirements. BHEL engineers may provide the support for explaining the in-house design details.

5. Composition of budgetary offer

The agency for design vetting should submit a proposal for above in two parts:
1) Technical proposal and
2) Commercial proposal separately indicating the overall price (including the breakup with respect to the scope of work) and time period required for each of the activities.
The total composition of offer shall include:

a) Price for the service including a breakup with respect to activities defined in Scope of Work (SOW).
b) Time schedule including breakup with respect to activities defined in SOW.
c) Date of start after receipt of order.
d) Terms and conditions of offer.
e) Credentials and/or previous experience of similar kind of motor design/vetting activities.

In case you require any further clarifications, please do contact us.

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