



भारत हेवी इलेक्ट्रिकल्स लिमिटेड

(भारत सरकार का उपक्रम)

A Maharatna Company

कॉर्पोरेट अनुसंधान एवं विकास प्रभाग, विकासनगर, हैदराबाद- 500 093. भारत

**Bharat Heavy Electricals Limited**

(A GOVT. OF INDIA UNDERTAKING)

Corporate Research & Development Division, Vikasnagar, Hyderabad- 500 093. INDIA

**MKVH Sarma**

**Additional General Manager**

*Materials Management/MM-C*

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RD/EOI441401

14-Jul-2014

**Expression of Interest – High Temperature Spin Test Rig (HTSTR) for large rotors**

BHEL Corporate R&D division invites expression of interest from original equipment manufacturers (OEM's) for “**Design, fabrication, assembly, preliminary acceptance, supply, installation and commissioning of a High Temperature Spin Test Rig (HTSTR) for large rotors.**”

Any changes shall be updated on our website [www.bhel.com](http://www.bhel.com). Under this heading. All vendors are requested to visit the site regularly.

This is for finalizing the technical specifications and short list of prospective vendors.

Vendors may please note that BHEL shall deal directly with foreign vendors, wherever required, for procurement of goods/ services. However, if any foreign principal desires to avail of the services of an Indian agent, then the foreign principal should ensure compliance to regulatory guidelines-which require mandatory submission of and Agency Agreement. The Agency agreement should specify the precise relationship between the foreign OEM/ foreign principal and their Indian agent and their mutual Interest in the business. All services to be rendered by the agent/ associate, whether of general nature or in relation to the particular contract, must be clearly stated by the foreign supplier/ Indian agent. Any payment, which the agent or associate receives in India or abroad from the OEM, whether as commission or as a general retainer fee should be brought on record in the agreement and be made explicit in order to ensure compliance to laws of the country. Any agency commission to be paid by BHEL to the Indian agent shall be in Indian currency only. Wherever Indian agents are representing on behalf of their principals, the relevant authorization letter and agency agreement copy to be enclosed along with technical

bid to consider the offer failing which BHEL shall deal with the principal for all correspondence and business purposes.

The vendor may note that the above specifications give a broad perspective and finer details will be shared as and when required. The vendor may contact the following person(s) for any technical clarifications:

1. Dr.K.Ramakrishna, Additional General Manager(EMV), Mobile: +91 9490118889
2. Sri Bishnu Pada Pal, Senior Engineer(EMV), Mobile:+91 9533099908

Manufacturers and suppliers of the above system may send their quotations along with catalogues, super-scribing the cover/ e-mail 'Expression of Interest- **High Temperature Spin Test Rig (HTSTR) for large rotors.**/ RD/EOI441401 dated 14-Jul-2014' to:

Additional General Manager(MM)  
Bharat Heavy Electricals Limited  
Corporate Research and Development  
Vikasnagar, Hyderabad 500093, India  
e-mail: eoffers@bhelrnd.co.in

**Last date for the submission of EOI along with techno commercial offers giving detailed price break-up for each system, sub systems and optional systems shall be 14<sup>th</sup> August 2014**

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**Bharat Heavy Electricals Limited**  
(A GOVT. OF INDIA UNDERTAKING)  
Corporate Research & Development Division, Vikasnagar, Hyderabad- 500 093. INDIA

**Expression of Interest (EOI) for**

**Design, fabrication, assembly, preliminary acceptance, supply, installation and commissioning of  
“High Temperature Spin Test Rig (HTSTR) for large rotors”**

**Preamble**

HTSTR is a test facility to be established for the experimental validation of design of large rotors (primarily steam turbine rotors) w.r.t. thermo mechanical conditions upto 800° C consisting of the following

- Creep failure at high temperatures
- Thermal Low Cycle Fatigue due to temperature gradients
- Steady state speed and Over speed
- High cycle fatigue
- Fracture Mechanics
- Torque simulations including transients

**1.0 Scope of Work**

Design, manufacture, supply of HTSTR and installation and commissioning at our Test Lab at above address.

**2.0 Important features**

Following are some of the important features to be incorporated in the test facility

- Highly robust rotor enclosure sufficient to withstand rotor bursts
- Hydraulic/Mechanical lid elevator system to allow for easy loading and unloading of test rotor
- On-line crack initiation monitoring system. (The system should have automatic halting facility with provision for manual override).
- Online crack growth monitoring system upto 800° C
- On-line radial and axial expansion measurement system for temperatures upto 800° C
- On-line rotor strain measurement system at elevated temperatures upto 800° C
- Online displacement measurement system at elevated temperatures upto 800° C
- Heating system capable of inducing radial temperature gradients/thermal shocks similar to actual start-up/shut down encountered in steam turbine upto 800° C
- Temperature condition is to simulate a steam turbine of 710° C steam conditions.
- The time to reach 800° C should be in line with a steam plant heating rate and should not be more than SIX hours for ambient start and one hour for hot start from 500° C
- Heating system should be capable of inducing isothermal conditions in the rotor
- Axial temperature gradients also ranging from 350° to 800° C along the length of the test rotor can be an optional feature
- Temperature tolerance is 800° ± 5° C
- Data acquisition system

### 3.0 System Requirements

Following are the requirements of the test facility

#### 3.1 Test chamber

The internal envelope of the test chamber should be sufficient to accommodate a rotor of the following size excluding the heating/cooling arrangement

Material of test piece: Alloy 617 and 9-10 Chrome steels

Maximum diameter : 1200mm

Maximum Length : 1200 mm

**Maximum** Weight considering the above dimensions to simultaneously exist on a test rotor

Supply of Test rig to support the above rotor Vertically or horizontally, meeting the following operating conditions

- Nominal speed of 3000rpm with feedback control
- Coast up from 600 RPM to 3000 RPM within five minutes (ambient start)
- Coast up from 0 to 3000 RPM within five minutes (hot start from any temperature above 500 °C)
- Maximum expected operating speed in test facility is 3750 rpm for ambient temperatures and 3600 RPM at the hot temperatures upto 800 °C and Test chamber should be able to contain rotor fragments in case of burst. The facility should also enable safe trip at 3300 RPM

#### 3.2 Auxiliaries

- loading and unloading system for the test rotor
- Lube oil system
- Water/air cooling systems as required by the main system
- Suitable Rotor heating device with feed back control to reach and retain temperatures of upto 800 °C across the length and diameter of the full rotor within a period of not more than six hours (ambient start) and one hour (hot start from 500° C). Simulation of thermal conditions as per the heat balance diagram
- The rotor should be able to sustain a temperature upto 800°C irrespective of operating speed
- Vacuum system that can create and maintain vacuum of minimum 1m bar absolute, to evacuate the enclosure within thirty minutes and prevent fire hazards.
- Sealing system at the interfaces between the rotating and stationary components

#### 3.3 Instrumentation and control system

- Instrumentation and control to monitor the parameters like speed, temperature at various points on the rotor (radial as well as axial), accumulated test time etc
- Data loggers
- Sixteen channel Strain measurement system on the surface of the rotor and at various radii from the centre with options for further upgradation of number of channels to 32

- Crack monitoring devices
- Centralized console
- Safety interlocks with redundancy
- Vibration monitoring system
- Emergency stop system to avoid any catastrophic failure
- Redundant system for data acquisition
- Periodic back up of Data storage

### **3.4 Miscellaneous**

- Tools, accessories
- Spares
- Erection and commissioning
- In-situ assistance and support during the test as per requirement
- Operating manuals
- One year warranty
- Minimum design life of 15000 hrs, for operating temperatures of 800° C for each test.
- The facility should be able to cater to minimum six successive tests as specified above.
- The design documents shall be furnished by the vendor to demonstrate that the design offered meets the specification.

### **4.0. Annual maintenance Charges (AMC)**

- AMC Charges, per year, Scope, Order Placement address.

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