

**Expression of Interest
For
Material samples and job prove-out/preform manufactured by
Electron Beam Additive Manufacturing (EBAM) method**

EoI document Ref. No: HW/STE/RPD/PIR/673/EoI/R00



**BHARAT HEAVY ELECTRICALS LIMITED,
HEAVY ELECTRICAL EQUIPMENT PLANT
HARIDWAR - 249403**

November, 2017

1) Introduction

- 1.1 Bharat Heavy Electricals Limited (BHEL), a Government of India undertaking, is the largest Engineering and Manufacturing organization in India and is one of the leading international companies for providing total business solutions in the field of Power Generation & Transmission, Defense, Transportation, Oil & Gas, Telecommunication etc. The company has 17 Manufacturing Units, two Repair Units, four Regional Offices, eight Service Centers, eight Overseas Offices, six Joint Ventures, fifteen Regional Marketing Centers and current project execution at more than 150 project sites across India and abroad. BHEL's highly skilled and committed manpower of approximately 38743 employees, the best of manufacturing facilities and practices together with the latest technologies, has helped BHEL to deliver a consistent track record of performance. With the current order book exceeding 100000 crore, BHEL is poised for excellent future growth. Entire range of BHEL's products and operations can be obtained by visiting our web site www.bhel.com
- 1.2 In the field of Power Generation, the organization is involved in Design, Manufacturing, Erection and Commissioning of Power Plant Equipment with state of the art production facilities. BHEL has more than 50 years of experience in this field and capacity ranging up to 800 MW.
- 1.3 Additive Manufacturing (AM) is an upcoming technological revolution by virtue of which cost of raw materials, toolings, lead time to product establishment and prototype manufacturing can be reduced considerably. At present there are two-technologies, which are mainly prevalent for Metal 3D printing, namely, (1) Powder Bed Fusion (PBF) popularly known as Direct Material Laser Sintering (DMLS), & (2) Directed Energy Deposition (DED).
- 1.4 Electron Beam Additive Manufacturing (EBAM), is a kind of DED type 3D printing. EBAM has capability to manufacture larger size parts vis-à-vis limitation of PBF which is suitable for small size components only. EBAM is being used by reputed global companies like GE, Lockheed martin, Siemens etc. for aerospace as well as other high performance applications.
- 1.5 By evaluating physical attributes and performance/functional parameters through proving of jobs and testing of representative samples of exotic material grades in this case will give BHEL a fillip in this direction. Moreover, as a strategic necessity there is need to develop indigenous/in-house manufacturing technology for complex designs and for components made of exotic alloys. AM and machining of Cassini Dome will open a product range for BHEL.

2) Present Expression of Interest

Additive Manufacturing (AM) is an upcoming technological revolution by virtue of which cost of raw materials, tooling, lead time to product establishment and prototype manufacturing can be reduced considerably. At present there are two-technologies, which are mainly prevalent for Metal 3D printing, namely, (1) Powder Bed Fusion (PBF) popularly known as Direct Material Laser Sintering (DMLS), & (2) Directed Energy Deposition (DED). Electron Beam Additive Manufacturing (EBAM), is a kind of DED type 3D printing. EBAM has capability to manufacture larger size parts vis-à-vis limitation of PBF which is suitable for small size components only. EBAM is being used by reputed global companies like GE, Lockheed martin, Siemens etc. for aerospace as well as other high performance applications.

We are searching technological partner, to undertake joint development to establish feasibility of new manufacturing technology, namely, Electron Beam Additive Manufacturing (EBAM) methods with the purpose to bridge technology gap for exotic alloy components supplied and newly developed by BHEL.

Three proposed job samples will be taken up for manufacture by EBAM methods as it is the process found to be most suitable form of Additive manufacture for our kind of manufacture, and also there are references of its application in the aerospace/space industry for all kinds of exotic material alloys.

3) Indicative Scope of work for Prospective Supplier

Supplier is to require to submit the following machining samples after manufacture it from their in house designed EBAM processes, for testing at BHEL. Supplier must be able to supply the equipment and transfer the technology of EBAM, after these samples are proved in BHEL.

S. No	Description	Quantity
1	<u>EBAM sample coupons of</u>	
	SET-1: Dissimilar metal material grades 'Gr91' (GX12CrMoWVNbN10-1-1/G911/ P91) and 'Alloy625' size: 1554mm x121mm x140mm	3
	SET-2: Material grade 'X22' (X22CrMoV12-1) size: 856mm x125mm x235mm	3

4) Selection of Prospective Vendor

Since it is a kind of joint development project; so during the evaluation of vendor's offer it will be a necessary fact that vendor must be willing to share technological information to BHEL. The selection of supplier will be based on the following facts...

- Technological edge and dominance in EBAM methods
- Experience in similar application ranges
- Potential L1 price bidder with the above mentioned capability will be selected for joint technological development.

5) Brief Description of EoI Process

The interested prospective company/organization shall ensure that its response; in the form of a signed letter; comprising the application as per format enclosed at Annexure-A and details requested as per the Annexures-B of this EoI; along with information and data required as per attachments and supporting documents thereof, should be received by BHEL within four weeks of publication of this EoI. Alternatively, a signed copy of the EoI may be sent by e-mail as advance copy, to be followed by original signed copy which should reach BHEL within 7 days of e-mail communication.

The response shall necessarily be accompanied with details on company/organization's background, experience in EBAM for different alloys. The responding prospective company/organizations on submission of their response can be contacted/invited for further discussions.

The response may be sent at the following address:

Mr. Akash Shukla,
Dy. Manager,
Steam Turbine Engineering,
Heavy Electrical Equipment Plant
Bharat Heavy Electricals Limited,
Ranipur, Haridwar
Uttarakhand, India
Phone: +91-1334-281946; FAX: +91-1334-226770
Email: akashs@bhelhwr.co.in

Any request for further information or clarification on the EoI document may be sent by mail to the address mentioned above. BHEL may respond to the queries raised/clarifications sought to the best of its ability. BHEL at its discretion may extend the due date for submission of EoI and the decision of BHEL in this respect would be final and binding on the respondents.

EoI submittals should be in English. Duly authorized representative shall sign on each page of the documents. EoI should be prepared in such a way so as to provide a straight forward, concise

description of applicant's capabilities.

If at any time during the evaluation of EoI, BHEL requires any clarification on the documents submitted by the prospective parties, it reserves the right to request a clarification so as to complete the evaluation.

6) Miscellaneous

6.1 Right to accept or reject any or all Applications

Notwithstanding anything contained in this EoI, BHEL reserves the right to accept or reject any application and to annul the EoI process and reject all applications, at any time without any liability or any obligation for such acceptance, rejection or annulment, and without assigning any reasons therefore. In the event that BHEL rejects or annuls all the applications, it may, at its discretion, invite all eligible OEMs/suppliers to submit fresh applications.

BHEL reserves the right to disqualify any applicant during or after completion of EoI process, if it is found there was a material misrepresentation by any such applicant or the applicant fails to provide, within the specified time, supplemental information sought by BHEL.

BHEL reserves the right to verify all statements, information and documents submitted by the applicant in response to the EoI. Any such verification or lack of such verification by BHEL shall not relieve the applicant of his obligations or liabilities hereunder nor will it affect any rights of BHEL.

6.2 Governing Laws & Jurisdiction

The EoI process shall be governed by, and construed in accordance with, the laws of India and the Courts at Haridwar (India) shall have exclusive jurisdiction over all disputes arising under, pursuant to and/or in connection with the EoI process.

Annexure-A

Expression of Interest Letter

(To be submitted on the letter head of the party submitting the EOI)

To,
Mr. Akash Shukla,
Dy. Manager,
Steam Turbine Engineering,
Heavy Electrical Equipment Plant
Bharat Heavy Electricals Limited,
Ranipur, Haridwar
Uttarakhand, India
Phone: +91-1334-281946; FAX: +91-1334-226770
Email: akashs@bhelhwr.co.in

Subject: EOI for Supply of Material for different components manufactured by additive manufacturing process (like as EBAM)

With reference to your EOI document Ref. No *HW/STE/RPD/PIR/673/EOI/R00* dated _____, we have examined the EOI document and understood its contents and hereby submit our application for pre-qualification for the aforesaid project.

1. We acknowledge that BHEL will be relying on the information provided in the Application and the documents accompanying such application for the aforesaid scope of work, and we certify that all information provided in the application and Annexure-A are true and correct; nothing has been omitted which renders such information misleading; and all documents accompanying such application are true copies of their respective originals.
2. We confirm to make available to BHEL, within the stipulated time, any additional information it may find necessary.
3. We agree and undertake to abide by all the terms and conditions of the EOI document.

In witness thereof, I / we submit this application under and in accordance with the terms of the EOI document.

Yours faithfully,
(Signature, name and designation of the Authorized Signatory
Name and seal of the Applicant)

Expression of Interest (EoI) for Material samples and job prove-out/preform manufactured by Electron Beam Additive Manufacturing (EBAM) method

Annexure-B

Information required to be furnished along with EoI

Sr. No.	DESCRIPTION OF REQUIREMENT	Relevant Document Attached (Yes/No)
1	Techno-commercial offer	
2	Experience in number of years on EBAM technology	
3	List of customers/application where EBAM technology supplied unpriced PO copy should be provided in support	
5	Experience in EBAM for high temperature application alloys (such as Inconel)	
6	Details of the patents obtained in EBAM technology	
7	D&B report	

(SIGNATURE)

Disclaimer

The information contained in this Expression of Interest document (the “EoI”) or subsequently provided to Applicant(s), whether verbally or in documentary or any other form, by or on behalf of BHEL or any of its employees or advisors, is provided to Applicant(s) on the terms and conditions set out in this EoI and such other terms and conditions subject to which such information is provided.

This EoI is not an agreement and is neither an offer nor invitation by BHEL to the prospective Applicants or any other person. The purpose of this EoI is to provide interested parties with information that may be useful to them in the formulation of their application for qualification pursuant to this EoI.

BHEL also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Applicant upon the statements contained in this EoI.

The issue of this EoI does not imply that BHEL is bound to select and shortlist Applicants for next stage of the Project.