

**INVITATION for**  
**EXPRESSION OF INTEREST (EOI)**

***SUPPLY, INSTALLATION, COMMISSIONING, AND TRAINING IN OPERATION OF  
UTM WITH FURNACE FOR HIGH TEMPERATURE TESTING OF CONCRETE AND  
STEEL STRUCTURAL MEMBERS  
(SOLUTION ON TURNKEY BASIS)***

**Reference No. IIT/SATHI/ENQ/2020-21/UTMFURNACE-01 14-07-2020**

Submission of EOI proposal : 14-08-2020 at 3:00 pm

Opening of EOI Proposal : 14-08-2020 at 4:15 pm

Presentation : To be intimated to the suppliers by e-mail



**INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR**

**Reference No. IIT/SATHI/ENQ/2020-21/UTMFURNACE-01 14-07-2020**

***Sub: Expression of Interest (EOI) for Supply, Installation, Commissioning, and training in operation of UTM with furnace for high temperature testing of concrete and steel structural components (Solution On Turnkey Basis).***

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Sealed Expression of Interest (EOI) are invited by Indian Institute of Technology Kharagpur from firms with proven track record and having capabilities in Supply, Installation, Commissioning, and training in operation of UTM with furnace for high temperature testing of concrete and steel structural components as a turnkey project at IIT Kharagpur, West Bengal.

The EOI document can be downloaded from Institute website by going through this link (<http://www1.iitkgp.ac.in/topfiles/tenders.php>) under the head of SATHI, and the same is also available on CPP Portal (<https://eprocure.gov.in>). **The estimated cost of the whole project is Rs. 10 crores (Rupees Ten crores).** Any corrigendum and addendum for the same shall only be published on the Institute Website and CPP Portal.

Interested parties are requested to send their sealed EOI as per Annexures under a sealed envelope superscribed with “**Expression of Interest (EOI) for Supply, Installation, Commissioning, and training in operation of UTM with furnace for high temperature testing of concrete and steel structural components**” by post or handed over to the Office of SATHI, IIT Kharagpur on or before 14-08-2020 by 3:00 pm.

The EOI Proposal will be opened on the same day, i.e. 14-08-2020 at 4:15 p.m. in the Conference Room, Civil Engineering Department, I.I.T. Kharagpur, India in the presence of authorized representative of the interested parties.

The EOI Proposal shall remain valid for evaluation for a period of 90 days from the date of opening of the EOI proposal.

The Institute will examine the credentials of the interested parties, based on the submitted documents as per the eligibility criteria.

After evaluation of eligibility criteria, as part of short listing exercise, vendors will be required to make a focused presentation on the required solution as given in the Annexures for not exceeding 15 minutes to the Technical Committee of IIT Kharagpur.

Based on the proposed acceptable solution Request For Proposal (RFP)/Tenders may be issued, based on which the vendors are supposed to submit their two part (Part A: Technical and Part B: Commercial) offers as per institute rules.

The Institute reserves the right to issue (RFP)/Tenders to vendor if deemed eligible and qualified based on the evaluation of the EOI submitted by the bidders, vendor presentations, etc. The decision of the Institute in this regard shall be final.

The competent authority of Indian Institute of Technology Kharagpur reserves the right to reject any or all the offers without assigning any reason. The Institute also reserves the right to amend the scope of the work at any point of time. Any attempt on the part of any firms to influence, negotiate directly or indirectly with the Institute will lead to exclusion from consideration.

**Please note: This is not a Request for Proposal (RFP), and commercials are not to be submitted with EOI.**

**Chairman, SATHI  
Attn: Prof. Arghya Deb  
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Email: -arghya@civil.iitkgp.ac.in (copy to sathi@iitkgp.ac.in)**

## 1. INTRODUCTION

The “Supply of UTM with furnace” will involve the following:

- *Supply of actuator of capacity 1000 kN with appropriate cooling arrangement*
- *Supply of furnace with maximum operating temperature of 1200°C*
- *Supply of loading frame for testing compression and bending specimens*
- *Provision of systems and fixtures for placing specimens in the test bed and removing them following testing*
- *Provision of strong floor for reacting out the loads*
- *Provision of safe arrangement for removal of exhaust from furnace*

## 2. **BIDDERS SHOULD MEET THE FOLLOWING MINIMUM ELIGIBILITY CRITERIA FOR CONSIDERATION OF THEIR PRESENTATION ON THEIR PROPOSED SOLUTION, BEFORE THE TECHNICAL COMMITTEE:**

Documents to be enclosed along with the application in a sealed envelope:

- (a) Bidder should have a minimum of 3 (three) years of experience in supplying and commissioning of **high temperature UTM** in an government / reputed private organizations (at State/National/ International levels) as on EOI submission deadline. Name, address/contact details of the present and past clients are to be provided.
- (b) Bidder should submit copies of audited Statement of Accounts for the last three years i.e. of 2017-18, 2018-19 and 2019-20, ending 31<sup>st</sup> March 2020.
- (c) Bidder should submit copies of PAN Card, GST/VAT Registration, Service Tax registration certificates.
- (d) Bidder should submit an undertaking in their letter head mentioning that they have not been debarred / blacklisted by any organization / institution.
- (e) For acceptance of the terms and conditions, bidder should submit a signed copy (along with company seal) of this EOI (all pages).

## 3. SCOPE OF WORK

**SUPPLY, INSTALLATION, COMMISSIONING, AND TRAINING IN OPERATION OF UTM WITH FURNACE FOR HIGH TEMPERATURE TESTING OF CONCRETE AND STEEL STRUCTURAL MEMBERS (SOLUTION ON TURNKEY BASIS):**

*The “Supply of UTM with furnace” will involve the following:*

- *Supply of actuator of capacity 1000 kN with appropriate cooling arrangement*
- *Supply of furnace with maximum operating temperature of 1200°C*
- *Supply of loading frame for testing compression and bending specimens*
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*Below mentioned are some of the specific features of this facility:*

**A. Actuator**

- *The actuator should be of capacity 1000 kN.*
- *The maximum rate of loading will be 1 mm/min*
- *The minimum rate of loading will be 0.01 mm/min*
- *The actuator will be used for compression and bend tests of reinforced concrete column and beam specimens.*
- *The actuator may also be used for compression and bend tests of structural steel column and beam specimens.*
- *The actuator as well as testing accessories (platens for compression testing etc.) should be made from heat resistant steels or from nickel based superalloys in order to retain full functionality for furnace temperatures up to 1200 °C.*
- *The actuator should be equipped with an appropriate cooling system to prevent temperatures in the actuator parts from exceeding their allowable temperatures*
- *The push rods should be made from heat resistant steels or nickel based superalloys. High temperature push rods should be sufficiently long to accommodate the furnace during high temperature tests and should be suitable for connection to high temperature testing accessories.*

***Specimen Details of Compression Specimens:***

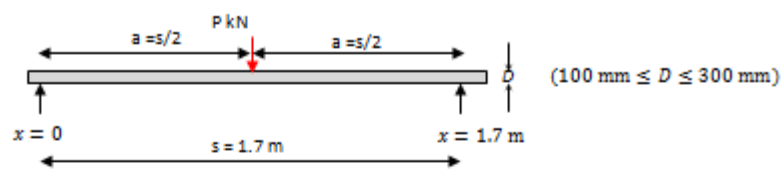
- *The compression (column) specimens are expected to have the following dimensions:  
Length: 3.3 m  
Maximum Cross-sectional Dimension: 300 mm  
Minimum Cross-sectional Dimension: 100 mm*
- *The maximum length of the column exposed to the fire would not exceed 2.2 m*
- *The maximum axial applied to bend specimens is 1000 kN*
- *The reinforced concrete compression specimens are expected to fail in compression rather than buckling. The slenderness ratio of the reinforced concrete specimens will be kept close to or below 12.*
- *The steel compression specimens may fail due to buckling.*
- *The maximum out of plane deflections of the specimens following compressive loading at high temperatures should not exceed 20 mm.*

***Specimen Details of Bend Specimens:***

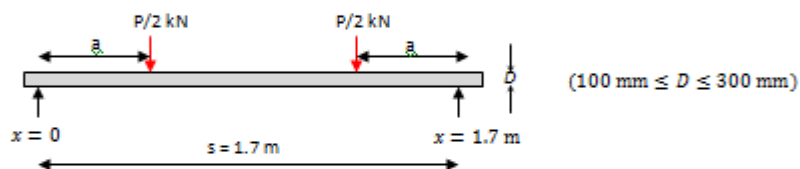
- *The bend specimens are expected to have the following dimensions:  
Length: 2 m  
Span (Unsupported length): 1.7 m  
Maximum Cross-sectional Dimension: 300 mm  
Minimum Cross-sectional Dimension: 100 mm*

- The maximum length of beam specimen exposed to fire should not exceed 1.5 m
- The bend specimen can be loaded in 3 point as per ASTM C78 as well as 4 point bending as per ASTM C78
- In case of 4 point bending the location of the loading points can be variable as specified in **Fig. 1**
- The maximum transverse applied to bend specimens is 150 kN
- The maximum transverse deflection of the specimen following transverse loading at high temperatures should not exceed 150 mm.

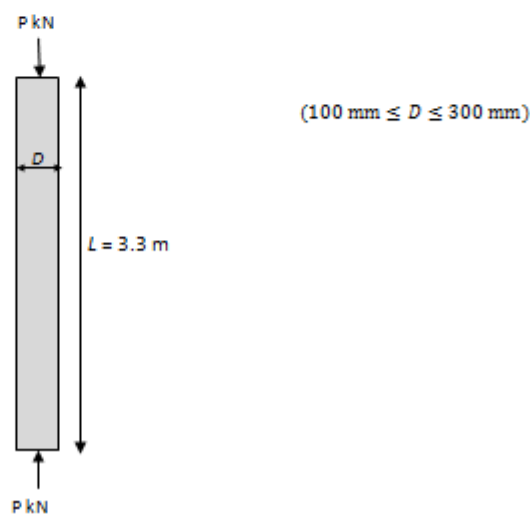
Beam 3 point bending:



Beam 4 point bending: (.25s ≤ a ≤ .45s)



Column:



**Fig. 1: Specimen dimensions**

**B. Fixtures for test specimens**

- For the compression specimen, anchor mounts will be provided on the floor to mount the bottom fixture
- The bottom of the compression specimen will be fixed constraint.
- The top of the compression specimen can have a fixed or pinned constraint depending on the nature of the test.

- *The bend specimens should have the option axially restrained or simply supported end conditions.*
- *The axial restraint stiffness of the loading frame and the axial restraint system should be of the order of 10-15 kN/mm.*
- *To minimize damage to the loading frame, the stiffness of the axial restraint system should be able to adjust automatically to zero using a relief valve when the axial restraint force exceeds about 120 kN.*
- *The axial restraint system should not provide any rotational restraints at the beam ends and thus the beam should be free to rotate at the supports.*
- *The loading can be 3 point or 4 point bending.*
- *For 4 point bending, the distance between the load points should be adjustable, as described in **Fig. 1***

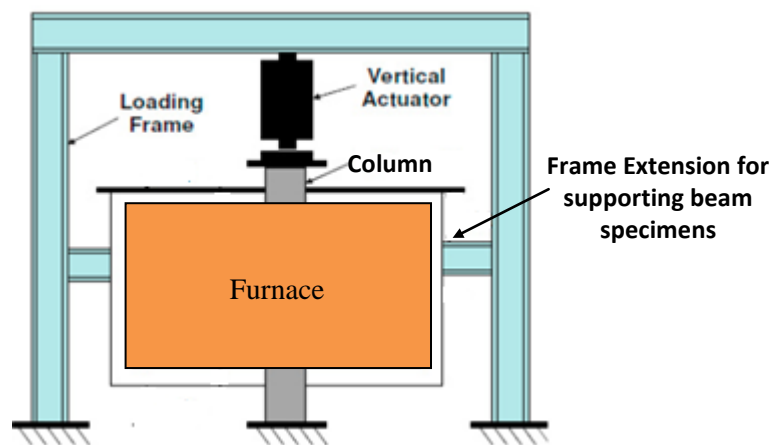
### **C. Furnace**

- *The furnace proposed will have a box-type structure (**Fig. 2**)*
- *Its internal dimensions should be able to accommodate the portion of the the compression and bend specimens that need to be heated as described in A above.*
- *It will be mounted on legs so as to stand independently on the ground.*
- *The hydraulic press structure for load testing the structural specimens will be constructed around the furnace.*
- *The furnace will have a lining of resilient insulation refractory materials.*
- *The floor will be constructed in high strength insulation bricks.*
- *Max Furnace Temperature : 1200 °C*
- *Rate of temperature rise : approx 1100 °C within 5 min*
- *It will have burners/electric induction heaters mounted in a manner to ensure temperature uniformity inside the chamber.*
- *Maximum allowable non-uniformity in temperature inside the chamber:  $\pm 20$  °C*
- *The furnace will be provided with removable openings (slats) of adequate dimension to ensure smooth insertion and removal of the specimens from the furnace.*
- *Two observation ports will be provided to view the specimen being tested.*
- *The average temperature of the chamber should follow specific pre-programmed Temperature-Time curve.*
- *Accuracy of average temperature of the chamber:  $\pm 10$  °C*
- *The furnace **can be a hydrocarbon furnace or an electrical induction furnace.***
- *Each burner/electrical induction heater will have a corresponding Cr/Al thermocouple associated with it for temperature sensing. The thermocouples will be connected to individual temperature displays and also to a solid-state multi-input Temperature Recorder.*
- *The heat generated by the burners/electrical induction heaters can be controlled automatically within a range through a PID controller*
- *If the furnace is a hydrocarbon furnace, there should be a cooling arrangement by ambient air burner blowers with exhaust to atmosphere through duct, and 2 exhaust ports should be provided at the top of the furnace.*
- *If the furnace is a hydrocarbon furnace, the burners will be fully automatic LPG-fired burners.*

#### **Specimen loading and placement:**

- *The furnace chamber will have a total of 4 ports - two at the top and bottom and two at the long ends of the furnace.*

- *These openings will be provided with removable plugs. Two types of plugs will be provided. One type will close the opening altogether. The second type will have a window in it of the specific size of the specimen to be tested.*
- *For column testing, the wall ports will be plugged fully. The top and bottom ports will be fitted with plugs with the required size of openings.*
- *For beam testing, the top and bottom ports will be plugged fully. The walls are fitted with plugs with the required size of openings.*
- *The specimen (column or beam) to be tested will have to be inserted into the furnace by using a loading device (for example, a roller arrangement for the beam and a crane arrangement for the column). To achieve this, the top centre and one side centre of the furnace will need to be made obstruction-free.*



**Fig. 2. 2D Furnace with column specimen loaded**

***Instrumentation & control panel:***

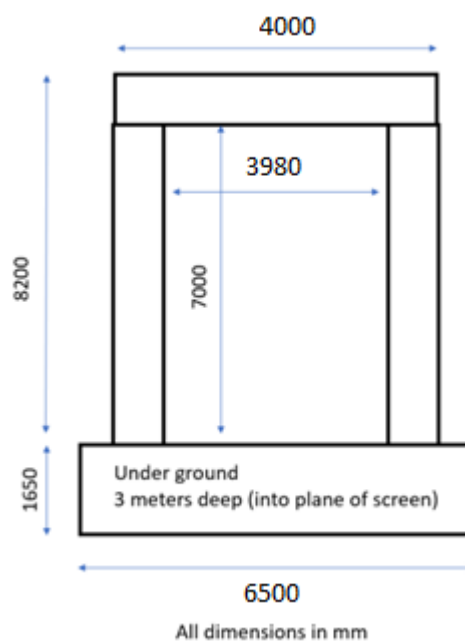
- *The furnace will be provided with a separate control panel. The panel will house an industrial PC which can be programmed for different Temperature-Time curves.*
- *PID controllers inside the panel will control the sets of burners/electric induction heaters to follow the heating and cooling parts of the selected curve and also maintain the desired temperature uniformity inside the chamber.*
- *The target curve and the temperature cycle in progress will be displayed on the screen simultaneously. There will also be display and recording of the data of all the temperature sensors including those mounted inside the specimen being tested through a SCADA system*
- *The instrumentation will control the burners/electric induction heaters in order to control rate of temperature change, temperature set point and data logging of all parameters in tabulated format and graphic as well as excel format of 60 temperature monitoring locations of the specimen.*
- *Dust proof power and control panel with all switchgear and PLC hardware will be provided with fire retardant cables with proper layout and ferule markings, crimped terminals etc. with blower Variable Frequency Drives.*
- *Desk type panel will be provided with industrial reputed branded PC with colour printer.*
- *Interconnecting cabling will be provided between control panel and furnace.*



- If the furnace is a hydrocarbon furnace, the flow of exhaust through the ducts should be monitored via a sensor activated mechanism to ensure safe operation and accumulation of carbon monoxide inside furnace.

#### **D. Loading Frame & Strong Floor**

- Four column loading frame
- Should be designed to accommodate specimens (as described in A above) for testing as well as furnace
- Design of crane/hoist for positioning/placing/lifting of the specimen inside the furnace should be provided and should be consistent with the furnace and frame specifications.
- The strong floor must be adequate to react out the maximum loading of 1000 kN
- Approximate dimensions of the frame and floor are provided in a 2D sketch included in **Fig. 3**. The out of plane width/spacing will be the same as the in-plane values.



**Fig. 3. 2D view of frame**

#### **E. Fencing of the facility and safety features**

- The supplier must provide fencing to the entire facility from all four sides.
- The supplier must also include and install safety devices for safe operation of the facility

#### **F. Unloading, installation, commissioning and training**

- It is the responsibility of the supplier to take care of unloading of the items on-site at IIT Kharagpur.
- IIT Kharagpur will provide the dedicated space for installation of the facility, the dimensions of which will be mentioned by the supplier.
- The supplier must install and integrate the entire unit. On successful commissioning, the supplier must provide training to scholars of IIT Kharagpur at IIT Kharagpur on operating the system.

#### **4. WARRANTY**

The entire facility must have a comprehensive warranty (parts, labour and visit by the service engineers) for a minimum period of 2 years (24 months) for all components after commissioning for defect-free operation and specified accuracies at IIT Kharagpur.

Any defect observed during the warranty period shall be replaced/repared free of cost with minimum down time.

#### **Correspondence and EOI submission address:**

For any query pertaining to this document, correspondence may be made to:

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