



# Bharat Heavy Electricals Limited, Jhansi

Material Test Laboratory (MT Lab)

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022



## TENDER DOCUMENT

For Tender Enquiry No.: MTL/TW/22/01/001, Dtd. 21.10.2022

For

**“Calibration of Reference Multi-Function Calibrator (MFC, 5500A, Fluke Make)  
Of MTL, BHEL- Jhansi”**

Tender Due Date: 01.11.2022, at 13:15 Hrs  
Tender Opening Date: 01.11.2022, at 14:00 Hrs

|            |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| Rev .....  | Short details of revision (In case of revision in tender document, otherwise NA) |
| Date: .... |                                                                                  |

**MATERIAL TEST LABORATORY  
BHEL, PO: BHEL, Jhansi 284120 (UP)**



# Bharat Heavy Electricals Limited, Jhansi

## Material Test Laboratory (MT Lab)

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

### DETAILS OF TENDER DOCUMENT

Nature of work: **Calibration of Reference Multi-Function Calibrator (MFC, 5500A, Fluke Make) of MTL, BHEL-Jhansi**

1. BHEL – JHANSI is in the process of finalizing the Works Contract **for Calibration of Reference Multi-Function Calibrator (MFC, 5500A, Fluke Make) of MTL, BHEL-Jhansi (Work Contract)**. The tender document has been detailed as follows:
  - a) Notice Inviting Tender (Annexure A)
  - b) Work Specifications, Scope of work & payment (Annexure B)
  - c) Qualifying Requirement (Annexure C)
  - d) Documents required (Annexure D)
  - e) Technical Bid Application (Annexure E)
  - f) Blank Price Bid format (Annexure F (a))
  - g) Price Bid format (Annexure F (b))
  - h) General Terms and Conditions (JHS 2055C R01)
  - i) Document referred in GTC (Annexure I- VIII)

The duly filled in Technical and Price / Rate bids (Annexure E and F (a & b) along with the instructions to the tenders, Contractor's Obligations, General Terms and Conditions with the signature of the tender on all the pages and complete in all respects super scribed as **"Quotation for Tender No. MTL/TW/21/01/001 Dated 21.10.2022"** should reach us in a sealed cover on or before 01.11.2022 (**13:15 hours**) through Registered / Speed post or the same may be dropped in the tender box available at the following address: (**refer GTC ii(c)**).

To  
Tender Box  
Security Control Room/Office  
Administrative Building  
Bharat Heavy Electricals Limited  
Jhansi-284120. UP

- Note: 1) Dropping of tender in the Tender Box within schedule time and date is the responsibility of the bidder.  
2) Technical bid and price bid should be submitted in separate sealed envelopes, in case the bids founds in one single envelope then the "bids" are liable to be rejected.  
3) Tender may be sent via e-mail to [tenderbox.jhs@bhel.in](mailto:tenderbox.jhs@bhel.in)



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Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

### Tender Documents

#### CONTENTS

| SN  | Description                                           | Annexure No.  | Page No. | No. of Pages |
|-----|-------------------------------------------------------|---------------|----------|--------------|
| 01. | Notice Inviting Tender                                | A             | 4-5      | 2            |
| 02. | Work Specification, Scope of work and Payment         | B             | 6-16     | 11           |
| 03  | Qualifying Requirements                               | C             | 17       | 1            |
| 04  | Documents Required                                    | D             | 18       | 1            |
| 05  | Performa for submitting Technical Bid                 | E             | 19       | 1            |
| 06  | Blank price bid                                       | F(a)          | 20       | 1            |
| 07  | Price bid                                             | F(b)          | 21       | 1            |
| 08  | General Terms & conditions of enquiry (JHS 2055C R02) | Copy Enclosed | 22-35    | 14           |
| 09  | Annexure (I,II,III & IV) Forms                        | I,II,III & IV | 36-39    | 4            |
| 10  | Self-declaration on company's letter head             | V             | 40       | 1            |
| 11  | Contract Agreement                                    | VI            | 41-43    | 3            |
| 12  | Indemnity bond                                        | VII           | 44       | 1            |
| 13  | Checklist of documents                                | VIII          | 45       | 1            |
|     | TOTAL                                                 |               |          | 42           |



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### ANNEXURE A

#### NOTICE FOR INVITING TENDER

| S. No. | Particulars                                                                                                                                                                                                                                                                                                                                                             | Details                                                                                                                                                   |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Brief Description of work                                                                                                                                                                                                                                                                                                                                               | <b>Calibration of Reference Laboratory Standards used for calibration of dimensional instruments in Metrology lab of MTL, BHEL-Jhansi (Work Contract)</b> |
| 2      | Tender Evaluation Criteria                                                                                                                                                                                                                                                                                                                                              | As per GTC point (iv)                                                                                                                                     |
| 3      | Last date of receipt of the Tender                                                                                                                                                                                                                                                                                                                                      | As per Page no. 1 of Tender Document                                                                                                                      |
| 4      | Date of opening of Techno – Commercial Bid.                                                                                                                                                                                                                                                                                                                             | As per Page no. 1 of Tender Document                                                                                                                      |
| 5      | Address for submitting the Tender                                                                                                                                                                                                                                                                                                                                       | As per GTC point ii(c)                                                                                                                                    |
| 6      | Earnest Money Deposit * (EMD)                                                                                                                                                                                                                                                                                                                                           | <b>Rs. 1520/-</b> ( Not applicable on State/Central Govt./PSU Deptt.)<br>(Rupees One Thousands Five Hundreds Twenty)                                      |
| 6(a)   | The EMD may be accepted only in the following forms:<br>(i) Electronic Fund Transfer credited in BHEL account (before tender opening)<br><i>BHEL account details: Bank Name: - SBI; A/c No. :- 10670828866 ; IFSC code:- SBIN0003807, A/c Holder Name:- BHARAT HEAVY ELECTRICALS LIMITED</i><br>(ii) Card swapping through POS machine at Cash section of BHEL Jhansi.) |                                                                                                                                                           |
| 7(a)   | In case of successful bidder, EMD will be converted and adjusted against the security deposit, if applicable.                                                                                                                                                                                                                                                           |                                                                                                                                                           |
| 7(b)   | <b>EMD will be forfeited in following cases.</b>                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                           |
| (i)    | After opening the tender, the bidder revokes his tender within the validity period or increases his quoted rate.                                                                                                                                                                                                                                                        |                                                                                                                                                           |
| (ii)   | The bidder does not commence the work within the stipulated period as per LOI/ Contract. In case the LOI/contract is silent in this regard, then within 15 days after award of contract.                                                                                                                                                                                |                                                                                                                                                           |
| (iii)  | MSEs bidders may be exempted from submission EMD and tender cost, however, MSEs bidders must ensure regarding declaration of UAM number Central Public Procurement Portal (CPPP), failing which such bidders will not be able to enjoy the benefit of exemption of EMD and tender cost.                                                                                 |                                                                                                                                                           |



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|      |                                                                                                                                          |                                                                                      |
|------|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 7(c) | EMD given by all unsuccessful tenderers shall be refunded normally within 15 days of acceptance of award of work by successful tenderer. |                                                                                      |
| 7(d) | EMD shall not carry any interest.                                                                                                        |                                                                                      |
| 8    | Cost of Tender                                                                                                                           | NIL                                                                                  |
| 9    | MSME Clause                                                                                                                              | As per GTC point (iii)                                                               |
| 10   | Validity of Offer                                                                                                                        | 120 Days                                                                             |
| 11   | Security Deposit                                                                                                                         | As per General terms & conditions (Not applicable on State/Central Govt./PSU Deptt.) |

**Note: \***

- The EMD shall be accepted only in the following forms:

Electronic Fund Transfer credited in BHEL account (before tender opening)

**BHEL account details: Bank Name: - SBI; A/c No. : - 10670828866; IFSCCode: - SBIN0003807 A/c Holder**

**Name: - BHARAT HEAVY ELECTRICALS LIMITED**

- The contractors may physically visit the work place before quoting their rates. For relevant details please visit our website "www.bhel.com" & [www.jhs.bhel.com](http://www.jhs.bhel.com)
- EMD may be waived of for Central/ State PSUs/ Government deptts/ Autonomous/ Educational/ Research institutions however, bidders must ensure regarding declaration for producing documents regarding being Central/ State PSUs/ Government deptts/ Autonomous/ Educational/ Research institutions to avail the benefit of exemption of EMD.

### ANNEXURE B

#### WORK SPECIFICATION / SCOPE OF WORK

**Name of Work:** Calibration of Reference Multi-Function Calibrator (MFC, 5500A, Fluke Make) of MTL, BHEL-Jhansi (Work Contract)

#### 1.0 Detail of work:

| Sl. No. | Job / Activity                                                             | Unit of Measurement | Quantum of Work |
|---------|----------------------------------------------------------------------------|---------------------|-----------------|
| 01      | Calibration of Reference Multi-Function Calibrator (MFC 5500A, Fluke Make) | Nos.                | 01              |

#### WORK SPECIFICATION

**Table 1: Calibration Points**

| Table: 1-1 Verification Tests for DC Voltage (Normal) |                   |             |                                                    |         |
|-------------------------------------------------------|-------------------|-------------|----------------------------------------------------|---------|
| Sl. No.                                               | Range             | Output      | Absolute Uncertainty, $\pm$ (%of output + $\mu$ V) |         |
|                                                       |                   |             | % of O/P                                           | $\mu$ A |
| 1                                                     | 0 to 329.9999 mV  | 1.0000 mV   | 0.006                                              | 3       |
| 2                                                     |                   | 10.0000 mV  | 0.006                                              | 3       |
| 3                                                     |                   | 100.0000 mV | 0.006                                              | 3       |
| 4                                                     |                   | 300.0000 mV | 0.006                                              | 3       |
| 5                                                     | 0 to 3.299999 V   | 0.500000 V  | 0.005                                              | 5       |
| 6                                                     |                   | 1.000000 V  | 0.005                                              | 5       |
| 7                                                     |                   | 3.000000 V  | 0.005                                              | 5       |
| 8                                                     | 0 to 32.99999 V   | 5.00000 V   | 0.005                                              | 50      |
| 9                                                     |                   | 10.00000 V  | 0.005                                              | 50      |
| 10                                                    |                   | 30.00000 V  | 0.005                                              | 50      |
| 11                                                    | 30 to 329.9999 V  | 50.0000 V   | 0.0055                                             | 500     |
| 12                                                    |                   | 100.0000 V  | 0.0055                                             | 500     |
| 13                                                    |                   | 300.0000 V  | 0.0055                                             | 500     |
| 14                                                    | 100 to 1020.000 V | 500.000 V   | 0.0055                                             | 1500    |
| 15                                                    |                   | 700.000 V   | 0.0055                                             | 1500    |
| 16                                                    |                   | 1000.000 V  | 0.0055                                             | 1500    |

**Table: 1-2 Verification Tests for DC Voltage (Auxiliary)**

| Sl. No. | Range           | Output     | Absolute Uncertainty, $\pm$ (%of output + $\mu$ V) |         |
|---------|-----------------|------------|----------------------------------------------------|---------|
|         |                 |            | % of O/P                                           | $\mu$ A |
| 1       | 0 to 329.999 mV | 10.000 mV  | 0.04                                               | 350     |
| 2       |                 | 100.000 mV | 0.04                                               | 350     |
| 3       |                 | 300.000 mV | 0.04                                               | 350     |
| 4       | 0.33 to 3.3 V   | 1.00000 V  | 0.04                                               | 350     |
| 5       |                 | 3.00000 V  | 0.04                                               | 350     |

**Table: 1-3 Verification Tests for AC Voltage (Normal)**

| Sl. No. | Range             | Output     | Frequency | Absolute Uncertainty, $\pm$ (%of output + $\mu$ V) |         |
|---------|-------------------|------------|-----------|----------------------------------------------------|---------|
|         |                   |            |           | % of O/P                                           | $\mu$ V |
| 1       | 1.0 to 32.999 mV  | 1.000 mV   | 50 Hz     | 0.15                                               | 20      |
| 2       |                   | 10.000 mV  | 50 Hz     | 0.15                                               | 20      |
| 3       |                   | 30.000 mV  | 50 Hz     | 0.15                                               | 20      |
| 4       |                   | 30.000 mV  | 1 kHz     | 0.15                                               | 20      |
| 5       | 33 to 329.999 mV  | 300.000 mV | 50 Hz     | 0.05                                               | 20      |
| 6       |                   | 300.000 mV | 1 kHz     | 0.05                                               | 20      |
| 7       |                   | 300.000 mV | 100 kHz   | 0.24                                               | 170     |
| 8       |                   | 300.000 mV | 500 kHz   | 0.7                                                | 330     |
| 9       | 0.33 to 3.29999 V | 3.00000 V  | 50 Hz     | 0.03                                               | 60      |
| 10      |                   | 3.00000 V  | 1 kHz     | 0.03                                               | 60      |
| 11      |                   | 3.00000 V  | 100 kHz   | 0.24                                               | 1700    |
| 12      |                   | 3.00000 V  | 500 kHz   | 0.5                                                | 3300    |
| 13      | 3.3 to 32.9999 V  | 30.0000 V  | 50 Hz     | 0.04                                               | 600     |
| 14      |                   | 30.0000 V  | 1 kHz     | 0.04                                               | 600     |
| 15      |                   | 30.0000 V  | 100 kHz   | 0.24                                               | 1700    |
| 16      | 33 to 329.999 V   | 300.000 V  | 50 Hz     | 0.05                                               | 6600    |
| 17      |                   | 300.000 V  | 1 kHz     | 0.05                                               | 6600    |
| 18      |                   | 300.000 V  | 20 kHz    | 0.09                                               | 33      |
| 19      | 330 to 1020.000 V | 1000.00 V  | 50 Hz     | 0.05                                               | 80000   |
| 20      |                   | 1000.00 V  | 1 kHz     | 0.05                                               | 80000   |
| 21      |                   | 1000.00 V  | 5 kHz     | 0.2                                                | 100     |

**Table: 1-4 Verification Tests for AC Voltage (Auxiliary)**

| Sl. No. | Range             | Output     | Frequency | Absolute Uncertainty, $\pm$ (% of output + $\mu$ V) |         |
|---------|-------------------|------------|-----------|-----------------------------------------------------|---------|
|         |                   |            |           | % of O/P                                            | $\mu$ V |
| 1       | 1 to 329.999 mV   | 300.000 mV | 50 Hz     | 0.1                                                 | 370     |
| 2       |                   | 300.000 mV | 1 kHz     | 0.1                                                 | 370     |
| 3       |                   | 300.000 mV | 10 kHz    | 0.4                                                 | 450     |
| 4       | 0.33 to 3.29999 V | 3.00000 V  | 50 Hz     | 0.09                                                | 450     |
| 5       |                   | 3.00000 V  | 1 kHz     | 0.09                                                | 450     |
| 6       |                   | 3.00000 V  | 10 kHz    | 0.4                                                 | 1400    |

**Table: 1-5 Verification Tests for DC Current (Normal)**

| Sl. No. | Range           | Output     | Absolute Uncertainty, $\pm$ (% of output + $\mu$ A) |         |
|---------|-----------------|------------|-----------------------------------------------------|---------|
|         |                 |            | % of O/P                                            | $\mu$ A |
| 1       | 0 to 3.29999 mA | 0.00100 mA | 0.013                                               | 0.05    |
| 2       |                 | 0.01000 mA | 0.013                                               | 0.05    |
| 3       |                 | 0.10000 mA | 0.013                                               | 0.05    |
| 4       |                 | 1.00000 mA | 0.013                                               | 0.05    |
| 5       |                 | 3.00000 mA | 0.013                                               | 0.05    |
| 6       | 0 to 32.9999 mA | 5.0000 mA  | 0.01                                                | 0.25    |
| 7       |                 | 10.0000 mA | 0.01                                                | 0.25    |
| 8       |                 | 30.0000 mA | 0.01                                                | 0.25    |
| 9       | 0 to 329.999 mA | 50.000 mA  | 0.01                                                | 3.3     |
| 10      |                 | 100.000 mA | 0.01                                                | 3.3     |
| 11      |                 | 300.000 mA | 0.01                                                | 3.3     |
| 12      | 0 to 2.19999 A  | 0.50000 A  | 0.03                                                | 44      |
| 13      |                 | 1.00000 A  | 0.03                                                | 44      |
| 14      |                 | 2.00000 A  | 0.03                                                | 44      |
| 15      | 0 to 11 A       | 3.0000 A   | 0.06                                                | 330     |
| 16      |                 | 5.0000 A   | 0.06                                                | 330     |
| 17      |                 | 11.0000 A  | 0.06                                                | 330     |





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We hereby accepted above (signature & seal of bidder)

Seal & Signature of BHEL contracting authority

**Table: 1-6 Verification Tests for AC Current (Normal)**

| Sl. No. | Range               | Output         | Frequency | Absolute Uncertainty, $\pm$ (% of output + $\mu$ A) |         |
|---------|---------------------|----------------|-----------|-----------------------------------------------------|---------|
|         |                     |                |           | % of O/P                                            | $\mu$ A |
| 1       | 0.029 to 0.32999 mA | 30.00 $\mu$ A  | 50 Hz     | 0.125                                               | 0.25    |
| 2       |                     | 300.00 $\mu$ A | 50 Hz     | 0.125                                               | 0.25    |
| 3       |                     | 300.00 $\mu$ A | 1 kHz     | 0.125                                               | 0.25    |
| 4       | 0.33 to 3.2999 mA   | 3.00000 mA     | 50 Hz     | 0.1                                                 | 0.3     |
| 5       |                     | 3.00000 mA     | 1 kHz     | 0.1                                                 | 0.3     |
| 6       | 3.3 to 32.999 mA    | 30.0000 mA     | 50 Hz     | 0.09                                                | 3       |
| 7       |                     | 30.0000 mA     | 1 kHz     | 0.09                                                | 3       |
| 8       | 33 to 329.99 mA     | 300.000 mA     | 50 Hz     | 0.09                                                | 30      |
| 9       |                     | 300.000 mA     | 1 kHz     | 0.09                                                | 30      |
| 10      | 0.33 to 2.19999 A   | 2.00000 A      | 50 Hz     | 0.1                                                 | 300     |
| 11      |                     | 2.00000 A      | 1 kHz     | 0.1                                                 | 300     |
| 12      | 2.2 to 11 A         | 5.0000 A       | 50 Hz     | 0.06                                                | 2000    |
| 13      |                     | 5.0000 A       | 1 kHz     | 0.33                                                | 2000    |
| 14      |                     | 11.0000 A      | 50 Hz     | 0.06                                                | 2000    |
| 15      |                     | 11.0000 A      | 1 kHz     | 0.33                                                | 2000    |

**Table: 1-7 Verification Tests for Resistance**

| Sl. No. | Range                                | Output              | Terminal | Absolute Uncertainty, $\pm$ (% of output + $\Omega$ ) |          |
|---------|--------------------------------------|---------------------|----------|-------------------------------------------------------|----------|
|         |                                      |                     |          | % of O/P                                              | $\Omega$ |
| 1       | 0 $\Omega$ to 10.99 $\Omega$         | 1.000 $\Omega$      | 4 Wire   | 0.012                                                 | 0.008    |
| 2       | 0 $\Omega$ to 10.99 $\Omega$         | 10.000 $\Omega$     | 4 Wire   | 0.012                                                 | 0.008    |
| 3       | 11 $\Omega$ to 32.999 $\Omega$       | 30.000 $\Omega$     | 4 Wire   | 0.012                                                 | 0.015    |
| 4       | 33 $\Omega$ to 109.999 $\Omega$      | 100.000 $\Omega$    | 4 Wire   | 0.009                                                 | 0.015    |
| 5       | 110 $\Omega$ to 329.999 $\Omega$     | 300.000 $\Omega$    | 4 Wire   | 0.009                                                 | 0.015    |
| 6       | 330 $\Omega$ to 1.09999 k $\Omega$   | 1.00000 k $\Omega$  | 4 Wire   | 0.009                                                 | 0.06     |
| 7       | 1.1 k $\Omega$ to 3.29999 k $\Omega$ | 3.00000 k $\Omega$  | 4 Wire   | 0.009                                                 | 0.06     |
| 8       | 3.3 k $\Omega$ to 10.9999 k $\Omega$ | 10.0000 k $\Omega$  | 4 Wire   | 0.009                                                 | 0.6      |
| 9       | 11 k $\Omega$ to 32.9999 k $\Omega$  | 30.0000 k $\Omega$  | 4 Wire   | 0.009                                                 | 0.6      |
| 10      | 33 k $\Omega$ to 109.999 k $\Omega$  | 100.000 k $\Omega$  | 4 Wire   | 0.011                                                 | 6        |
| 11      | 110 k $\Omega$ to 329.999 k $\Omega$ | 300.000 k $\Omega$  | 2 Wire   | 0.012                                                 | 6        |
| 12      | 330 k $\Omega$ to 1.09999 M $\Omega$ | 1.00000 M $\Omega$  | 2 Wire   | 0.015                                                 | 55       |
| 13      | 1.1 M $\Omega$ to 3.29999 M $\Omega$ | 3.00000 M $\Omega$  | 2 Wire   | 0.015                                                 | 55       |
| 14      | 3.3 M $\Omega$ to 10.9999 M $\Omega$ | 10.0000 M $\Omega$  | 2 Wire   | 0.06                                                  | 550      |
| 15      | 11 M $\Omega$ to 32.9999 M $\Omega$  | 30.0000 M $\Omega$  | 2 Wire   | 0.1                                                   | 550      |
| 16      | 33 M $\Omega$ to 109.999 M $\Omega$  | 100.0000 M $\Omega$ | 2 Wire   | 0.5                                                   | 5500     |
| 17      | 110 M $\Omega$ to 330 M $\Omega$     | 300.0000 M $\Omega$ | 2 Wire   | 0.5                                                   | 16500    |

**Table: 1-8 Verification Tests for Capacitance**

| Sl. No. | Range                   | Output         | Absolute Uncertainty, $\pm$ (% of output + $\eta$ F) |          | Frequency |
|---------|-------------------------|----------------|------------------------------------------------------|----------|-----------|
|         |                         |                | % of O/P                                             | $\eta$ F |           |
| 1       | 0.33 to 0.4999 $\eta$ F | 0.4 $\eta$ F   | 0.5                                                  | 0.01     | 1 kHz     |
| 2       | 0.5 to 1.0999 $\eta$ F  | 1.0 $\eta$ F   | 0.5                                                  | 0.01     | 1 kHz     |
| 3       | 1.1 to 3.2999 $\eta$ F  | 3.0 $\eta$ F   | 0.5                                                  | 0.01     | 1 kHz     |
| 4       | 3.3 to 10.999 $\eta$ F  | 10.0 $\eta$ F  | 0.5                                                  | 0.01     | 1 kHz     |
| 5       | 11 to 32.999 $\eta$ F   | 30.0 $\eta$ F  | 0.25                                                 | 0.1      | 1 kHz     |
| 6       | 33 to 109.99 $\eta$ F   | 100.0 $\eta$ F | 0.25                                                 | 0.1      | 1 kHz     |
| 7       | 110 to 329.99 $\eta$ F  | 300.0 $\eta$ F | 0.25                                                 | 0.3      | 1 kHz     |
| 8       | 0.33 to 1.0999 $\mu$ F  | 1.000 $\mu$ F  | 0.25                                                 | 1        | 1 kHz     |
| 9       | 1.1 to 3.2999 $\mu$ F   | 3.000 $\mu$ F  | 0.35                                                 | 3        | 1 kHz     |
| 10      | 3.3 to 10.999 $\mu$ F   | 10.000 $\mu$ F | 0.35                                                 | 10       | 100 Hz    |
| 11      | 11 to 32.999 $\mu$ F    | 30.000 $\mu$ F | 0.40                                                 | 30       | 100 Hz    |
| 12      | 33 to 109.99 $\mu$ F    | 100.00 $\mu$ F | 0.50                                                 | 100      | 100 Hz    |
| 13      | 110 to 329.99 $\mu$ F   | 300.00 $\mu$ F | 0.70                                                 | 300      | 100 Hz    |

**Table: 1-9 Verification Tests for DC Current Amplitude (With 50 Turn Current Coil)**

| Sl. No. | Range     | Nominal Value in MFC | Equivalent Current Value (Alongwith 50 Turn Current Coil) |
|---------|-----------|----------------------|-----------------------------------------------------------|
| 1       | 0 to 11 A | 0.2000 A             | 10.0 A                                                    |
| 2       |           | 1.0000 A             | 50.0 A                                                    |
| 3       |           | 2.0000 A             | 100.0 A                                                   |
| 4       |           | 4.0000 A             | 200.0 A                                                   |
| 5       |           | 11.0000 A            | 550 A                                                     |

**Table: 1-10 Verification Tests for AC Current Amplitude (With 50 Turn Current Coil)**

| Sl. No. | Range             | Frequency | Nominal Value in MFC | Equivalent Current Value (Alongwith 50 Turn Current) |
|---------|-------------------|-----------|----------------------|------------------------------------------------------|
| 1       | 0.33 to 2.19999 A | 50 Hz     | 0.2000 A             | 10.0 A                                               |
| 2       |                   | 50 Hz     | 1.0000 A             | 50.0 A                                               |
| 3       |                   | 50 Hz     | 2.0000 A             | 100.0 A                                              |
| 4       | 2.2 to 11 A       | 50 Hz     | 4.0000 A             | 200.0 A                                              |
| 5       |                   | 50 Hz     | 11.0000 A            | 550.0 A                                              |

# Bharat Heavy Electricals Limited, Jhansi

## Material Test Laboratory (MT Lab)

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

**Table: 1-11 Temperature Calibration: Thermocouple Source Mode**

| Sl. No. | Thermocouple Type | Thermoelectric Voltage Nominal Value (mV) | Equivalent Value Temperature (°C) | Absolute Uncertainty $\pm$ (°C) |
|---------|-------------------|-------------------------------------------|-----------------------------------|---------------------------------|
| 1       | J                 | 7.890                                     | -200                              | 0.27                            |
| 2       |                   | 4.633                                     | -100                              | 0.16                            |
| 3       |                   | 0 / nearest 0                             | 0 / nearest 0                     | 0.14                            |
| 4       |                   | 5.269                                     | 100                               | 0.14                            |
| 5       |                   | 27.393                                    | 500                               | 0.17                            |
| 6       |                   | 69.555                                    | 1200                              | 0.23                            |
| 7       | K                 | -5.730                                    | -190                              | 0.33                            |
| 8       |                   | -3.554                                    | -100                              | 0.18                            |
| 9       |                   | 0 / nearest 0                             | 0 / nearest 0                     | 0.16                            |
| 10      |                   | 4.096                                     | 100                               | 0.16                            |
| 11      |                   | 20.644                                    | 500                               | 0.26                            |
| 12      |                   | 52.410                                    | 1300                              | 0.40                            |
| 13      | R                 | 0 / nearest 0                             | 0 / nearest 0                     | 0.57                            |
| 14      |                   | 0.647                                     | 100                               | 0.57                            |
| 15      |                   | 2.401                                     | 300                               | 0.35                            |
| 16      |                   | 4.471                                     | 500                               | 0.33                            |
| 17      |                   | 10.506                                    | 1000                              | 0.33                            |
| 18      |                   | 20.222                                    | 1700                              | 0.40                            |
| 19      | S                 | 0 / nearest 0                             | 0 / nearest 0                     | 0.47                            |
| 20      |                   | 0.646                                     | 100                               | 0.47                            |
| 21      |                   | 4.233                                     | 500                               | 0.36                            |
| 22      |                   | 11.951                                    | 1200                              | 0.37                            |
| 23      |                   | 16.777                                    | 1600                              | 0.46                            |
| 24      |                   | 17.947                                    | 1700                              | 0.46                            |

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

**Table: 1-12 Temperature Calibration: RTD**

| Sl. No. | RTD Type      | Temperature Nominal Value (°C) | Resistance Equivalent Value (Ω) | Absolute Uncertainty ± (°C) |
|---------|---------------|--------------------------------|---------------------------------|-----------------------------|
| 1       | Pt 385, 100Ω  | -200                           | 18.520                          | 0.05                        |
| 2       |               | -100                           | 60.256                          | 0.05                        |
| 3       |               | 0                              | 100.000                         | 0.07                        |
| 4       |               | 100                            | 138.505                         | 0.09                        |
| 5       |               | 500                            | 280.978                         | 0.12                        |
| 6       |               | 800                            | 375.704                         | 0.23                        |
| 7       | Pt 385, 200Ω  | -190                           | 45.651                          | 0.02                        |
| 8       |               | 0                              | 200.000                         | 0.04                        |
| 9       |               | 250                            | 388.2                           | 0.05                        |
| 10      |               | 630                            | 646.6                           | 0.16                        |
| 11      | Pt 385, 500Ω  | -190                           | 114.127                         | 0.01                        |
| 12      |               | 0                              | 500.000                         | 0.05                        |
| 13      |               | 100                            | 692.5                           | 0.06                        |
| 14      |               | 630                            | 1.62 k                          | 0.11                        |
| 15      | Pt 385, 1000Ω | -190                           | 228.255                         | 0.01                        |
| 16      |               | 0                              | 1000.00                         | 0.04                        |
| 17      |               | 500                            | 2.810 k                         | 0.07                        |
| 18      |               | 630                            | 3.23 k                          | 0.23                        |

**Table: 1-13 Verification Tests for DC Power for Voltage Range 33 mV to 1020 mV**

| Sl. No. | Voltage | Current | Power Output | Absolute Uncertainty, ± (% of output) |
|---------|---------|---------|--------------|---------------------------------------|
|         |         |         |              | % of O/P                              |
| 1       | 10 V    | 1.0 A   | 10.0000 W    | 0.06                                  |
| 2       | 10 V    | 10.0 A  | 100.0000 W   | 0.09                                  |
| 3       | 100 V   | 1.0 A   | 100.0000 W   | 0.06                                  |
| 4       | 100 V   | 10.0 A  | 1000.000 W   | 0.09                                  |
| 5       | 240 V   | 1.0 A   | 240.0000 W   | 0.06                                  |
| 6       | 240 V   | 10.0 A  | 2.400000 kW  | 0.09                                  |
| 7       | 1000 V  | 1.0 A   | 1000.000 W   | 0.06                                  |
| 8       | 1000 V  | 10.0 A  | 10.00000 kW  | 0.09                                  |

**Table: 1-14 Verification Tests for AC Power (at Frequency 50 Hz)**

| Sl. No. | Voltage | Frequency | Power Factor | Current | Output     | Absolute Uncertainty, $\pm$ (% of output) |
|---------|---------|-----------|--------------|---------|------------|-------------------------------------------|
|         |         |           |              |         |            | % of O/P                                  |
| 1       | 25 V    | 50 Hz     | 1            | 0.1 A   | 2.5000 W   | 0.15                                      |
| 2       | 25 V    | 50 Hz     | 1            | 1.0 A   | 25.000 W   | 0.15                                      |
| 3       | 25 V    | 50 Hz     | 1            | 10.0 A  | 250.000 W  | 0.15                                      |
| 4       | 100 V   | 50 Hz     | 1            | 0.1 A   | 10.0000 W  | 0.15                                      |
| 5       | 100 V   | 50 Hz     | 1            | 1.0 A   | 100.000 W  | 0.15                                      |
| 6       | 100 V   | 50 Hz     | 1            | 10.0 A  | 1000.000 W | 0.15                                      |
| 7       | 240 V   | 50 Hz     | 1            | 0.1 A   | 24.000 W   | 0.15                                      |
| 8       | 240 V   | 50 Hz     | 1            | 1.0 A   | 240.00 W   | 0.15                                      |
| 9       | 240 V   | 50 Hz     | 1            | 5.0 A   | 1200.00 W  | 0.15                                      |
| 10      | 240 V   | 50 Hz     | 1            | 10.0 A  | 2400.00 W  | 0.15                                      |
| 11      | 480 V   | 50 Hz     | 1            | 0.1 A   | 48.000 W   | 0.15                                      |
| 12      | 480 V   | 50 Hz     | 1            | 1.0 A   | 480.000 W  | 0.15                                      |
| 13      | 480 V   | 50 Hz     | 1            | 5.0 A   | 2.400 kW   | 0.15                                      |
| 14      | 480 V   | 50 Hz     | 1            | 10.0 A  | 4.800 kW   | 0.15                                      |
| 10      | 240 V   | 50 Hz     | 0.5 Lag      | 0.1 A   | 12.0000 W  | 0.45                                      |
| 11      | 240 V   | 50 Hz     | 0.5 Lag      | 1.0 A   | 120.0000 W | 0.45                                      |
| 12      | 240 V   | 50 Hz     | 0.5 Lag      | 5.0 A   | 600.0000 W | 0.45                                      |
| 13      | 240 V   | 50 Hz     | 0.5 Lag      | 10.0 A  | 1200.000 W | 0.45                                      |
| 14      | 240 V   | 50 Hz     | 0.5 Lead     | 0.1 A   | 12.0000 W  | 0.45                                      |
| 15      | 240 V   | 50 Hz     | 0.5 Lead     | 1.0 A   | 120.0000 W | 0.45                                      |
| 16      | 240 V   | 50 Hz     | 0.5 Lead     | 5.0 A   | 600.000 W  | 0.45                                      |
| 17      | 240 V   | 50 Hz     | 0.5 Lead     | 10.0 A  | 1200.000 W | 0.45                                      |
| 18      | 100 V   | 50 Hz     | 0.2 Lag      | 0.1 A   | 2.0000 W   | 1.25                                      |
| 19      | 100 V   | 50 Hz     | 0.2 Lag      | 1.0 A   | 20.0000 W  | 1.25                                      |
| 20      | 100 V   | 50 Hz     | 0.2 Lag      | 10.0 A  | 200.000 W  | 1.25                                      |
| 21      | 100 V   | 50 Hz     | 0.2 Lead     | 0.1 A   | 2.0000 W   | 1.25                                      |
| 22      | 100 V   | 50 Hz     | 0.2 Lead     | 1.0 A   | 20.0000 W  | 1.25                                      |
| 23      | 100 V   | 50 Hz     | 0.2 Lead     | 10.0 A  | 200.000 W  | 1.25                                      |

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

**Table: 1-15 Verification Tests for Power Factor (at 5A)**

| Sl. No. | Range       | Output Current | Output Voltage | Frequency | Power Factor PF |
|---------|-------------|----------------|----------------|-----------|-----------------|
| 1       | 2.2 to 11 A | 5.0000 A       | 240 V          | 50.00 Hz  | 1.000 Lag       |
| 2       |             |                |                |           | 0.800 Lag       |
| 3       |             |                |                |           | 0.400 Lag       |
| 4       |             |                |                |           | 0.200 Lag       |
| 5       |             |                |                |           | 0.100 Lag       |
| 6       |             |                |                |           | 1.000 Lead      |
| 7       |             |                |                |           | 0.200 Lead      |
| 8       |             |                |                |           | 0.400 Lead      |
| 9       |             |                |                |           | 0.800 Lead      |

**Table: 1-16 Verification Tests for Phase Angle (at 5A)**

| Sl. No. | Range       | Output Current | Output Voltage | Frequency | Phase Angle $\phi$ | Power Uncertainty Adder due to Phase Error (%) |
|---------|-------------|----------------|----------------|-----------|--------------------|------------------------------------------------|
| 1       | 2.2 to 11 A | 5.0000 A       | 240 V          | 50.00 Hz  | 0.00 °             | 0.00                                           |
| 2       |             |                |                |           | 30.00 °            | 0.15                                           |
| 3       |             |                |                |           | 45.00 °            | 0.26                                           |
| 4       |             |                |                |           | 60.00 °            | 0.45                                           |
| 5       |             |                |                |           | 75.00 °            | 0.98                                           |
| 6       |             |                |                |           | 80.00 °            | 1.49                                           |
| 7       |             |                |                |           | 85.00 °            | 2.99                                           |
| 8       |             |                |                |           | 90.00 °            | —                                              |

**Table: 1-17 Verification Tests for Frequency (at 3V)**

| Sl. No. | Range             | Output    | Frequency  | Absolute Uncertainty, (ppm $\pm$ mHz) |     |
|---------|-------------------|-----------|------------|---------------------------------------|-----|
|         |                   |           |            | ppm                                   | mHz |
| 1       | 0.33 to 3.29999 V | 3.00000 V | 1.00 Hz    | 25                                    | 1   |
| 2       |                   |           | 10.00 Hz   | 25                                    | 1   |
| 3       |                   |           | 50.00 Hz   | 25                                    | 1   |
| 4       |                   |           | 100.00 Hz  | 25                                    | 1   |
| 5       |                   |           | 1000.0 Hz  | 25                                    | 1   |
| 6       |                   |           | 10.000 kHz | 25                                    | 1   |
| 7       |                   |           | 100.00 kHz | 25                                    | 15  |
| 8       |                   |           | 1000.0 kHz | 25                                    | 15  |
| 9       |                   |           | 2.0000 MHz | 25                                    | 15  |

**Table: 1-18 Temperature Calibration: Thermocouple Measure Mode**

| Sl. No. | Thermocouple Type | Thermoelectric Voltage<br>Nominal Value (mV) | Equivalent Value<br>Temperature (°C) | Absolute Uncertainty<br>± (°C) |
|---------|-------------------|----------------------------------------------|--------------------------------------|--------------------------------|
| 1       | J                 | 7.890                                        | -200                                 | 0.27                           |
| 2       |                   | 4.633                                        | -100                                 | 0.16                           |
| 3       |                   | 0 / nearest 0                                | 0 / nearest 0                        | 0.14                           |
| 4       |                   | 5.269                                        | 100                                  | 0.14                           |
| 5       |                   | 27.393                                       | 500                                  | 0.17                           |
| 6       |                   | 69.555                                       | 1200                                 | 0.23                           |
| 7       | K                 | -5.730                                       | -190                                 | 0.33                           |
| 8       |                   | -3.554                                       | -100                                 | 0.18                           |
| 9       |                   | 0 / nearest 0                                | 0 / nearest 0                        | 0.16                           |
| 10      |                   | 4.096                                        | 100                                  | 0.16                           |
| 11      |                   | 20.644                                       | 500                                  | 0.26                           |
| 12      |                   | 52.410                                       | 1300                                 | 0.40                           |
| 13      | R                 | 0 / nearest 0                                | 0 / nearest 0                        | 0.57                           |
| 14      |                   | 0.647                                        | 100                                  | 0.57                           |
| 15      |                   | 2.401                                        | 300                                  | 0.35                           |
| 16      |                   | 4.471                                        | 500                                  | 0.33                           |
| 17      |                   | 10.506                                       | 1000                                 | 0.33                           |
| 18      |                   | 20.222                                       | 1700                                 | 0.40                           |
| 19      | S                 | 0 / nearest 0                                | 0 / nearest 0                        | 0.47                           |
| 20      |                   | 0.646                                        | 100                                  | 0.47                           |
| 21      |                   | 4.233                                        | 500                                  | 0.36                           |
| 22      |                   | 11.951                                       | 1200                                 | 0.37                           |
| 23      |                   | 16.777                                       | 1600                                 | 0.46                           |
| 24      |                   | 17.947                                       | 1700                                 | 0.46                           |



Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

### Scope of Work and Payment

| S. No. | Scope                                                                                                                                                                                                                                                | Vendor to specify (Yes/No) |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 1      | Details of instrument for calibration bearing Sl. No. 9430019: Multi-Function Calibrator, Quantity: 1 No., Make: Fluke, Model: 5500A, Accuracy & Range: As per table 1 of Annex B.                                                                   |                            |
| 2      | Calibration is to be done on mutually agreed date and time schedule.                                                                                                                                                                                 |                            |
| 3.1    | Calibration is to be done as per specification attached (Refer table 1 of Annexure B) & in reference of Manufacturer's Specification. Should there be any comments or points which are technically not feasible; the same may please be brought out. |                            |
| 3.2    | Calibration agency shall have valid NABL or other equivalent accreditation as per ISO 17025 in concerned parameter and range. Agency to specify NABL accreditation certificate no.                                                                   |                            |
| 3.3    | The scope of accreditation of calibration agency shall cover all the ranges of instrument/s for which the instrument is to be calibrated and for which the agency submits the offer.                                                                 |                            |
| 4      | The calibration work will have to be completed within one month after submission of instrument to the Calibration Agency. Delay in execution of work may cause penalty of 0.5% of contract value per week up to maximum of 10%.                      |                            |
| 5      | The instruments shall be calibrated at the works of External laboratory i.e. at your laboratory.                                                                                                                                                     |                            |
| 6      | The Standard Equipment/ Instruments used for calibration shall have capability (class/accuracy/stability) to maintain proper Test Uncertainty Ratio (TUR) during calibration and traceability to National/ International Standards.                  |                            |
| 7      | Calibration stickers bearing equipment details, calibration date, calibration status and next due date shall be put on the Instrument after calibration.                                                                                             |                            |
| 8      | Detail calibration certificate of the instrument shall be prepared in line with ISO 17025 and should be submitted within 7 days from date of completion of calibration.                                                                              |                            |
| 9      | The payment shall be made after completion of work and submission of Final Invoice/ Bill.                                                                                                                                                            |                            |
| 10     | Offer shall be submitted separately in 2 sealed bids namely Technical Bid & Price Bid.                                                                                                                                                               |                            |
| 11     | Deviation, if any, shall be clearly brought out.                                                                                                                                                                                                     |                            |
| 12     | The Party shall confirm all the above points failing which their offer may not be considered.                                                                                                                                                        |                            |



# Bharat Heavy Electricals Limited, Jhansi

## Material Test Laboratory (MT Lab)

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022  
ANNEXURE –C

| Sl. No. | Description of Qualifying requirement                                                                                                                                                                                                                                                       | Vendor to specify (Yes/No) |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 1       | Calibration agency shall have valid NABL accreditation as per ISO 17025 in concerned parameter and range (Refer table 1 of Annexure B). Calibration agency shall have to submit the valid certificate of accreditation.                                                                     |                            |
| 2       | The scope of accreditation of calibration agency shall cover all the ranges of instrument/s (Refer table 1 of Annexure B) for which the instrument is to be calibrated and for which the agency submits the offer. Calibration agency shall have to submit the NABL scope of accreditation. |                            |
| 3       | Calibration agency shall have PAN number.                                                                                                                                                                                                                                                   |                            |
| 4       | Calibration agency shall have GST number (PAN based).                                                                                                                                                                                                                                       |                            |
| 5       | Calibration agency are required to submit a self-declaration on their letter head duly signed, with seal and stamp of the Bidder as per the format enclosed as annexure V.                                                                                                                  |                            |



# Bharat Heavy Electricals Limited, Jhansi

## Material Test Laboratory (MT Lab)

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022  
**ANNEXURE –D**

### ESSENTIAL DOCUMENTS

1. The bidder should have valid NABL accreditation certificate and scope as per ISO 17025 in concerned parameter and range
2. The bidder should have PAN/TAN number.
3. The bidder should have VAT/TIN No. if material is supplied/consumed.
4. Undertaking duly signed, with seal and stamp of the Bidder, on their letter head as per annexure V.
5. Documentary proof in support of above eligibility criteria along with EMD (if applicable) shall be submitted along with Techno Commercial Bid.
6. Blank Price Bid as per Annexure – F(a).

# Bharat Heavy Electricals Limited, Jhansi

## Material Test Laboratory (MT Lab)

Tender Enquiry No: MTL/TW/22/01/001,

Dated 21.10.2022

### ANNEXURE E

#### PROFORMA FOR SUBMITTING TECHNICAL BID

|    |                                                       |                                                 |
|----|-------------------------------------------------------|-------------------------------------------------|
| 1  | Name of the firm<br><b>(Essential)</b>                |                                                 |
| 2  | Address and Contact Numbers<br><b>(Essential)</b>     |                                                 |
| 3  | Name of the Proprietor<br><b>(Essential)</b>          |                                                 |
| 4  | Registration Number of the Firm<br><b>(Essential)</b> |                                                 |
|    | Copy of the Certificate                               | Enclosed / Not Enclosed                         |
| 5  | Labour License Number<br><b>(Desirable)</b>           |                                                 |
|    | Copy of the License                                   | Enclosed / Not Enclosed                         |
| 6  | PF Code Number<br><b>(Desirable)</b>                  |                                                 |
|    | Copy of PF registration                               | Enclosed / Not Enclosed                         |
| 7  | ESI Code Number<br><b>(Desirable)</b>                 |                                                 |
|    | Copy of ESI registration                              | Enclosed / Not Enclosed                         |
| 8  | PAN/TAN Number<br><b>(Essential)</b>                  |                                                 |
| 9  | GST Number (PAN Based)<br><b>(Essential)</b>          |                                                 |
| 10 | Validity of offer                                     | 120 days from the date opening of technical bid |
| 11 | Blank Price bid format<br><b>(Essential)</b>          | Enclosed / Not Enclosed                         |
| 12 | Valid E-Mail Id <b>(Essential)</b>                    |                                                 |

**We will fulfill all the obligations of the contractor and abide by the Terms & Conditions mentioned in the enquiry.**