

| Technical Annexure-1A                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
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| Supply, Installtion & commissioing and post installation training of 3–D Digital Image Correlation system for Non Contact Full Field 3 Dimensional Displacement and Strain Measurement including High Temperature Spray paint as per specifications |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
|                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
|                                                                                                                                                                                                                                                     | BHARAT HEAVY ELECTRICAL LTD                                                                                                                                                                                                                                                                                                 | Enquiry No. :      |  |  |
|                                                                                                                                                                                                                                                     | Corporate Research and Development                                                                                                                                                                                                                                                                                          | Due Date :         |  |  |
|                                                                                                                                                                                                                                                     | Vikasnagar, Balanagar                                                                                                                                                                                                                                                                                                       | Supplier Qtn. No.: |  |  |
|                                                                                                                                                                                                                                                     | Hyderabad-500093                                                                                                                                                                                                                                                                                                            |                    |  |  |
|                                                                                                                                                                                                                                                     | Telangana, India                                                                                                                                                                                                                                                                                                            | Date :             |  |  |
|                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
|                                                                                                                                                                                                                                                     | <b>SPECIFICATION CUM COMPLIANCE FOR 3–D DIGITAL IMAGE CORRELATION SYSTEM FOR NON CONTACT FULL FIELD 3 DIMENSIONAL DISPLACEMENT AND STRAIN MEASUREMENT INCLUDING HIGH TEMPERATURE SPRAY PAINT AS PER SPECIFICATIONS AT BHEL CORP R&amp;D, HYDERABAD, TELANGANA.</b>                                                          |                    |  |  |
|                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
|                                                                                                                                                                                                                                                     | NAME & ADDRESS OF THE SUPPLIER :                                                                                                                                                                                                                                                                                            |                    |  |  |
|                                                                                                                                                                                                                                                     | CONTACT PERSON:                                                                                                                                                                                                                                                                                                             |                    |  |  |
|                                                                                                                                                                                                                                                     | TELEPHONE NOS.:                                                                                                                                                                                                                                                                                                             |                    |  |  |
|                                                                                                                                                                                                                                                     | FAX NOS.:                                                                                                                                                                                                                                                                                                                   |                    |  |  |
|                                                                                                                                                                                                                                                     | E-MAIL ADDRESS :                                                                                                                                                                                                                                                                                                            |                    |  |  |
|                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
| NOTE:-                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                             |                    |  |  |
| 1                                                                                                                                                                                                                                                   | The "Vendor Offer" Column and where applicable, the "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance. |                    |  |  |
| 2                                                                                                                                                                                                                                                   | The offer and all documents enclosed with offer should be in English language only.                                                                                                                                                                                                                                         |                    |  |  |
| 3                                                                                                                                                                                                                                                   | Vendor has to submit the list of standard accessories for the system along with Technical offer                                                                                                                                                                                                                             |                    |  |  |
| 4                                                                                                                                                                                                                                                   | Vendor has to submit the mandatory spares for the warranty period and has to be included in the scope                                                                                                                                                                                                                       |                    |  |  |
| 5                                                                                                                                                                                                                                                   | Vendor has to quote the prices as per the given price bid format. Unpriced bid format with taxes and duties rates are to submitted along with technical offer                                                                                                                                                               |                    |  |  |

| SNO | DESCRIPTION FOR BHEL REQUIREMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BHEL SPEC         | VENDOR OFFER | REMARKS |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------|---------|
| 1.0 | <b>Preamble</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |              |         |
|     | <p>BHEL R&amp;D, HYDERABAD intends to establish a 3D Digital Image Correlation (DIC) system facility for 3-dimensional strain measurement on stationary as well as rotating test object. The system will be used for both laboratory research work and studies in the field like thermal power plant, balancing tunnel, rotor test rig etc. Since the system is needed for field applications, the system must be portable. Given the multiple applications, extensive technical support from the vendor is required. Vendors who have sufficient experience and expertise in realistic research using 3D DIC may participate in the tender.</p> <p>It is mandatory that the bidder must have supplied the 3D DIC system to research laboratory/institutes in India. Performance certificates / Technical Papers from user institute/ laboratory may be attached with the bid.</p> | Vendor to Confirm |              |         |

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| <b>2.0</b>     | <b>Parameters to be measured:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |  |  |
| 2.1            | Contour with coordinates.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Confirm |  |  |
| 2.2            | In-plane displacements along X and Y Directions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Vendor to Confirm |  |  |
| 2.3            | Out of plane displacements - Z Direction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Confirm |  |  |
| 2.4            | Strains: $\epsilon_{xx}$ , $\epsilon_{yy}$ , $\gamma_{xy}$ , Engineering and Principal strains.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vendor to Confirm |  |  |
| 2.5            | Vector Directions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Vendor to Confirm |  |  |
| 2.6            | Principal Strain Directions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Vendor to Confirm |  |  |
| 2.7            | Full Field Accelerations (X, Y and Z Direction)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vendor to Confirm |  |  |
| 2.8            | Dynamic measurement with Full Field Frequency Analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Vendor to Confirm |  |  |
| 2.9            | Full Field FFT Analysis – Amplitude vs. Frequency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Vendor to Confirm |  |  |
| 2.1            | Amplitude Variable: - Displacements, Strains and Accelerations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Vendor to Confirm |  |  |
| <b>3.0</b>     | <b>Details of the test object:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Vendor to Confirm |  |  |
|                | i. Speed/orientation of the test object: 0 to 3600RPM / Vertical<br>ii. Operating Environment for the test object: Air and Nitrogen<br>iii. Pressure of Environment: 50 micro bar to 5 bar<br>iv. Temperature of the test object : Room temperature to 800 Deg C<br>v. Diameter / length of the test object: Max 1.5 meter / length max 1.2 meter<br>vi. Area of interest for measurement: 10mmx10mm to 500mmx500mm square-shape (surface could be flat or curved with maximum of 1m diameter)<br>vii. Min / Max Strain (Range / Resolution): Range: +/- 5000 micro strain; Resolution: 50 micro strain or better<br>viii. Temperature near the camera: Camera shall be operated safely up to 50 Deg C.<br>ix. Speckle pattern paint life on test object: up to 2000 Hrs (paint used for speckle pattern on the test object will get exposed to the temperature of 800 Deg. C for this duration). | Vendor to Confirm |  |  |
| <b>4.0</b>     | <b>System Configuration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |  |  |
| 4.1            | Software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |  |  |
| 4.1.1          | Image Acquisition software                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |  |  |
| <b>4.1.1.1</b> | <b>Low Speed Image Acquisition:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |  |
| 4.1.1.1.1      | Manual: Press of keyboard or mouse click.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Confirm |  |  |
| 4.1.1.1.2      | Time Capture: User can define the time interval for a limited or unlimited period of time. The user should have the option to stop and subsequently restart the image acquisition from the point it had stopped and without any loss of stored data.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Vendor to Confirm |  |  |
| 4.1.1.1.3      | Flexible Capture for Fatigue Measurements: Capture first set of images in a certain time period and subsequent set of images in different time periods.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Vendor to Confirm |  |  |
| 4.1.1.1.4      | Hardware trigger: Using TTL (Transistor logic) or input signal from an external sensor or manual or time.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Confirm |  |  |
| 4.1.1.1.5      | Analog Trigger: Based on the analog signal input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Vendor to Confirm |  |  |
| 4.1.1.1.6      | The software should be able to handle over exposed images and show clear images. and/or software should provide tools to avoid over exposure (automatic exposure adjustment)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Vendor to Confirm |  |  |
| 4.1.1.1.7      | The software should clearly show if the calibration carried out is correct and should indicate if the sources of errors for calibration, if any.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Vendor to Confirm |  |  |

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| 4.1.1.1.8      | System should be capable of acquiring load cell, displacement sensor etc. at least 8 data channels and display-selected channels without disturbing the acquired data.                                          | Vendor to Confirm |  |  |
| <b>4.1.1.2</b> | <b>High Speed Image Acquisition:</b>                                                                                                                                                                            |                   |  |  |
| 4.1.1.2.1      | The software should be integrated with the High Speed Cameras.                                                                                                                                                  | Vendor to Confirm |  |  |
| 4.1.1.2.2      | Image capture via TTL.                                                                                                                                                                                          | Vendor to Confirm |  |  |
| 4.1.1.2.3      | Features of vi, vii and viii as mentioned above.                                                                                                                                                                | Vendor to Confirm |  |  |
| <b>4.1.2</b>   | <b>3D Digital Image Correlation Software : Software with the following features are needed:</b>                                                                                                                 |                   |  |  |
| 4.1.2.1        | Resolution of displacement measurement.<br>For a Field of View of 100mm; In Plane Displacement = 1 microns; Out of Plane displacement = 2 Microns. Resolution of strain measurement: 50 micro strain or better. | Vendor to Specify |  |  |
| 4.1.2.2        | Measurement range: Strain range: Max mean static value +/- 5000 micro strain and pk-pk dynamic 1000 micro strain                                                                                                | Vendor to Specify |  |  |
| 4.1.2.3        | Expected strain computation algorithms: Lagrange, Engineering and Principal strains                                                                                                                             | Vendor to Confirm |  |  |
| 4.1.2.4        | Smoothing of data.                                                                                                                                                                                              | Vendor to Confirm |  |  |
| 4.1.2.5        | User selection of the subset size, step size and strain filter size.                                                                                                                                            | Vendor to Specify |  |  |
| 4.1.2.6        | Indication of the appropriate subset size to be selected.                                                                                                                                                       | Vendor to Confirm |  |  |
| 4.1.2.7        | Indication, if the correlation carried out is correct and if not, indicate sources of errors.                                                                                                                   | Vendor to Confirm |  |  |
| 4.1.2.8        | Correlation: Software should generate automatic start point and sequence analysis.                                                                                                                              | Vendor to Confirm |  |  |
| 4.1.2.9        | 3D Displacement and Strain measurements.                                                                                                                                                                        | Vendor to Confirm |  |  |
| 4.1.2.10       | 2D and 3D Plots of the images                                                                                                                                                                                   | Vendor to Confirm |  |  |
| 4.1.2.11       | Co-ordinate transformation                                                                                                                                                                                      | Vendor to Confirm |  |  |
| 4.1.2.12       | Export of data/plots in ASCII, TIF, JPEG, AVI, clipboard, etc.                                                                                                                                                  | Vendor to Specify |  |  |
| 4.1.2.13       | Profile over a line, point or area measurement.                                                                                                                                                                 | Vendor to Confirm |  |  |
| 4.1.2.14       | Animation of the result                                                                                                                                                                                         | Vendor to Confirm |  |  |
| 4.1.2.15       | Color coded display of Displacements, Tangential Strains, Principal Strains (combined with direction)                                                                                                           | Vendor to Confirm |  |  |
| 4.1.2.16       | Computation of Principal Strains, Engineering strains and Lagrange strains                                                                                                                                      | Vendor to Confirm |  |  |
| 4.1.2.17       | Velocities in X, Y and Z Direction.                                                                                                                                                                             | Vendor to Confirm |  |  |
| 4.1.2.18       | Full Field FFT analysis of Displacements, Velocity, Acceleration (X, Y and Z Direction) and strains                                                                                                             | Vendor to Confirm |  |  |
| 4.1.2.19       | Import of 3D DIC Data into a project from other project files.                                                                                                                                                  | Vendor to Confirm |  |  |
| <b>4.1.3</b>   | <b>Software Licenses:</b>                                                                                                                                                                                       |                   |  |  |
| 4.1.3.1        | License 1: One Main license with portable controller system for data acquisition and post processing.                                                                                                           | vendor to confirm |  |  |
| 4.1.3.2        | License 2: One Post Processing License with workstation                                                                                                                                                         | vendor to confirm |  |  |
| 4.1.3.3        | Licenses must be on a USB Dongle.                                                                                                                                                                               | vendor to confirm |  |  |
| 4.1.3.4        | Update of the software should be free during warranty period                                                                                                                                                    | vendor to confirm |  |  |
| 4.1.4          | <b>Speckle Generator Software:</b> Suitable speckle generator software for generating speckles.                                                                                                                 | Vendor to Specify |  |  |
| 4.1.5          | <b>Grid Generator software:</b> Suitable grid generator software for generating custom built grids.                                                                                                             | Vendor to Specify |  |  |
| 4.1.6          | Any other software which are required for normal operation and post processing of data.                                                                                                                         | Vendor to Specify |  |  |

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| 4.2    | <b>Optics and Hardware:</b> A complete 3D DIC system must be quoted and vendors must include all accessories with the system.                                                                                                                                                                                                                                                                                                                                                                                                                                         | vendor to confirm |  |  |
| 4.2.1  | <b>Camera:</b> 5 MP, 40 fps or better Gigabit Ethernet Cameras – 2 Nos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Vendor to Specify |  |  |
| 4.2.2  | High Speed Cameras with accessories and interface cables-2Nos<br>- Resolution 1 MP at 2000 fps.<br>- 12 Bit Monochrome CMOS Cameras.<br>- Global Shutter:- Less than 1.5 microsecond<br>- Interface:- Gigabit Ethernet.<br>- Synchronization of the 2 cameras with data acquisition system                                                                                                                                                                                                                                                                            | Vendor to Specify |  |  |
| 4.2.3  | Giga Bit Ethernet Hub – 1 No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Vendor to confirm |  |  |
| 4.2.4  | Trigger Switch for the camera – 1 No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Vendor to confirm |  |  |
| 4.2.5  | Lenses:- C Mount Lens – with focal length:- 16mm , 28mm and 50mm – 2 Nos each<br>Lenses for High Speed cameras:- F-Mount with focal lengths – 35 mm, 50 mm and 100 mm.<br>The vendor should clearly mention the make of the lenses offered.                                                                                                                                                                                                                                                                                                                           | Vendor to Specify |  |  |
| 4.2.6  | IR filters for all the lenses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Specify |  |  |
| 4.2.7  | Data Acquisition Module:- 1 No<br>- USB Daq.<br>- Integrated with the Camera Capture.<br>- 16 Bit ADC.; +/-10 VDC.<br>- 8 Channels.                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vendor to Specify |  |  |
| 4.2.8  | Hard carry case for the Optics.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Vendor to Specify |  |  |
| 4.2.9  | Lens Cleaning Kit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Vendor to Specify |  |  |
| 4.2.10 | High intensity monochromatic LED illumination system with intensity control to illuminate 1m2 area (surface could be flat or curved with maximum of 1m diameter)                                                                                                                                                                                                                                                                                                                                                                                                      | Vendor to Specify |  |  |
| 4.2.11 | Suitable Tripod for mounting the cameras with 3 way Tripod head in stereo vision- 1 Set                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Vendor to Specify |  |  |
| 4.2.12 | Suitable Aluminum Channel Mounting unit for the cameras -1 Set                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Vendor to Specify |  |  |
| 4.2.13 | Suitable calibration grids for the specified measurement area and range. They should be provided with proper carrying case. Since measurements are done in the field the grids should be rugged. Should the grid drop on the floor it should withstand the impact and be undamaged                                                                                                                                                                                                                                                                                    | Vendor to Specify |  |  |
| 4.2.14 | <b>Portable controller system with warranty period of 5 years:</b> Suitable portable controller system for the data acquisition and DIC algorithm with following or better configuration<br>2.9. GHz or higher, Quad i7, Minimum 15.6" with 1920x1080 resolution, DVD-RW, 32 GB DDR4 (2400 MHz) RAM, 256 GB SSD, 1TB Hard Disk(7,200RPM), 4GB NVIDIA Graphics Card or better, Windows 10 – 64 Bit , MS Office -2016, USB 3.0 Super Speed Ports Carry Case and other Standard Features.<br>The Same controller will be used for Low Speed and High Speed Measurements. | Vendor to Specify |  |  |

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| 4.2.15     | <b>Fixed controller system with post processing and storage features with warranty period of 5 years:</b> Suitable fixed controller system for the data acquisition and DIC algorithm with following or better configuration<br>Dual Intel Xeon processor with each 18 cores with base frequency of min 3GHz, minimum 256GB ECC Type - {32GB, DDR4-2666 MHz} RAM expandable to 1TB, Minimum 512GB SSD, 4TB HDD with 7200 RPM or more, Two No. 2 Gigabit Ethernet ports, LED Monitor with resolution 3840x2160@60Hz or better, Additional One No. Integrated GigaBit Ethernet ports, Genuine Window 10 – 64 Bit Professional, MS Office -2016 , Minimum 4 no's of USB 3.1G ports, Minimum 4 no's USB 2.0 ports and Graphics Card: NVIDIA Quadro P5000 with 16GB GDDR5X | Vendor to Specify |  |  |
| 4.2.16     | 8 Channel USB data acquisitions module to capture analog inputs along with the images.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Vendor to Specify |  |  |
| 4.2.17     | Speckle rollers of various dot sizes of 0.15mm to 0.5mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Vendor to Specify |  |  |
| 4.2.18     | High temperature paint – For application upto 800 Deg C and long duration of at least 2000hrs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Specify |  |  |
| 4.2.19     | Air Brush Set – Air Brush with nozzle – 0.15mm, 0.2mm, 0.4mm, 0.6mm nozzles; Hose Pipe compressor, White Paint – 2.0 Lts; Black Paint – 2.0 Lts; Cleaning Liquid – 4.0 Lts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Vendor to Specify |  |  |
|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |  |  |
| <b>5.0</b> | <b>Pre-Dispatch Inspection &amp; training:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |  |  |
| 5.1        | Pre-dispatch inspection to be carried out at supplier's works. Inspection shall be carried out by BHEL. Vendor should demonstrate the working of the system as per the specifications. Vendor shall provide hands on training at their works after PDI.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Vendor to Confirm |  |  |
| 5.2        | The Vendor shall give minimum of 28 days' notice for inspection along with internal test certificates.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Vendor to Confirm |  |  |
| 5.3        | Scope, Duration and daily schedule for PDI and training for 2 BHEL officials should be indicated in the offer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Vendor to Confirm |  |  |
| 5.4        | During PDI, suggested modifications/ changes, if any by BHEL official should carried out and intimated to BHEL for dispatch clearance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Vendor to Confirm |  |  |
| 5.5        | PDI charges, if any, have to be quoted separately with the enquiry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vendor to Confirm |  |  |
| <b>6.0</b> | <b>Acceptance test procedure:</b> During PDI System to be demonstrated in a strain simulator to cover entire strain range as specified and withstandibility of paint upto 1000 degC for at least 1 hour.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Vendor to Specify |  |  |
| <b>7.0</b> | <b>Installation, Commissioning and Post Installation training:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |  |  |
| 7.1        | Vendor has to carry out the installation and commissioning (I&C) and Post Installation training at BHEL R&D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Vendor to Confirm |  |  |
| 7.2        | Any special tools/materials for installation and commissioning shall be supplied by vendor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Vendor to Confirm |  |  |
| 7.3        | Any other requirements during installation and commissioning shall be specified clearly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Vendor to Confirm |  |  |
| 7.4        | Vendor shall provide training to BHEL engineers after successful installation at BHEL R&D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Vendor to Confirm |  |  |
| 7.5        | Training shall cover, operation and maintenance of the DIC system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Vendor to Confirm |  |  |
| 7.6        | Training shall cover safety features/guidelines for the protection of men and equipment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Vendor to Confirm |  |  |
| 7.7        | Scope, Duration and daily schedule for post installation training should be indicated in the offer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vendor to Specify |  |  |
| 7.8        | I&C report should be submitted to BHEL after successful completion of the I&C and Post installation training.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Vendor to Confirm |  |  |

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| 7.9        | <b>Supplier should indicate duration (in weeks) for completion of Installation &amp; commissioning (including Post Installation training) from the date of BHEL intimation about site readiness.</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | Vendor to Specify |  |  |
| 7.10       | Delay in completion of I&C (including Post Installation training) within stipulated time indicated earlier will attract penalty as per Late Delivery (LD) clause mentioned in commercial terms and conditions (CTC) as applicable.                                                                                                                                                                                                                                                                                                                                                                                       | Vendor to Confirm |  |  |
| 7.11       | <b>The Supplier should quote these charges (I&amp;C and Post Installation Training Charges) as % of System price (on ex works basis i.e. Sl.No.11 of Unpriced and price bid format of Annexure II&amp;III).</b> Only in case where quoted value is less than the value (in %) specified above or separate value is not mentioned in the offer, value for I&C shall be deemed to be considered as the value indicated above (3%) and accordingly supply value will be adjusted from that quoted value and balance will be released as I&C payment as per Payment terms- under Commercial terms and conditions of enquiry. | Vendor to Specify |  |  |
| 7.12       | All travel, boarding, lodging and other charges (if any) for authorized personnel deputed for E&C/Installation and demonstration should be borne by the vendor                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |  |  |
| <b>8.0</b> | <b>Warranty:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |  |  |
| 8.1        | Warranty for the system except controllers (portable and fixed) shall be 12 months from the date of installation and acceptance at R&D or 18 months from the date of supply, whichever is earlier.                                                                                                                                                                                                                                                                                                                                                                                                                       | Vendor to Confirm |  |  |

|             |                                                                                                                                                                                                                                                                                                                                        |                   |  |  |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--|--|
| 8.2         | Vendors shall quote and supply the spares (including low-shelf life spares) required for this warranty period.                                                                                                                                                                                                                         | Vendor to Specify |  |  |
| 8.3         | Warranty for the controllers (portable and fixed) shall be 60 months from the date of installation and acceptance at R&D or 66 months from the date of supply, whichever is earlier.                                                                                                                                                   |                   |  |  |
| 8.4         | During warranty period, the repairs and maintenance of the system and sub-systems shall be carried out by the vendor free of cost at BHEL R&D, Hyderabad.                                                                                                                                                                              | Vendor to Confirm |  |  |
| 8.5         | During warranty period, all upgrades to the operation related to data acquisition, processing and data-logging software must be provided free of cost.                                                                                                                                                                                 | Vendor to Confirm |  |  |
| 8.6         | Contact information of service engineers MUST be provided at the time of installation & commissioning.                                                                                                                                                                                                                                 | Vendor to Confirm |  |  |
| 8.7         | Availability of trained service engineers in India for attending the problem in at most 7 days has to be ensured and complied to.                                                                                                                                                                                                      | Vendor to Confirm |  |  |
| <b>9.0</b>  | <b>DOCUMENTATION :</b><br><b>Three sets of following documents (Hard copies) in English language should be supplied along with the system</b>                                                                                                                                                                                          |                   |  |  |
| 9.1         | Data sheets of the DIC System and all the optics and hardware quoted.                                                                                                                                                                                                                                                                  | Vendor to Confirm |  |  |
| 9.2         | User manual, schematic of the system.                                                                                                                                                                                                                                                                                                  | Vendor to Confirm |  |  |
| 9.3         | For bought out items, details of the vendor shall be provided.                                                                                                                                                                                                                                                                         | Vendor to Confirm |  |  |
| 9.4         | For consumables, Grade and Make details shall be provided                                                                                                                                                                                                                                                                              | Vendor to Confirm |  |  |
|             |                                                                                                                                                                                                                                                                                                                                        |                   |  |  |
| <b>10.0</b> | <b>After sales support and non-comprehensive Annual Maintenance Contract (AMC) for the system excluding controller (portable and fixed):</b>                                                                                                                                                                                           |                   |  |  |
| 10.1        | Non-comprehensive AMC charges shall be quoted for 4 years beyond the stipulated warranty period quoted on per year basis as % of basic system cost (which is Sl.No. 7 of Unpriced and price bid format of Annexure II&III).                                                                                                            | Vendor to Confirm |  |  |
| 10.2        | BHEL will add the quoted AMC charges of 4 years for cost evaluation while deciding the tender priorities                                                                                                                                                                                                                               | Vendor to Confirm |  |  |
| 10.3        | BHEL reserves the right to place a separate order/ orders for AMC contract for 4 years and/ or part thereof, at the rates quoted after warranty period.                                                                                                                                                                                | Vendor to Confirm |  |  |
| 10.4        | All software upgrades have to be provided free of cost during service AMC period.                                                                                                                                                                                                                                                      | Vendor to confirm |  |  |
| 10.5        | AMC charges will be paid on half yearly basis after completion of services including mandatory visit to BHEL R&D, failure of which shall entail forfeiture of the half yearly payment and extension of warranty at the discretion of BHEL. Consequential impact on any failure due to the above shall be to the account of the vendor. | Vendor to confirm |  |  |