



An ISO 9001
Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

NIT_33487 Corrigendum 1		Phone: +91 431 257 7653 Email : skaruna@bheltry.co.in Web : www.bhel.com	
TWO PART BID Tender to be submitted in two Parts	Enquiry Number: 2601700036	Enquiry Date: 04.07.2017	Due date for submission of quotation: 28.07.2017
You are requested to quote the Enquiry number date and due date in all your correspondence. This is only a request for quotation and not an order. Please note that under any circumstances both delayed offer and late offers will not be considered. Hence vendors are requested to ensure that the offer is reaching physically our office before 14.00 hrs on the Date of tender opening.			
Item	Description		Quantity
10	Transmission Electron Microscope with Accessories as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)		1 No.
<u>Corrigendum 1</u> <i>Revised technical document with 11th page of Part B of Technical specification is uploaded.</i> BHEL's General guidelines / instructions (refer MM/CE/GENL/001 - EMD), compliance form and technical specification can be downloaded from BHEL web site http://www.bhel.com or from the Government tender website http://tenders.gov.in (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2601700036".			
Tenders should reach us before 14:00 hours on the due date Tenders will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present		Yours faithfully, For BHARAT HEAVY ELECTRICALS LIMITED  Manager / Capital Equipment / MM	

S.PARTHASARATHY
MANAGER
CAPITAL EQUIPMENT / MM
BHEL, TRICHY-620014

PART- A**TENDER REQUIREMENTS FOR THE SUPPLY OF
"TRANSMISSION ELECTRON MICROSCOPE with ACCESSORIES"****SECTION – I: Qualifying Criteria**

The BIDDER has to compulsorily meet the Qualification Criteria indicated in the Section – I to get qualified. Details need be given in additional sheets (with clause reference number) if required to cover all the aspects and to substantiate the claim. Otherwise the technical offer will not be considered.

S.No.	TENDER PARTICULARS	VENDOR's RESPONSE
1.1	The VENDORS /Original Equipment Manufacturer (OEMs) should have supplied and commissioned at least Five Numbers of "Transmission Electron Microscope" of the similar model in the past TEN years (as on the date of opening of this Tender).	
1.2	Only those vendors (OEMs) should quote, who have supplied and commissioned in the last FIVE years (as on the original date of this tender opening) at least TWO number of "Transmission Electron Microscope" of similar model / capacity in India. The referred equipment shall be presently working satisfactorily for more than one year from the date of commissioning (as on the original date of tis tender opening). The name and contact addresses of the customers, to whom the above said equipment were supplied, to be furnished with details with the OFFER.	
1.3	If accessories (such as Energy Dispersive X-Ray Spectroscopy (EDX/EDS/XEDS), Electron Energy Loss Spectroscopy or Energy Filtered TEM (EELS/EFTEM), Imaging systems (such as CMOS camera), Scanning Transmission Electron Microscope (STEM) attachment including Bright Field (BF)/ (Annular Dark Field) ADF detectors, (High Angle ADF) HAADF detector, etc.) as per the specifications in this tender have different OEM(s), each of them must have authorized service agent in India or an office in India for provision of after-sales service, support and maintenance.	

S.No.	TENDER PARTICULARS	VENDOR's RESPONSE
1.4	Vendor has to submit at least ONE PERFORMANCE CERTIFICATE (as per ANNEXURE-A) for satisfactory performance of "Transmission Electron Microscope" as referred under above Clause No. 1.2, for a minimum period of one year from the date of commissioning (as on the original date of this tender opening) from their customers in India or in any other country outside the country of origin, supplied and commissioned in the last FIVE years. Performance Certificate in Original Form may also be sent by E-mail / TELEFAX directly from the OEM's Customer to BHEL/Purchase Department.	
1.5	BHEL reserves the right to verify the information provided by the Vendor for the referred equipment at their referred customer's works. It shall be the responsibility of the vendor to facilitate the visit of BHEL's team at their refereed customer works. The Travel, Boarding and Lodging expenses for BHEL Personnel shall be borne by BHEL. In case the information provided by vendor is found to be false / incorrect, the offer shall be rejected. BHEL reserves the right to accept or reject the OEM's OFFER based on the assessment of their technical and financial capability.	

SECTION – II

The BIDDER/OEM are requested to provide the following information:-

S.No.	TENDER PARTICULARS	VENDOR's RESPONSE
2.1	The BIDDER / VENDOR to furnish Reference List of Customers, with complete address, details of contact person, where "Transmission Electron Microscope" have been supplied in the past.	
2.2	Specify details of "Transmission Electron Microscope" supplied to other unit of BHEL, if any (Year of commissioning with details etc).	

S.No.	TENDER PARTICULARS	VENDOR's RESPONSE
2.3	Details on SERVICE -AFTER-SALES Set-up in India including the Address of Agent/Service Centers In India to be provided	
2.4	To provide the copy of the OEM Plant Training Certificate for Indian Service Personnel, with the TECHNICAL OFFER.	
2.5	Any Additional data to supplement the manufacturing capability of the BIDDER for the subject equipment, may be furnished.	

SECTION – III

The BIDDER has to note the following and comply with, while submitting the OFFER

S.No.	TENDER PARTICULARS	VENDOR's COMPLIANCE
3.1	The BIDDER shall submit the offer in TWO PARTS - Technical [with PART A & PART B] & Commercial and the Price Bid separately.	
3.2	The Offer shall contain a comparative statement of Technical Specifications given by BHEL and the Offer details submitted by the Bidder, against each clause. A just 'CONFIRMED' or 'COMPLIES' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer. In case of any deviations in any of the technical specifications, such deviations should be clearly specified in the comparative statement.	
3.3	The BIDDER shall assure a continuous support for SPARES and SERVICE for TEN years, from the date of successful commissioning of the equipment at BHEL Works.	
3.4	The Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details / literature on the QUOTED MODELS of TEM.	
3.5	The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation for the scope of supply.	

ANNEXURE - A

Suggestive Format of Performance Certificate

The Performance of TEM should be certified by the customer on Customer's Letter Head and submitted along with the offer.

PERFORMANCE CERTIFICATE

1.0	Name & Type of the Equipment:	
2.0	Supplier/s Name and Address	
3.0	Make & Model Number of the TEM and other Sub-Systems / Major Accessories forming part of the MAIN EQUIPMENT	
4.0	Month & Year of Commissioning	
5.0	Application for which the Equipment is generally used	
6.0	EQUIPMENT DETAILS :	
7.0	Performance of the Equipment (Please tick the appropriate option)	Satisfactory Non Satisfactory
8.0	Service after Sales Support Promptness (Please tick the appropriate option)	Satisfactory Non Satisfactory
9.0	Other Remarks (if any)	
Date :		Signature & Seal of the Authority Issuing the Performance Certificate

PART B**TECHNICAL SPECIFICATIONS FOR 'TRANSMISSION ELECTRON MICROSCOPE - TEM'**

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR'S OFFER
1.0	PURPOSE & APPLICATION	
	The comprehensive equipment being procured must cater to the analyses on samples of Metals (such as Steels (plain Carbon, Oxide Dispersed Strengthened (ODS), Stainless Steel (18Cr steels, Super304H, etc.), low alloy and high alloy steels viz., 1.25 Cr steels, 9-10 Cr Steels, etc. (for boiler tubing/ piping applications), Ni-base super-alloys (such as Inconel 617M, CCA 617, Inconel 740/740II, for very high temperature and much high pressure thermal power plant component applications), Copper alloys (Cupronickel, Brass, etc. for condenser tubing materials, Cu-Be alloys for generator applications), Titanium alloys (α, α/β alloys, etc. for low-pressure last-stage steam-turbine blade applications), etc. The applications include: • Bright Field (BF)/ Dark Field (DF) imaging of grains and precipitates (ordered or otherwise) • Phase identification from Selected Area Diffraction (SAD) patterns • Elemental analysis/ mapping by EDX or spectral analysis/ mapping of elements added in very small quantities in an observed micrograph for qualitative analysis • Observing dislocation structure in the material by weak-beam dark field imaging • Understanding bonding at interface structure of bond coat/coating/corrosion product layer with base metal • Spectral analysis/ energy filtered imaging/ mapping of light elements (such as B, etc.) or elements added in small quantities which may diffuse to grain boundaries, absolute quantification of elements at a particular location/region, etc. • EFTEM elemental mapping and/or weak beam dark field imaging of dislocation structure in materials • Characterization for failure analysis purpose of all the above mentioned materials • Defect characterization, phase contrast or High Resolution (HR) imaging for obtaining misfit in case of ordered precipitates in Ni-base superalloys • Characterization of fine precipitates such as γ', γ'', MX, etc. in the matrix • STEM (BF and/or HAADF) configuration for EELS spectral imaging and analysis of spectrum from the selected region of the observed micrograph	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
2.0	SCOPE OF SUPPLY	
2.1	Scanning Transmission Electron Microscope	
2.2	Bright Field (BF)/ (Annular Dark Field) ADF detectors	
2.3	Selected Area Diffraction	
2.4	High Angle ADF (HAADF) detector	
2.5	Energy Dispersive X-Ray Spectroscopy (EDX/ EDS/ XEDS)	
2.6	Electron Energy Loss Spectroscopy or Energy Filtered TEM (EFTEM and EELS)	
2.7	Essential Auxiliaries / Accessories	
3.0	ELECTRON SOURCE	
3.1	High Brightness Field Emission Schottky type – ZrO/W electron source with three years' warranty	
3.2	Beam/Emission Current ≥ 100 nA	
3.3	Probe Current: 0.5 nA or more in 1 nm spot/probe	
3.4	Spot Drift ≤ 1 nm/ min	
3.5	Display for all gun settings and readouts such as gun vacuum, extraction voltage, extraction current, gun lens voltage, suppressor voltage, lifetime of the emitter, etc. has to be available in the user interface.	
3.6	One additional FEG source with three year warranty has to be supplied at the time of expiry of source (cost and undertaking to be included in the commercial and price bid). NOTE : Originally supplied FEG with the main equipment (TEM) shall have a minimum life of THREE CONTINUOUS YEARS from the date of successful commissioning of the main equipment. In case of premature failure, free replacement and commissioning shall be effected within a notice period of 7 days.	
4.0	ACCELERATING VOLTAGE/ HIGH TENSION	
4.1	High Tension (HT) Range: 80 kV to 200 kV	
4.2	HT must be continuously variable/ flexible with a minimum step size of 50 V	
4.3	HT stability must be equal to or better than 1 ppm/ 10 mins	
4.4	Energy spread: 0.8 eV or less	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
5.0	STANDARD/ PRE-SET ACCELERATING VOLTAGE/ HIGH TENSION SETTINGS	
5.1	80, 120, 140, 160, 180, 200 kV should be provided as standard/ pre-set accelerating voltages/ high tensions	
5.2	User interface control or push-button action must be capable of changing controls for changing the settings from one to another without need of a service engineer and without the need to switch off high tension/ microscope.	
5.3	The above requirement / action must be fast and should typically be completed in few minutes	
5.4	Alignment has to be carried out periodically (during AMC visit) at these accelerating voltages	
6.0	VACUUM SYSTEM	
6.1	Clean vacuum system need to be offered with Turbo-Molecular Pump(s) (TMP)/ Ion-Getter Pump(s) (IGP)/ Sputter Ion Pump(s) (SIP)/ Diffusion Pump(s) (DP)/ Combination of TMP, IGP, SIP, DP	
6.2	Pre-pumping of gun, column and specimen air-lock has to be carried out by TMP / SIP / IGP / DP or Combination of TMP, IGP, SIP, DP	
6.3	The specimen chamber should have anti-contamination device (ACD) as standard	
6.4	ACD shall have 4 hours capacity or higher with respect to liquid nitrogen filling. For column, fully interlocked differential pumping is to be ensured	
6.5	Gun, column and specimen chamber have to be pumped by separate TMP/IGP/SIP/DP	
6.6	Specimen exchange must be fast and specimen airlock pumping time has to be <3 minutes for dry samples	
6.7	Status display has to be made available on user interface	
6.8	Vacuum level in each area (gun, column and specimen chamber) should be measured using vacuum gauges and the same should be visible in the user interface	
6.9	Vacuum levels in specimen chamber must be $< 3 \times 10^{-5}$ Pa and gun must be $< 1 \times 10^{-5}$ Pa	
7.0	RESOLUTION	
7.1	Point resolution: 0.25 nm or lower(better);	
7.2	Line/ lattice resolution: 0.10 nm or lower(better);	
7.3	STEM (HAADF) resolution: 0.20 nm or lower(better)	
8.0	MAGNIFICATION	
8.1	Magnification range in various modes (if any): 50X or lower, to 900kX or higher.	
8.2	If various modes exist, each mode with respective number of steps and magnification ranges have to be furnished with details	
8.3	Rotation-free magnification and diffraction series shall be offered	
8.4	Automatic alignment for high resolution objective lens centering shall be ensured	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
9.0	OBJECTIVE LENS SYSTEM	
9.1	HR objective lens with capability for analytical TEM work such as EDX, EELS, EFTEM shall be offered	
9.2	Spherical aberration coefficient (C_s) : 1.4 mm or lower	
9.3	Chromatic aberration coefficient (C_c) : 1.4 mm or lower	
9.4	Minimum focus step : 1.8 nm or lower	
9.5	Stigmator must be electromagnetic with centering	
9.6	Constant focus is required over entire range of magnification	
10.0	DIFFRACTION	
10.1	All modes of diffraction from coherent illumination for SAD to nano-diffraction and highly convergent beam electron diffraction (CBED) must be possible.	
10.2	Maximum diffraction angle must be ± 10 degrees or more.	
11	APERTURES	
11.1	Size details of all apertures to be used for condensers, objective lens, SAD shall be furnished	
11.2	Motorized mechanism(s) for changing all kinds of apertures is mandatory and control units have to be available on joy-stick and GUI (Graphical User Interface).	
12.0	SPECIMEN STAGE	
12.1	High stability, fully computer controlled eucentric side-entry five-axis stage ($XYZ\alpha\beta$) with accurate recall and retrieve facility shall be offered	
12.2	Anti-contamination device shall form part of supply, as standard;	
12.3	X-movement : ± 1 mm or higher	
12.4	Y-movement : ± 1 mm or higher	
12.5	Z-movement : ± 0.2 mm or higher	
12.6	Specimen drift : ≤ 1 nm/ min with standard holder	
12.7	Tilt : ± 30 degrees or higher with single tilt and double tilt holder	
12.8	Tilt : ± 70 degrees or higher with tomography holder;	
12.9	Tomography module with software for control, image acquisition and automatic image reconstruction shall be provided with automatic drift correction	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
13.0	SAMPLE HOLDER(s)	
13.1	Specimen size : 3 mm diameter or any other specific sizes to be specified by the bidder	
13.2	The following sample holders should be quoted along with the equipment: (a) Standard single tilt holder for imaging and EDX, (b) Standard double tilt holder with low background for EDX, (c) Tomography holder for large tilts (as per X, Y, Z, tilt conditions mentioned above) Other special sample holders such as d) Specimen heating-tilting holder with control unit and e) Specimen cooling-tilting holder (single tilt cryo holder) with control unit and liquid nitrogen pumping station and related essential accessories.	
13.3	All types of retainers and etc. shall be offered with technical details and unit price.	
14.0	IMAGE RECORDER(s) and BEAM STOPPER(s)	
14.1	4k x 4k pixels or better, full frame, bottom mount retractable CMOS camera with built-in shutter, compatible with 200kV BF/DF microscopy, Energy Filtered TEM (EFTEM) and EELS module, having fiber-optic coupling. This bottom mount camera shall be compatible with having beam stopper covering the direct beam in case of recording diffraction patterns; Beam stopper has to be provided in the column or image recording chamber for preventing damage to the scintillator from direct beam in case of recording diffraction.	
14.2	Ability to view "live" video of in-situ TEM experiments at resolution of 4096 x 4096 pixels at 25 frames per second (fps) to 512 x 512 pixels at ≥300 fps, with usage of the in-situ upgrade option and with suitable high end server type PC configuration. It should be possible to do in-line data processing with real time drift correction at 25 fps. This camera should be compatible with the microscope being offered. All computer controls (hardware if any) and imaging software(s) with video option have to be included in the price and listed clearly. The camera has to be provided with samples required for calibration and it has to be indicated in the compliance sheet. The camera has to be calibrated during installation/ commissioning and also during routine/ periodic AMC visit(s).	
14.3	This has to be installed/ commissioned along with the equipment. All cooling parts (if any) required should be provided or taken from the main equipment or shall be interconnected to TEM auxiliaries. Training and demonstration on all modes of the usage have to be provided at site after installation/commissioning.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
15.0	REMOTE OPERATION CAPABILITY	
	TEM with all accessories shall be capable of being operated from a remote location not less than 5 meters from where it is installed/ commissioned. Therefore, all connecting cables, adapters, accessories, networking modules, etc. which are required for remote operation must be provided along with the microscope. Details about how the microscope can be controlled remotely have to be provided for technical bid. If any cables, accessories, adapter, networking modules are required separately, these should be quoted and clearly indicated.	
16.0	VIEWING CHAMBER	
	Should be equipped with viewing window and should contain large horizontal and small retractable phosphor screens, binocular and beam stopper	
17.0	SAMPLE HOLDER ENCLOSURE	
	Sample holder of the microscope being quoted must have an enclosure that should be capable of withstanding sudden acoustic noise and sudden thermal variations. This is a mandatory requirement. This has to be complied to and photographs of the same on the same kind of instrument being quoted have to be provided for technical bid.	
18.0	CONTROL UNIT AND SOFTWARE	
18.1	All controls of the gun, pumping system(s), sample holder motions, various mode shifts, adjustments of imaging and diffraction parameters, etc. must be available in the user interface (to be provided on dual monitors of 21 inch size atleast) as well as on the control panel(s).	
18.2	The following also have to be available in user interface: alignment of user defined feature of diffraction pattern onto optical axis, reduce non-eucentric motions during usage of double-tilt holder; Licensed software(s) for performing the following: (a) image and diffraction pattern acquisition, display, storage, recall, analysis/ processing (b) conversion of format from microscope generated format to required formats such as tiff, jpeg (c) dimensional measurement (d) analysis and/or simulation of SAD patterns and Kikuchi lines when tilting crystal to different orientations (e) CBED analysis package (f) latest electron diffraction database and analysis software (g) diagnostics software for troubleshooting (f) Tomography acquisition and image reconstruction softwares, have to be indicated with clear justification and are to be provided;	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
18.0	CONTROL UNIT AND SOFTWARE	
18.3	Additional off-line license of all the processing/analysis software(s) shall be offered.	
18.4	All the software modules being provided have to be compatible with Windows 7 (64 bit) or later version. If software for Windows 7 is quoted, it must be upgraded along with operating system (OS) once the upgrades' stable version is released and available with latest OS.	
18.4	Support system (latest high end workstation in which all off-line licensed processing/ analysis softwares) have to be loaded – details to be furnished	
18.5	For connecting the microscope computer through ethernet connection for safe, virus-free data management, the system shall be equipped with a multilayer DVD +/- RW and anti-virus software.	
18.6	Monitor should be 21 inch or larger LED type with Intel Xeon (6 core or higher) processor having 3.1 GHz or faster processor, 16 GB RAM with 3 TB internal memory and a 1 GB graphics card. Both 32 bit and 64 bit Windows 7 operating system have to be included in the standalone support system.	
19.0	STEM and HAADF	
19.1	BF, ADF and HAADF detectors for imaging modes should be provided as a part of STEM module and it should be compatible with the microscope	
19.2	The above units shall be fully digital scan system.	
19.3	HAADF shall be present before the entry of electron beam into the energy filter.	
20.0	EDX/ EDS/ XEDS	
20.1	The unit shall cover active area of 100 sq mm or more	
20.2	Liquid Nitrogen (LN2) free, Silicon Drift Detector(s) (SDD(s)) with windowless configuration	
20.3	Unit shall be capable of detecting qualitatively elements beyond Beryllium (Be) upto U or beyond in the periodic table and should be capable of performing quantitative analysis automatically after acquiring the spectrum	
20.4	Total EDS solid angle should be 0.9Sr or higher (better)	
20.5	Energy resolution should be $\leq 136\text{eV}$ for Mn K α peak	
20.6	All the peaks identified have to be indexed automatically	
20.7	Specimen drift has to be taken care of automatically	
20.8	If there is any hardware and/or software configuration for taking care of automatic drift correction, it has to be included and provided along with this attachment	
20.9	Elemental and/or phase mapping at high resolutions should be possible through data acquisition software.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
20.0	EDX/ EDS/ XEDS	
20.10	In case spectra is required from a specific region mapped, it should be possible to extract spectral information and further analyze it	
20.11	Multi-point analysis and line-scan analysis shall be possible.	
20.12	Capability is required for automatic retraction to a safe position when high electron flux is incident on the detector or when vacuum loss happens	
20.13	EDS off-site license has to be provided for analysis purpose.	
20.14	Data on collection efficiency on tilt angle has to be provided In case the collection efficiency is not dependent on tilt angle, clear justification shall be furnished / provided.	
20.15	All softwares required for spectral acquisition, spectral mapping, elemental mapping, phase mapping, quantification, control of EDS unit, user interface in settings mode indicating status of the equipment shall be compulsorily offered with details	
20.16	Simultaneous acquiring of EDS and EELS spectra/mapping shall be possible	
20.17	This unit has to be installed/ commissioned along with the instrument.	
20.18	Any pneumatic and/or hydraulic connections required have to be taken from/ interconnected through TEM and its auxiliaries.	
20.19	Training and demonstration on all modes of usage of this attachment after installation/commissioning have to be provided at site.	
21.0	EFTEM and EELS	
21.1	EELS spectrometer system consisting of post-column filter /In-column filter for EFTEM imaging shall be offered	
21.2	EELS spectroscopy or spectral mapping and having energy resolution of 0.8 eV or better (lower) shall be offered	
21.3	It shall be capable of running on 64-bit software/ OS. Should have BF/DF detectors of STEM be integrated with EELS system and optimized for camera length with control unit and optimized for exposures under same TEM conditions for absolute quantification of particularly carbides, nitrides, carbo-nitrides and borides.	
21.4	Spectral imaging in co-ordination with STEM system has to be possible. It should also be possible to select spectra from a point, line or an area from the larger spectral image.	
21.5	Elemental mapping in STEM mode should be possible with spectral acquisition rate of at least 1000 /s.	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
21.0	EFTEM and EELS	
21.6	All computer controls (including hardware if any), imaging (including a separate camera if the existing camera is not suitable for EELS) with image/ spectral control, acquisition, analysis and processing software(s) have to be quoted and justified.	
21.7	Compatibility with the TEM has to be ensured and all modes of this accessory set have to be demonstrated during installation. EFTEM and EELS off-site license and an additional offline license for processing software(s) (if quoted/ to be provided) have to be provided for analysis purpose for the standby computer.	
21.8	Distortion correction should be taken care of while image acquisition.	
21.9	Absolute quantification and auto drift corrector for imaging at high magnification are mandatory requirements.	
22.0	STANDARD SAMPLES AND HANDLING TOOLS	
22.1	The standard samples required for demonstration of all offered modes of TEM such as STEM-HAADF (using Silicon crystal, etc.),	
22.2	EDX energy resolution (using standard Mn sample, etc.),	
22.3	Point and line resolution in BF/DF imaging (using Gold on Carbon or Gold on Germanium or Amorphous Germanium, etc.),	
22.4	EELS and EFTEM(for demonstrating resolution of 0.8 eV or less)(using Boron Nitride on Carbon and doped TiO ₂ standard sample),	
22.5	CMOS cameras (calibration standard) and other modes have to be mentioned, justified and indicated clearly	
22.6	A set of tools required for sample handling such as precision forceps, etc. have to be listed and provided.	
23.0	AUXILIARIES	
23.1	On-line Uninterrupted Power Supply (UPS) system should be supplied for TEM and Chiller. The UPS should be able to keep the TEM operational in case of sudden power cut or spike and support the complete TEM system with all accessories with full load for duration of 1.5 hour. There should be 5 years on-site comprehensive warranty for UPS, including onsite replacement warranty for batteries from the date of installation.	
23.2	Suitable power supply unit to all parts of the microscope including the accessories has to be quoted (including high tension tank). BHEL provides electrical input supply through a $415 \pm 10\%$ V, 50 ± 2 Hz, 3 Phase AC Supply through a 4 wire system (4 th wire for earthing) .	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
23.0	AUXILIARIES	
23.3	Closed loop, automatic temperature and flow rate controlled (with low temperature fluctuation), compact, water chiller suitable for working under Indian conditions (maximum temperature around 48°C, RH about 85%, both do not occur simultaneously) has to be quoted for all the requirements of microscope as well as for the accessories.	
23.4	The compressed air supplied by BHEL will have a pressure of 4 to 5 bar and if needed a suitable oil filter and moisture remover shall form part of the supply.	
23.5	Suitable air compressor for all the (pneumatic) requirements of microscope as well as the accessories has to be quoted;	
23.6	2 Nos of high purity Nitrogen/Argon cylinders with gas (one for storage and one for usage) for purging and/or other purposes with regulators/ flow controllers and connecting tubes have to be quoted;	
23.7	SF6 gas cylinder with gas (high purity) with regulator/ flow controllers and connecting tube have to be offered with details.	
23.8	All connections for compressor, chiller and nitrogen/argon gas cylinder and flow meters to the microscope and/or accessories have to be provided.	
23.9	Digital room temperature monitor and Relative Humidity (RH) monitor have to be provided	
23.10	In case any other auxiliary is required, it has to be justified and indicated explicitly;	
23.11	20 liters Liquid Nitrogen dewar along with tilting and transport trolley are required and are to be supplied	
23.12	Vibration isolation arrangement is preferred if available and this has to be indicated clearly.	
24.0	SPARES and CONSUMABLES	
	Recommended or suggested spares kit for first 5 years of normal, consumables, etc. trouble-free working of equipment by the OEM have to be quoted and listed with unit rate and details. This list of spares has to be provided from OEM and a certificate in proof of this has to be submitted by OEM along with the offer. A spare FEG assembly has to be quoted as an optional item. The following must be provided as mandatory: 1. Tools kit with all standard and major/ essential tools required during maintenance, servicing at site, etc. 2. One additional set of tools required for sample handling such as precision forceps, etc. have to be listed and provided	

S. No.	PARTICULARS & BHEL SPECIFICATIONS	VENDOR's OFFER
25.0	EQUIPMENT OPERATING SKILLED PERSONNEL	
25.1	The services of a SKILLED technician trained on identical equipment has to be positioned for the proper operation and functioning of the equipment and the total system, from the date of installation and commissioning of the total equipment for the following THREE years. A separate quote for such a service has to be offered, giving the qualifications and skill level of the technician . This service payment for operator positioning shall be made on a half yearly basis separately against satisfactory performance certification.	
25.2	The operator will work as an employee of the vendor and institute shall have no responsibility for his/her service liabilities.	
25.3	He shall perform all activities in TEM starting from specimen preparation and other TEM functions at Welding Research Institute (WRI) BHEL Tiruchirappalli and helps to train our engineers at WRI.	
26.0	WARRANTY	
26.1	Guarantee or Warranty for all parts (including the accessories and auxiliaries) : 36 months from the date of Erection and Commissioning or 48 months from the date of supply/ shipment whichever is earlier	
26.2	Contact information of service engineers MUST be provided at the time of installation or E&C	
26.3	Availability of trained service engineers in India for attending the problem in at most 3 days has to be ensured and complied to	
26.4	It is the responsibility of the VENDOR to ensure the availability of experienced service support on daily basis for operation of all modes of the equipment and accessories, and for sample preparation during the warranty period	
27.0	ERECTION AND COMMISSIONING (E&C) OR INSTALLATION	
27.1	All the accessories (such as STEM attachment, HAADF detector, EDX, EELS, CMOS camera(s), etc.) and spares being provided must be compatible with the TEM being supplied	
27.2	E&C or Installation has to be done at Welding Research Institute (WRI) BHEL Tiruchirappalli, by the OEM or their authorized service agency/ personnel only. All cables and adapters required for integration of the equipment have to be supplied along with the equipment. It is the responsibility of the supplier to integrate all the systems (including auxiliaries and accessories) and ensure the functionality of the entire equipment and every accessory.	
27.3	E&C charges and the period of E&C have to be quoted separately. All the tools and fixtures shall be arranged by the VENDOR for the E&C works, including helpers and consumables required.	

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27.0	ERECTION AND COMMISSIONING (E&C) OR INSTALLATION	
27.4	Supplier should intimate all pre-installation and utility requirements (such as water connection(s), power requirement(s), earthing/grounding requirement(s), temperature and humidity control requirement(s), etc.) after taking a detailed site survey (including vibration level measurement, electro-magnetic noise survey, temperature and humidity survey, etc.) subsequent to the receipt of Purchase Order.	
27.5	In case any partition requirements or civil works requirements, the intimation can be provided immediately after receipt of Purchase Order by the OEM or authorized service agent and after suitable site evaluation at Welding Research Institute BHEL Tiruchirappalli along with drawings	
27.6	Documentation : Two manuals in English (Hardcopies and softcopy (in a CD/DVD)) should be supplied along with the equipment and the accessories being supplied indicating detailed usage/ operation instructions, cleaning procedures (if any), troubleshooting issues, maintenance and service manuals, precautions to be taken, safety procedures to be followed.	
28.0	TRAINING	
28.1	Detailed training at OEM works/ factory has to be provided by factory engineer to 3 officials from BHEL on working of all modes of the equipment along with the accessories and the software(s) being provided. Training should also be provided on safety features, task to be performed in case of emergency, etc. Detailed scope, location of training and duration of training for all modules of the equipment and accessories has to be indicated. The training charges only have to be quoted separately per official excluding travel, boarding/ loading, etc.	
28.2	Post-installation training shall also be provided by the installation engineers for all modes of equipment along with accessories and the software(s) being provided, at site of installation for 3 officials	
29.0	PRE-DISPATCH INSPECTION OF MAIN EQUIPMENT	
	The following inspection tests will be carried out at factory site: • Verification of energy spread of FEG source • Point resolution and line/ lattice resolution will be verified • STEM-HAADF resolution will be verified • Imaging at various accelerating voltages should be demonstrated using standard samples • Demonstration of all modes being procured such as BF/DF imaging in conventional TEM mode, BF/ADF/HAADF imaging in STEM mode, SAD, CBED on standard samples Vacuum levels in the gun, column and specimen chamber will be recorded. Their stability for 4 hours duration will also be recorded	

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30.0	FUTURE UPGRADE POSSIBILITIES	
	All future upgrade possibilities to the present TEM configuration have to be indicated (including additional hardware and/or software upgradation etc.).	
31.0	AFTER SALES SUPPORT AND AMC	
31.1	It has to be clearly mentioned in the offer, the responsibility of OEM of TEM regarding after-sales service, support and maintenance for the main equipment (i.e., TEM with auxiliaries) and each accessory being quoted. In case OEM of TEM decides to transfer responsibility of service for accessories only, to OEM or authorized service provider of each accessory, the same has to be indicated and details have to be furnished along with the bid. Depending on this, subsequent to expiration of warranty, AMC will be directly taken up with the concerned OEM or authorized service provider for each accessory. In such a case each accessory's service provider and OEM of TEM have to indicate AMC charges explicitly per year for 3 years after expiration of standard warranty. The AMC charges shall be added for cost evaluation. BHEL reserves the right to place a separate order/ orders for AMC contract for 3 years and/ or part thereof before expiry of standard warranty period at the rates quoted.	
31.2	If OEM of TEM decides to take responsibility for service of all accessories along with the main equipment, AMC charges for the equipment along with all the accessories for 3 years beyond the warranty period have to be quoted per year for 3 years after expiration of the standard warranty. These charges have to be valid for 3 years beyond the standard warranty period. The AMC charges shall be added for cost evaluation. BHEL reserves the right to place a separate order/ orders for AMC contract for 3 years and/ or part thereof before expiry of standard warranty period at the rates quoted. In such a case, AMC Charges should be quoted as follows: AMC Charges after 2nd year: __ %; AMC Charges after 3rd year: __ %; AMC Charges after 4th year: __ %	
31.3	During AMC routine visit, calibration, alignment checks, general service checks, etc having to be carried out.	
31.4	Availability of trained service engineers in India for attending the problem in at most 3 days has to be ensured and complied to during emergency visit	
31.5	It is the responsibility of the supplier to ensure provision of experienced service support on daily basis for operation of all modes of the equipment and accessories, and for sample preparation during the AMC period	
31.6	All software upgrades have to be provided free of cost during AMC period	

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32.0	BROCHURES/ TECHNICAL DETAILS	
	Brochures/ Technical details/ supporting information for compliance to the all the item specifications listed in the enquiry has to be submitted along with the offer. Photographs of the equipment also have to be submitted.	
33.0	CONSUMABLES OR SAMPLE STORAGE REQUIREMENTS	
33.1	TEM amorphous carbon coated, centre marked, copper grids of 100 mesh – 200 to 240 Nos; Sufficient number of grid storage boxes for the grids being supplied are required.	
33.2	TEM grids storage vacuum desiccators – 5 Nos having 40-60 grids capacity have to be provided with 1 No. of suitable oil-free vacuum pump and necessary connectors	
34.0	MANUFACTURER'S TEST CERTIFICATE	
	Manufacturer's test certificate shall be provided for FEG source (for the one installed on equipment and for the spare), for objective lens system and all operating parameters including spherical and chromatic aberration coefficients; Calibration certificates shall also be provided.	