

TECHNICAL SPECIFICATION SHEET

CLAUSE NO.	DESCRIPTION FOR BHEL REQUIREMENT	SUPPLIERS REMARK	BHEL'S REMARK
1.0	APPLICATION:		
1.1	The Universal testing machine(UTM) of 10 kN capacity shall be capable of carrying out all mechanical tests such as Tensile Strength, Proof Stress, Compression Test on Metals, Non Metals and Spring etc. and shall electronically display the concerned test results on PC/ Control panel display.		
1.2	UTM shall be table top model, double column load frame with ball screws having anti backlash screw design.		
2.0	SCOPE OF SUPPLY:		
2.1	Electro Mechanical Universal Testing Machine (UTM) of 10 kN.		
2.2	Load cell (two nos.) as per clause 6.1 (Unit price to be quoted).		
2.3	Grips four sets (four upper and four lower) as per clause 6.2.0.		
2.4	Compression plates as per clause 6.2.4		
2.5	One Electronic Extensometer (Clause 6.4.0).		
2.6	One PC, printer and UPS as per clause 6.6.0		
2.7	UTM Operating Software (hence forth UOS) as per clause 8.0.		
2.8	Licensed operating system Software & CD as per clause 6.6.11.		
2.9	One mounting table for UTM as per clause 6.7.0.		
2.10	All Power Cables, Connecting Cables & Interface Cables etc. one set.		
2.11	Machine mounted control panel as per Clause 7.1.		
2.12	Calibration Certificates as per clause 11.0.		
2.13	Documentation as per clause 23.0.		
2.14	Any other accessories if required.		
3.0	QUALIFYING CONDITIONS:		
3.1	Vendor should be original equipment manufacturer (OEM) or authorized dealer/distributor of OEM. In case of dealer/distributor, they should furnish the details of OEM and valid authorization certificate from OEM.		
3.2	Vendor must have well functioning service centre in India. Details to be submitted.		
3.3	Overview about OEM (When established, Product Range, market etc.) to be submitted.		
3.4	Only those vendors shall quote, who or their principal have supplied and commissioned at least one number of UTM of 10 kN or more capacity, for similar applications, within last 7 years. Following documents shall be furnished along with technical bid to support this qualification criteria:		
3.4.1	The list of supplied UTMs having following information:		
3.4.2	Make & Model		
3.4.3	Capacity		
3.4.4	Month & Year of Supply		
3.4.5	Customer Name		
3.4.6	Customer Address		
3.4.7	Customer Contact Person		
3.4.8	Customer Contact Nos/Email		
3.4.9	Minimum one number of unpriced copy of Purchase order of equipment supplied mentioned in clause 3.4		
3.4.10			
3.5	Minimum one number of Performance Certificate (issued by customer for satisfactory performance of at least one year) of UTM supplied mentioned in clause 3.4.		
3.6	BHEL reserves the right to verify the information provided by vendor. If the information provided by vendor is found to be false/incorrect at any point of time, the offer shall be rejected.		

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4.0	GENERAL REQUIREMENTS		
4.1	The offer shall be submitted in two bids (Techno-commercial and Price Bid).		
4.2	Unit prices of the main system along with required accessories shall be indicated in the price bid.		
4.3	The vendor shall furnish unpriced copy of Price Bid along with technical Bid.		
4.4	Considering the specification requirement, vendor shall identify the quoted items in following category and clearly mention them in both, technical and price bid.		
4.4.1	Mandatory Items (Required essentially for fulfilling the purpose and complying the requirement of this specification).		
4.4.2	Optional Items (Not required essentially but available with vendor for enhancement of performance/extension of machine capability/simplify the operations. The vendor shall quote item wise unit price for these items.		
4.5	The vendor shall furnish item wise scope of supply along with technical bid.		
4.6	The system offered shall be complete in all respects. It shall contain all additional hardware / accessories/ software required for satisfactory operation of the system.		
5.0	TECHNICAL SPECIFICATION		
5.1	UTM shall be Electro Mechanical Universal Testing UTM.		
5.2	Machine Capacity : 10 kN		
5.3	Over all class of the UTM shall be 0.5 as per IS1828-part I/ ISO 7500-part 1		
5.4	Load Accuracy: Equal to or better than $\pm 0.5\%$ of indicated load within 2% to 100% of load cell capacity.		
5.5	Test width 400 mm or more.		
5.6	Cross Head Traveling excluding grip should be 1050 mm or more.		
5.7	Cross Head Speed range during test condition: 0.001 to 1000 mm/minute or better. There shall be facility on the local control panel to move the cross head up and down independent of UTM operating software.		
5.8	Cross Head Speed range 0.001 to 1000 mm/minute or better.		
5.9	Cross Head speed accuracy: 0.1% of set speed or better.		
5.10	Position/ displacement measurement accuracy : ± 0.01 mm or 0.05% of displacement (whichever is greater), or better.		
5.11	Position/ Displacement resolution: 1 micron or better.		
5.12	UTM should have facility for zero point correction (for both load and distance).		
5.13	There shall be facility to load the sample from fully open front wedge type grip.		
5.14	The UTM shall be able to work in the temperature range of 10°C - 35° C.		
5.15	The UTM, including attachments and accessories, should be suitable for continuous operation to its full capacity for eight hours in a day.		
5.16	There shall be facility to test the spring constant (compressive length per unit load) with local control panel as well as PC based software. The test includes compressing the spring between compression plates and taking readings at different compressive lengths. (Manual calculation is done as per displacement and force reading).		
5.17	The overall range of the UTM i.e. from 1 kN to 10 kN shall be available at a time.		
5.18	The UTM shall be screw driven with no overhead motor.		
5.19	There shall be facility for automatic recognition and calibration of load cell.		
5.20	The machine shall be electro mechanical and its operation (including operation of grips) shall not be done by hydraulic / pneumatic system.		
5.21	Frame stiffness shall be 70 kN/mm or better.		

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6.0	ACCESSORIES (UNIT PRICE TO BE FURNISHED)		
6.1	LOAD CELL		
6.1.1	One compatible Electronic load cell of capacity 10 kN has to be supplied.		
6.1.2	One compatible Electronic load cell of capacity 500 N has to be supplied.		
6.1.3	The accuracy of the load cell shall be as per defined in clause 5.4.		
6.1.4	Facility for automatic identification of load cell shall be provided.		
6.1.5	Load cells should be robust in order to withstand the forces up to 150% of their indicated value.		
6.1.6	Effective warning system to protect the load cell from overloading shall be built into the system.		
6.1.7	The entire measurement range should be available in even with preloads caused by test fixtures or specimen grips.		
6.1.8	Load cells should conform to or exceed DIN 51221, EN10002-2, ASTM E4, ISO 7500-1		
6.2	GRIPS		
6.2.1	Suitable Grips made up of hardened steel to hold the flat and round specimens for tensile mode and compression plates for compression mode covering following dimensions shall be supplied with UTM (One set of grips for flat specimen and one set for round specimen).		
6.2.2	Jaws for flat test piece shall be able to hold test piece of thickness of 1 mm to 12 mm or wider.		
6.2.3	Jaws for round test piece shall be able to hold test piece having dia of 4-15 mm or wider.		
6.2.4	One pair of case hardened compression plates having dia from 125- 156 mm shall be provided.		
6.2.5	The grips should be efficient to avoid any chances of slippages. (Materials tested will be metals in the shape of plates, rods, sheets etc. of copper, iron and its alloys, insulation sheets, pre compress pressboards etc.)		
6.2.6	Grips and Jaws shall be self aligned, wedge type having manual screw type or lever type mechanism to provide the initial gripping and allow rapid loading and unloading of the specimen.		
6.2.7	Flat and round test grips shall be able to withstand the temperature in the Heating chamber/ furnace (up to 250°C) without any damage (materials to be tested in the furnace are wood, insulation sheet, iron, copper samples etc.).		
6.2.8	Hardness of grips shall not be less than 55 HRC.		
6.2.9	Suitable cord grip shall be provided for testing of metallic or non metallic cords of dia 2-10 mm for testing up to 10kN load.		
6.2.10	One set grips with of flat rubber coated jaw faces has to be supplied. These will be used for testing of sheet materials, paper, plastic films, and waxed paper of width up to 75 mm and thickness up to 1mm. (unit price to be quoted in price bid).		
6.2.11	One set of heavy duty vice grip with facility of exerting considerable gripping pressure via hand wheel/ lever etc. has to be provided. The jaws shall be corrugated. Dimension of the samples : width 75mm and thickness 2mm (unit price to be quoted in price bid).		

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6.4.0	EXTENSOMETER		
6.4.1	The vendor shall supply one suitable strain gauge based axial electronic extensometer having following specification along with UTM:		
6.4.2	One extensometer of 50 mm gauge length with axial travel of 1 mm or more.		
6.4.3	The extensometer shall be robust and should clamp effectively on round and flat specimen. Thickness of flat specimen will vary from 5-10 mm and dia of round specimen will vary from 5 to 15 mm.		
6.4.4	The extensometer shall Comply with ISO 6892 Part I, ISO 9513 class 0.5 or ASTM E83 class B1 for accuracy.		
6.4.5	Extensometers shall be of spring loaded/ clip on model with one hand mounting facility.		
6.4.6	The reading from the extensometer shall be automatically transported to adjoining computer with real time transferring of data and corresponding graph showing value of proof stress be displayed in real time.		
6.5.0	HEATING CHAMBER / FURNACE COMPATIBILITY		
	There shall be provision in the hardware (grips, testing platform etc.) and software of UTM to add on a roller mounted heating chamber in future if required.		
6.6.0	PERSONAL COMPUTER & PRINTER (MINIMUM REQUIREMENT)		
6.6.1	One Desktop personal computer suitable for operation of the system shall be supplied along with the UTM.		
6.6.2	PC shall be of latest configuration and having following minimum specifications:		
6.6.3	Make IBM, Dell/ HP.		
6.6.4	8 GB RAM DDR3, core i5/i7 processor or better, 500 GB internal memory, 64 bit system.		
6.6.5	LCD screen (at least 17" flat monitor, screen resolution 1280x1024 or more).		
6.6.6	Mouse and keyboard as input devices.		
6.6.7	UPS of adequate capacity to cover PC & Printer.		
6.6.8	One colour laser printer (having 3 coloured and one black cartridge), make HP/ Canon of A4 size shall be supplied along with the UTM for printing of graphs, test results in A4 format.		
6.6.9	Compatible cables for connection shall be supplied along with the equipment.		
6.6.10	Any additional equipment/accessories required for satisfactory operation of the system and identified during commissioning shall be supplied by vendor without any price implication.		
6.6.11	The PC shall have licensed windows OS (Win 10 or later) installed. Any other software installed on the PC shall also be a licensed version. CD of the OS has to be supplied.		
7.0	PLATFORM		
6.7.1	A suitable mounting table for the UTM, having drawers for keeping tools, fixtures, accessories shall be supplied.		
6.7.2	Height of the platform shall be 28-32 inch with adequate width to accommodate the UTM and personal computer.		
7.0	CONTROL OF UTM		
7.1	UTM shall be able to be controlled from local control panel with screen which shall control as well as display the test results.		
7.2	Additionally the UTM shall be able to be controlled by a UTM operating software installed on a PC (to be supplied by Vendor as per clause 6.6.0).		
7.3	The control of the UTM either by local panel or PC shall be complete and independent of each other.		

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8.0	SOFTWARE & PC INTERFACE		
8.1	UTM Operating Software (hence forth UOS) shall have following features:		
8.1.1	UOS shall be licensed version, fully compatible with the latest version of Windows installed on the personal computer as specified in clause 6.6.0.		
8.1.2	UOS shall have user friendly interface, self learning module/ detailed user guide/ tutorials, interactive help options.		
8.1.3	There should be direct communication interface between the UTM and PC.		
8.1.4	In case of any upgradation of UOS within five years, it shall be provided and installed at BHEL works without any price implication.		
8.2	DATA INPUT		
8.2.1	The UOS shall be able to capture real time data during testing. The data from extensometer, heating chamber etc. should also be transferred to the PC in real time.		
8.3.0	OPERATION		
8.3.1	The UOS shall have library of test method for tensile, compression, bend test and other parameters and shall be able to control all the functions of the UTM.		
8.3.2	The UOS shall have facility to control the stress and strain rate of testing.		
8.3.3	Facility shall be available to create multiple customized test requirements, procedures so that by merely putting the standard of the material (i.e. IS 1608, ASTM A 370 etc.) the sample characteristics, testing requirement could be ascertained automatically.		
8.3.4	UOS along with UTM & controller should have the ability to perform the test in various modes like stress, strain, force and displacement control and these to be done in close loop and these should comply the various test standards.		
8.3.5	The UOS should provides the following results :Force at break, Strain at break, strain at maximum force, strain at reference values, yield strain, upper/lower yield stress, e-modulus, proof stress ratio, yield stress ratio, anisotropy etc.		
8.3.6	The UOS shall be able to plot real time curve of following:		
8.3.6.1	stress vs. strain		
8.3.6.2	load vs. position		
8.3.6.3	stress vs. time		
8.3.6.4	strain vs. time		
8.3.6.5	any other by default		
8.3.6.6	Elongation of the sample shall be displayed without using an extensometer.		
8.3.6.7	An installation CD of the UOS shall be provided so that UOS can be loaded on another PC in case of failure of parent PC.		
8.4	DATA OUTPUT		
8.4.1	UOS should have the facility to do statistical evaluation/ comparison for given sample or stored batch (based on material specification, with in a particular period etc.).		
8.4.2	UOS should be in position to store and export results in various format like excel, XML, PDF etc. in the format as per IS 1608, ISO 6892, ASTM A370 and other customized requirements.		
8.4.3	Built-in methods library as per ASTM, ISO and other international standards		
8.4.4	Option of multiple graphs on same screen and facility of curve regenerations and post-test analysis functionality.		
8.4.5	There shall be facility of loadcell overload protection and crosshead over travel protection in software.		

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9.0	ELECTRICAL SYSTEM:		
9.1	The system shall work on following Power Supply available at BHEL. 240 VAC (+10% -15%), 50 Hz $\pm$ 3%, single phase OR 415 VAC (+10% -15%), 50 Hz $\pm$ 3%, 4 wire system		
9.2	All type of cables, connectors, prefabricated communication cables etc. required for connecting different parts of the UTM/control cabinets, shall be supplied by vendor, whether specifically mentioned or not.		
9.3	All electrical/ electronic control cabinets & panels should be dust, vermin, rodent proof & earthed when being installed.		
9.4	All power supply related devices (Protection devices, Stabilizers etc.) if required, shall be supplied along with the UTM.		
10.0	CALIBRATION:		
	The UTM shall be calibrated in all ranges covering minimum and maximum measurable points by any accredited (against ISO 17025) competent calibration agency/NMIs. The Calibration Certificate shall be compatible with ISO 7500 and shall be endorsed by accreditation logo.		
11.0	COMPLIANCE:		
11.1	Equipment shall be complied with the requirement of EN10002-1, ASTM E-8, IS 1608 & ISO 6892-1:2009.		
12.0	ENVIRONMENTAL PERFORMANCE OF THE UTM:		
12.1	The UTM should conform to following factors related to environment:		
12.2	Maximum noise level shall be $\leq$ 60 dB(A) at normal load condition, 1 meter away from the UTM with correction factor for back ground noise, if necessary. This would be verified with practical demonstration.		
12.3	There shall not be any emissions from the UTM except particles of samples produced during testing. Suitable arrangement shall be there to ensure that the particles of tested samples do not enter in to UTM thereby interfering with its smooth operation. Vendor to provide details.		
12.4	No hazardous chemicals shall be required to be used in the UTM.		
12.5	If any safety / environmental protection enclosure is required it should be built in the UTM by the vendor.		
12.6	Paint of the UTM should be oil/ grease resistant and should not peel off and mix up with them.		
13.0	SAFETY ARRANGEMENTS:		
13.1	Following safety features in addition to other standard safety features should be provided on the UTM:		
13.2	UTM should have adequate and reliable safety interlocks / devices, guards to avoid damage to the UTM, work piece and the operator due to the malfunctioning or mistakes or any danger arising out of the general use. UTM functions should be continuously monitored and alarm / warning indications should be available. Details to be furnished.		
13.3	All the pipes, cables etc. on the UTM should be well supported and protected.		
13.4	Emergency Switch at suitable location as per International Norms are to be provided.		
14.0	SPARES: OPTIONAL, TO BE QUOTED SEPARATELY		
14.1	Vendor shall quote for unit price of all spares for the equipment, Recommendation for spares to be given for 5 years trouble free running of the equipment. Spares will be procured as per requirement. Note: Prices of spares will not determine the L-1 criterion for the equipment.		
14.2	All types of spares for total UTM and accessories should be available with the vendor for at least ten years after supply of the UTM. If UTM or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide details of recommended spares & suppliers to enable BHEL to procure these in advance, if required.		

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15.0	PRE DESPATCH INSPECTION/ ACCEPTANCE OF UTM		
15.1	Pre dispatch Inspection of the complete system including physical verification, functionality testing and accuracy verification shall be done by BHEL at OEM's works. Four weeks advance information shall be furnished for inspection. Travel, boarding & lodging charges will be borne by BHEL.		
15.2	Specifications mentioned in clause 5.0 shall be demonstrated by vendor to BHEL engineers during pre-acceptance tests at OEMs works. The equipment is to be completely tested and inspected and duly verified by BHEL Engineers before dispatch and four copies of inspection certificates are to be provided by vendor with UTM.		
16.0	ERECTION AND COMMISSIONING		
16.1	Erection & Commissioning is to be done by vendor at Mechanical Lab(TSD), BHEL Bhopal, India.		
16.2	Schedule of Commissioning shall be submitted with the offer.		
	Supplier shall carry out erection, commissioning, testing of UTM, it's control & all types of other supplied equipment, demonstration of all the features of the UTM, testing of material samples and software etc. to the satisfaction of BHEL engineers without any price implication. In case there is price implication the same shall be quoted as lump sum price which shall be loaded to vendor's offer. Per day price will not be acceptable.		
16.4	Service requirement like power shall be provided by BHEL at only one point to be indicated by supplier. Connectivity of the system with power supply from that point shall be the responsibility of the supplier. The Other requirements like crane and helping personnel shall be provided by BHEL. Details of these requirements should be informed by vendor in advance.		
16.5	All tools and equipment required for erection of the UTM shall be brought by the vendor. The clearance(between wall and platform) required for the rolling facility of heating chamber to be installed shall be clearly mentioned by the supplier.		
16.6	Vendor shall submit the layout drawing for BHEL's information within two weeks from the date of P.O. The Layout should consist of all requirements pertaining to UTM and all accessories.		
17.0	FINAL ACCEPTANCE		
17.1	Two samples in each mode, (compression & tensile) will be tested at BHEL.		
17.2	Capacity, accuracy, speed, software performance etc. will be rechecked at BHEL.		
17.3	Final acceptance of the UTM at BHEL will be given after verification and ensuring that all the clauses of this specification are duly complied and the required training as per clause 20.0 has been provided to the BHEL personnel. Calibration at BHEL Bhopal to be done by a NABL accredited lab after installation and certificates to be given to BHEL.		
18.0	GUARANTEE		
18.1	The equipment should be guaranteed with respect of design, material construction, operation and any manufacturing defects for a period of 24 months from the date of receipt of complete equipment at BHEL Bhopal or 18 months from the date of commissioning, whichever is later. Four copies of Test certificates and Guarantee certificates are to be furnished before dispatch.		
18.2	Free after sales service including spares is to be provided during the guarantee period at BHEL Bhopal.		
18.3	Prompt service during guarantee period is to be ensured.		

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19.0	PACKAGING		
19.1	Rigid, seaworthy packing for all items of complete equipment, all accessories and other supplied items to avoid any damage / loss in transit shall be done.		
20.0	TRAINING		
20.1	BHEL Persons shall be trained at BHEL immediately after installation in the area of (a) use of all the aspect of UTM and the controlling Software (b) Electrical, Electronic, Mechanical & general maintenance for UTM & other supplied equipment and accessories. (c) Operation of the UTM & other supplied equipment.		
20.2	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel without any price implication		
20.3	Expenditure of training cost if any shall be quoted as total consolidated training cost (Inclusive of travel Lodging & boarding of Expert) which will be loaded to the vendor's offer. Per day charges are not acceptable.		
	LITERATURE WITH OFFER		
21.1	The following documents amongst other shall be enclosed with offer by vendor.		
21.2	Supplier shall enclose the leaflets/ catalogue/ brochure having detail specification, photograph, Model No & Manufacturers Name of offered equipment.		
21.3	A detailed sketch/ drawing of the UTM has to be submitted showing its dimensions.		
22.0	DOCUMENTATION TO BE SUPPLIED WITH THE UTM		
22.1	Four sets of Operation and Service Manual (two hard and two soft copies) shall comprise of operating procedure, calibration procedure, applicable calibration certificates, trouble shooting charts, circuit/block diagram and parts list etc. have to be supplied.		
22.2	Backup/ setup of all installed software (including OS) with license/ keys have to be supplied.		
22.3	Ghost backup of HDD of PC after final commissioning		