

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
1.0	PURPOSE & WORKPIECE MATERIAL				
1.1	Purpose:				
	Impulse Generator System is required for impulse testing (Lightning and Switching) of power transformer, Reactors, Bushings, CTs & CVTs.	Vendor to note			
1.2	Jobs to be tested : Power Transformers will include following maximum ratings: Max. rating 500 MVA, 3 Phase, 400 kV and 500 MVA, 765 kV 1-Phase Reactors: Max 150 MVA, 3 Phase, 400 kV, 110 MVA, 1-phase, 765 kV Bushings, CTs & CVTs etc. upto 800 kV	Vendor to note			
	Quantity : 01 Nos.				
2.0	SPECIFICATION:				
2.1	Impulse Voltage Generator				
2.1.1	Voltage rating : 4000 kV	Vendor to confirm			
2.1.2	Energy : 400 kJ	Vendor to confirm			
2.1.3	Impulse generator should have the flexibility of connecting at least 4 stages in parallel to deliver high energy at lower voltage (200 kVp).	Vendor to confirm			
2.1.4	Impulse Generator should have separate spring contacts for front and tail resistors. It should have sufficient (minimum 3) connecting sockets for front resistor and two parallel for the tail resistors in order to allow maximum number of different combinations of front and tail resistors to achieve the desired wave-shape for different loads.	Vendor to confirm			
2.1.5	Impulse generator structure should be designed to withstand earth quakes as per IS 1893 pt 4. Basic Horizontal Seismic Coefficient for Bhopal is Zone II and Zone Factor 0.10	Vendor to confirm			

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2.1.6	Impulse Generator shall have proper construction of supporting structure for its mechanical stability and for the enclosure of the main spark gaps.	Vendor to confirm			
2.1.7	Impulse Generator construction shall have integrated safety grounding system which discharges all potential terminals of all stage impulse capacitors of the impulse generator. The earthing system must function even in case of power outage and should operate fully automatically.	Vendor to confirm			
2.1.8	Impulse Generator shall have modular design for ease of quick installation. Each module should comprise of minimum 3 stages.	Vendor to confirm			
2.1.9	Impulse genearator should have provision of steps inside it to climb in the generator upto top for changing resistance and connecting generator for different configuration.	Vendor to confirm			
2.2	SET OF RESISTORS:				
2.2.1	Set of resistors suitable for lightning impulse required for Testing Transformers, Reactors, CTs, CVTs, Bushings as per details given above. Vendor to specify the total number of front and tail resistors included in the scope of supply.	Vendor to specify & confirm			
2.2.2	Set of Switching Impulse resistors (as per IEC 60076) required for Testing Transformers, Reactors, CTs, CVTs, Bushings as per details given above. Vendor to specify the total number of front and tail resistors included in the scope of supply.	Vendor to specify & confirm			
2.3	CHARGING RECTIFIER : 200 kV, 200 mA.	Vendor to confirm			
2.4	Control unit housed in Industrial PC based computerized system with keyboard, mouse and 19 inch monitor (portable on wheels) to be supplied with: Set of control cables, length 60 m (Control cables to be supplied with the junction box of suitable rating to easy movement of Impulse generator in test bay).	Vendor to confirm			

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2.4.1	Controller Hardware with features: Analog to digital conversion of the measured impulse signal. Control and regulation of the charging voltage. Time control of triggering, generation of trigger impulses for the measuring system and chopping device. Synchronization of the triggering with an AC voltage. Digital input and output ports. Generator controls and measuring system shall communicate to allow efficiency correction of charging voltage. This allows to enter test voltage rather than charging voltage.	Vendor to confirm			
2.4.2	Software for operation of Impulse Test System should include the following features: Configuration of impulse test system for particular test conditions. Configuration of system with regard to the external measuring device. Besides fully automatic operation software should allow manual / semi-automatic operation of the test system and selection of every individual parameter (i.e. charging voltage, no. of stages, generator gap, chopping gap) plus manual release of trigger impulse. Indication of pre set levels and actually measured voltage. Impulse counter for a pre-selectable number of pulses with automatic stop. Detection and display of flashovers, indication of trip levels, system status and failure condition. (All the parameters to be set up the PC and values displayed on the screen) Any other function required for satisfactory operation should also be included.	Vendor to confirm			
2.5.0	Impulse Voltage Divider (CR type): Transformation ratio and transfer behaviour should comply with requirements of IEC 60060-2 edition 2011 requirements with respect to measuring accuracy and dynamic behaviour.	Vendor to confirm			
2.5.1	Voltage rating : LI 3000 kV or above for negative and positive polarity (LI), SI - 2000 kV or above for negative polarity, 1700 kV and above for positive polarity	Vendor to confirm			
2.5.2	Measuring cable : 40 m. each - 8 nos.	Vendor to confirm			
2.5.3	Secondary LV Units - 2 Nos. for different impulse ratios.	Vendor to confirm			

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2.6.0	MULTIPLE CHOPPING GAP.				
2.6.1	Voltage : 3000 kV	Vendor to confirm			
2.6.2	Stages : Minimum 5 Modules	Vendor to confirm			
2.7.0	Overshoot Compensation Device: Internal serial overshoot compensation device with compensating capacitor in parallel to compensating resistor and compensating inductor is connected in series to the impulse capacitances (Divider / Test Object) should be provided to compensate the loop inductance. Vendor to confirm that use of overshoot will not affect the efficiency of Impulse	Vendor to confirm			
2.7.1	Impulse Generator efficiency under no load conditions with and without overshoot compensation device will be more than 90% for LI test.	Vendor to confirm			
2.8.0	High Resolution Impulse Measuring and Analyzing system				
2.8.1	No. of channels : 4 (Each channel should be an independent channel insert & detachable)	Vendor to confirm			
2.8.2	Amplitude resolution : 12 - bit or better	Vendor to confirm			
2.8.3	Sampling rate: 120 MS/sec or better	Vendor to confirm			
2.8.4	HV input : Max. 1950 Vpp	Vendor to confirm			
2.8.5	Amplitude uncertainty: $\leq 1\%$	Vendor to confirm			
2.8.6	Time parameter uncertainty: $\leq 2\%$ for LI & SI $\leq 2.5\%$ for LIC	Vendor to confirm			
2.8.7	Measurement, evaluation and analysis of impulse voltage and impulse current shall be as per IEC 61083, IEC 60060 edition 2010-11, IEC 60076	Vendor to confirm			
2.8.8	Impulse analysing system should be installed in mini rack with desk top version. It should be combined with rack for control unit to get better space utilisation.	Vendor to confirm			

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2.9	<p>Standard Analysis Software of Impulse Analysing system with features as below: Should be latest licensed windows based operating system (WINDOWS 10 or above). Minimum 8th Gen. Intel i7 processors, 8 GB RAM, 1 TB HDD, 2 GB Graphics, 16X DVD+/-RW DRIVE & minimum 1 HDMI, 2 USB Slots. Should have flexible configuration of report generation eg.incorpoation of BHEL logos etc. Should allow independent adjustment of all parameters like sampling rate, range etc. for every channel. Should allow automatic wave form analysis in full accordance with IEC61083-2. Should allow software calibration in full accordance with IEC 61083-2. Should allow fully automatic hardware calibration with 4 channel Reference Impulse calibrator(RIC). Should allow superimposed display of at least two impulse waves with comparison of differences. Should allow step response measurement analysis. All other supporting software must be installed on the computer. (All the softwares must be original and licensed.)</p>	Vendor to confirm			
2.9.1	Licensed latest Office software to analyze measurement on PC	Vendor to confirm			
2.9.2	Coherence and transfer function software should give graphical representation and screen display of corresponding curves.	Vendor to confirm			
2.9.3	Impulse analysing software should have full IEC 61083 calibration routine (press start .. get a report) together with Reference Impulse Calibrator without any further manual operations (to allow overnight calibration)	Vendor to confirm			
2.10	The impulse generator system should be fitted on Aero caster for movement of system. The aero caster system should contain following:	Vendor to confirm			
2.10.1	Load Module system: Load carrying pallets and rubber pads suitable for carrying system load	Vendor to specify and confirm			
2.10.2	Control console(for controlling of air pressure)	Vendor to specify and			
2.10.3	Hose reel with suitable pipes for connecting pallets to control console and compressed air pressure points	Vendor to specify and confirm			

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2.10.4	Vendor to specify the mode for movement (drive or manually). The system should supplied with suitable drive(if applicable)	Vendor to specify and confirm			
2.10.5	Air supply system :- BHEL will provide compressed air supply at maximum 6 bar with wetness of air between 60% to 98%. Suitable arrangement to be made by vendor.	Vendor to note and confirm			
2.11	Set of cage shunts for current measurement (4 nos. of shunt of different values varies from 0.1 ohm to 1.0 ohm)	Vendor to specify and confirm			
2.12	Base Load Capacitor for achieving desired SI waveshape on Shunt reactor as per IEC 60076 - 1700 kV minimum				
2.13	Any item/components not listed above required for achivement of the required impulse (lightning and switching impulse) parameters as per IEC 60076, IEC 60060 for the jobs listed in clause 1.2 shall be in vendor's scope and should quoted and supplied by vendor.	Vendor to specify and confirm			
2.14	SAFETY ARRANGEMENTS:				
	Following safety features in addition to other standard safety features should be provided on the system:				
	1. Impulse generator should be equipped with the automatically controlled safety system which switches off the generator, shorts and grounds all capacitors automatically upon power failure or opening of safety inerlock.	Vendor to confirm			
	2.System should have adequate and reliable safety interlocks / devices to avoid damage to the system, workpiece and the operator due to the malfunctioning or mistakes.	Vendor to confirm			
	3. All electronics parts are housed in EMI/EMC compatible shielded enclosures.	Vendor to confirm			
2.15	ENVIRONMENTAL PERFORMANCE OF THE SYSTEM:				
	The Instrument shall conform to following factors related to environment :				
	(a) If any safety / environmental protection enclosure is required it should be built in the system by the vendor.	Vendor to confirm			

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3.0	ACCESSORIES:				
3.1	Vendor to furnish list and details of accessories if any	Vendor to specify			
4.0	SPARES (Optional - to be quoted seperately):				
4.1	The vendor to submit list of mandatory spares & all spares for the equipment and quote for the unit price of each spare. Note: The price of the spares will not be considered for the evaluation of the machine cost (L1 criteria).	Vendor to Specify			
5.0	DOCUMENTATION : Following documents in English language should be supplied along with the system				
5.1	Two sets in hard copies of Test certificate and warantee certificate for 24 months from date of commissioning of system.	Vendor to Confirm			
5.2	Two sets in hard copies of detailed electrical schematic of the system, Operation and Service Manual shall be supplied comprise of operating procedure, calibration procedure, maintenance manual with trouble shooting charts and detail circuit diagram and parts list.The uploadable software backup to be provided.	Vendor to Confirm			
5.3	Soft copy of manuals mentioned in clause 5.2 - 3 sets	Vendor to Confirm			
5.4	Ghost backup of HDD of the PC based system	Vendor to Confirm			
5.5	Backup of all installed software(including OS) with key/ licence	Vendor to Confirm			
5.6	One set of calibration certificate from the calibration lab having scope of impulse calibration in their accreditation certificate as per ISO 17025. Lab accreditaion should have traceability from International Calibration Agency(ILAC)	Vendor to Confirm			

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6.0	CRITERIA FOR DESPATCH CLEARANCE:				
6.1	Inspection at suppliers works before dispatch	Vendor to Confirm			
6.2	All routine and type tests to be performed at supplier's works on all components of the system before dispatch in presence of BHEL representatives. List of tests to be furnished alongwith the offer.	Vendor to specify & confirm			
6.3	Demonstration of all features of the Impulse Generator system.	Vendor to Confirm			
6.4	Calibration tests on Impulse measuring system as per IEC 60060 and IEC 61083	Vendor to Confirm			
7.0	TRAINING:				
7.1	BHEL testing engineer and maintenance person should be trained at supplier's Works for 5 days period in the area of (a) Use of all system Features, programming for Measuring Systems & supplied accessories etc. (b) Electrical, Electronic & maintenance for system & other supplied equipments	Vendor to Confirm			
7.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to Confirm			
7.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to Confirm			
8.0	INSTALLATION & COMMISSIONING				
8.1	Supplier have to take full responsibility for carrying out entire installation and commissioning of the equipment. Complete commissioning, testing including all the tests will be in the scope of supplier. Commissioning to be done in presence of technical expert.	Vendor to Confirm			
8.2	Successful demonstration of voltage generation and measurement of voltage and time parameters upto 3000 kV for lightning impulse with chopping and upto 2000 kV switching impulse without load with display of all the parameter like voltage, current, time, chopping time, polarity reversal etc.	Vendor to Confirm			

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8.3	Successful conduction of Lightning and switching impulse test on 2 Nos. of Power Transformer or Shunt Reactor (Provided by BHEL at Bhopal Works) upto rated voltage of that particular transformer & reactor. It include voltage generation and measurement of voltage and time parameters as per IEC 60060-1 and IEC 60076 latest revision and achieving relative overshoot less than 5% in the provided transformer or reactor.	Vendor to confirm			
8.4	Demostration by actual use of the supplied equipment and its accessories.	Vendor to confirm			
8.5	Commissioning spares shall be brought by the supplier.	Vendor to confirm			
8.6	Schedule of Commissioning shall be submitted with the offer.	Vendor to confirm			
8.7	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.	Vendor to confirm			
9.0	ACCEPTANCE CRITERIA:				
9.1	Successful conduction of impulse test on 02 Nos Transformers or shunt reactor. The test object for measurement will be provided by BHEL at Bhopal plant.	Vendor to confirm			
10.0	AMBIENT CONDITIONS & THERMAL STABILITY :				
10.1	Total System and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply: Voltage: 415 V $\pm 10\%$, 3-phase, 3-wire supply with no neutral Frequency: 50 Hz ± 1.5 Hz Operating Humidity : 10% to 90% Operating Temperature : 5°C to 40°C for HV components mounting outside control room BHEL will provide compressed air supply at maximum 6 bar with wetness of air between 60% to 98%. (Vendor to confirm that system is suitable for above and details of provisions on the system for the same are to be furnished by Vendor. The ambient conditions mentioned above for control system will be made available with suitable air-conditioning at works.)	Vendor to confirm			

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10.2	Thermal Stability of the complete system keeping in view specified Ambient Conditions and accuracy requirements of BHEL components and trouble free operation of the system should be ensured by vendor. (Vendor to confirm that system is suitable for above and details of provisions on the system for the same should be furnished by Vendor)	Vendor to confirm			
11.0	PACKING:				
11.1	Air worthy/Sea worthy & rigid packing for all items of complete system, all Accessories and other supplied items to avoid any damage/loss in transit. When system is despatched in containers, all small loose items shall be suitably packed in boxes	Vendor to confirm			
12.0	GUARANTEE :				
12.1	24 months from the date of commissioning of the system.	Vendor to confirm			
13.0	GENERAL : The vendor should submit the following information along with offer:				
13.1	Equipment Model & make	Vendor to submit			
13.2	Total weight of the equipment	Vendor to submit			
13.3	Vendor to submit, along with offer, the reference list of customers where similar systems have been supplied mentioning the customer, Machine Model, major specifications of the supplied system, Year of Supply etc.	Vendor to submit			
13.4	Detailed catalogues , outline drawing/schematic/sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to submit			
14.0	QUALIFYING CONDITIONS :				
14.1	The supplier should either be an Original Equipment Manufacturer(OEM) or an authorised dealer of the OEM for the offered equipment. Dealers have to submit along with the offer, a valid Certificate of Authorisation from OEM for quoting the equipment, alongwith declaration for support from OEM for warranty, erection & commissioning, after sales service & necessary spares.	Vendor to specify & submit			

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14.2	The vendor (OEM or Principal of authorised representative) must have supplied and commissioned (directly or through any of its dealers) at least one equipment of OEM make of 4000 kV,400 kJ rating in the seven years (on the date of opening of Tender) and the equipment is working satisfactorily for more than one year after commissioning.	Vendor to confirm			
14.3	Following documents/information should be submitted by the vendor in reference to supplied equipment, this is required from all the vendors for qualification of their offer.	Vendor to submit			
14.3.1	One copy of Purchase Order in name of OEM or any Dealer/Vendor for equipment supplied in line with Clause 14.2	Vendor to submit			
14.3.2	Complete postal address and contact details of customer where above system is installed/supplied.	Vendor to Specify			
14.3.3	Month & Year of commissioning of equipment.	Vendor to Specify			
14.3.4	The PO copy to clearly mention name of item, type, make and model no. including other details.	Vendor to submit			
14.3.5	Catalogue of the supplied equipment if model is not same as the quoted one.	Vendor to submit			
14.3.6	Performance certificate (issued within 3 years of tender opening date) from the customers regarding satisfactory performance of the equipment supplied to them vide the Purchase Order as per clause 14.3.1. showing minimum one year satisfactory performance	Vendor to submit			
14.3.7	BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false/incorrect, the offer shall be rejected.	Vendor to note			
15	POINTWISE CONFIRMATION:				
15.1	Vendor should confirm/clarify pointwise (all the points) as per specification and provide technical leaflet, technical details, photographs, scope of supply etc. at the first instance.	Vendor to confirm			