Section IV T -Technical Specification

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Tender Enquiry No : CPRIBLR22UHVRL15C1101-GT

Description of the Equipment/Goods/Services : Impulse voltage test system

Note : 1) The technical bid submitted in other than this format is liable to be rejected.

2) All blue fields are mandatorily to be filled in.

Name and address of the bidder	
Quotation Number and Date	

Sl.No.	Technical Specifications/Parameters	Qty	To be completed by the Bidder		
			Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
	1.0. PREQUALIFYING REQUIREMENTS for BIDDER				
1	The bidder should have designed, manufactured, tested, supplied, installed and commissioned at least one numbers of 2000 kV 200 kJ Impulse voltage generator suitable for superimposed DC voltage testing during last five years from Original Equipment Manufacturer (OEM) and successful in operation for more than a one year. The bidder shall have to submit the documentary evidences such as performance certificate of test system by clearly indicating the ratings of system, model, type, serial number, suitable application for superimposed LI/SI on DC voltage and successful operation of the system for more than one year from the user. CPRI reserve the right to contact the user/organization, who has issued the performance certificate of the system. .	01 Number			
	Technical Specifications - Impulse Voltage Test System				
2	**Scope:** Design, engineering, supply, test, transportation, insurance, commissioning, installation and training of the complete Impulse voltage Test System (IVTS) as per the requirements mentioned in further sections				
3	1. ***Part-I: Impulse Voltage Generation System*** a. 3200 kVp, 320 kJ Indoor type Impulse voltage generator b. 3000 kVp Indoor type multiple chopping gap arrangement				
4	2. ***Part-II: Impulse Voltage Measuring System*** : a. 3200 kVp Damped capacitive voltage divider for impulse voltage measurement b. 250 MS/sec, 4-Channel impulse measuring system c. 1200 kV Resistive impulse voltage divider for measurement of steep front impulse voltages				
5	3. ***Part-III: Impulse Voltage Calibration System*** a. 800 kVp Universal Reference Voltage divider (Impulse, AC and DC) b. AC/DC Peak voltmeter				
6	**Ambient Conditions:** The ambient condition at installation location as indicated below				
6.1	Ambient temperature variation : 10°C to 45°C				
6.2	Relative Humidity : 40 % to 85 %				
6.3	Altitude : 542 m above sea level				
6.4	Seismic zone level : Zone-II				
6.5	Pollution severity zone : medium				

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7	**Installation location:** The impulse voltage test system shall be installed inside the indoor shielded laboratory of Ultra High Voltage Research Laboratory (UHVRL), Central Power Research Institute (CPRI), Hyderabad.				
8	**Main Power supply**: The following mentioned type of main supply is available at site for desired power requirement. a. 230 V, 50 Hz single phase b. 415 V, 50 Hz Three phase or two phase				
9	***PART-I: IMPULSE VOLTAGE GENERATION SYSTEM***				
9.1	***Application:*** The impulse voltage generator shall be able to perform the Lightning , switching impulse voltage tests and super imposed LI/SI impulse on DC voltage test on various AC and DC electrical equipment according to the standard impulse voltage waveform specified in the relevant technical committee of electrical equipment (IEC, ANSI, IEEE, other national standards etc). The major electrical equipment includes the distribution, power & inverter duty transformers, instrument transformer (IVT, CT, CVT), coupling capacitors, insulators, circuit breakers, disconnectors, GIS systems, Bushings, HVDC equipment (converters, SVC, DC insulators, etc), transient recovery voltage capacitors etc.				
9.2	**Input voltage** : As per the supplied design specification, The power supply available are single phase 230 V, 50 Hz or 415 V Three Phase or two phase supply at required power level				
9.3	Rated output voltage level : 20 kVp to 3200 kVp level (Lightning Impulse voltage) and Up to 2000 kVp for switching impulse voltage				
9.4	Rated Energy level : 320 kJ				
9.5	Max. load capacitance (test object capacitance): standard impulse voltage wave shape up to 2 nF and extended front time up to 8 µsec for capacitor voltage transformer with capacitance range up to 8.8 nF at 800 kV HSV level				
9.6	Number stages : 16 stages				
9.7	Rated voltage per stage : 200 kVp per stage				
9.8	Duty Cycle: 30 sec per impulse per 8 hours continuous duty up to 80% of charging voltage. One impulse per minute at 100% charging voltage				
9.9	**Installation**: Mobile type. The complete impulse voltage generator along with rectifier transformer shall be mobile with air cushion arrangement				
9.10	The impulse generator shall be designed for superimposed DC voltage test on HVDC equipment and supplied along with related protective equipment. **Note: The impulse voltage generator shall be demonstrated for superimposed testing during the commissioning stage.**				
9.11	**Rectifier Transformer**: The charging rectifier (200 kV) is used to charge the impulse capacitors of an impulse voltage with stage charging voltage up to 0-100 % of rated voltage of stage capacitor. The rectifier shall be able to reverse with motorized mechanism for polarity reversal. The peak inverse voltage of the rectifier shall be double the rated voltage of stage capacitor.				

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9.12	**Isolation transformer**: The delta start with neutral isolation transformer shall be provided for supply voltage to control circuit				
9.13	**Impulse stage capacitors**: Rated voltage : 200 kVp, Rated capacitance : As per the Manufacturer specifications, Type: Oil impregnated oil filled with low inductive nature or equivalent insulation type				
9.14	**Front time wave shape resistor**: The front time resistors shall be supplied with following set of values to control the front time of the impulse voltage wave shape				
	• Rated voltage level: 200 kVp per stage				
	• Rated Energy level: 30 kJ per stage				
	• Type: Wire wound, non-inductive type				
	• Insulation: Cast resin				
	• Number values: To meet the requirement of load range specified in S.No. 9.5				
	• Quantity required: 6 sets for Lightning impulse and Switching impulse to cover the load range specified in S.No.9.5				
	• Colour identification of each resistor with respect to its value				
9.15	**Tail Time wave shape Resistor** : The tail time resistors shall be supplied with following set of values to control the tail time of impulse voltage waveform				
	• Rated Voltage: 200 kVp per stage				
	• Rated energy level: 30 kJ per stage				
	• Type: Wire wound				
	• Insulation: Cast resin				
	• End fittings: End fittings of resistors shall be provided with suitable arrangement to insert into resistor housing slots				
	• Number of Values: To meet the requirement of load range specified in S.No. 9.5				
	• Quantity required: 6 sets for Lightning impulse and Switching impulse to cover the load range specified in S.No.9.5				
	• Colour identification of each resistor with respect to its value				
9.16	**Resistor Housing slot**: The mechanism shall be equipped with slot for placement of at least 3 numbers of resistors for front and tail time waveshape resistors				
9.17	**AC voltage regulation**: The AC voltage regulator shall be controller based on the charging voltage with specified time constant controller circuit.				

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9.18	**Glaninger Circuit: The Glaninger circuit shall be supplied to increase the generator testing range for low inductive loads**				
	Resistor : 50 Ω , 200 Ω, 400 Ω - 2 set for each resistor				
	Inductor : 0.1 mH, 0.2 mH, 0.3 mH - 2 set for each inductor				
9.19	**Overshoot compensation circuit:** The overshoot compensation circuit is an additional circuit to increase the impulse voltage testing range up to high capacitive load range to obtain the standard impulse voltage wave shape				
	This circuit shall be assembled inside the impulse voltage generator				
	Note: The overshoot compensation circuit functionality shall be demonstrated during the installation and final commissioning stage				
9.19	**Base of Impulse voltage Generator**: The base of the impulse voltage generator shall be equipped with rectangular steel frames.				
9.20	**Support Frame/Structures**: The internal insulating ladder shall be arranged inside the impulse voltage generator to reach maximum height of the generator to change the configuration of generator and any related regular maintenance				
	The insulating working platform shall be arranged at regular intervals (one working insulated platform for every three stages).				
	The steps of the insulated ladder shall be covered with special grip materials in order to ensure the safety of the working professionals.				
9.21	**Protective Grounding system**: The impulse generator shall be equipped with special grounding system which can be operated automatic mode and manual mode to de energizing the impulse generator				
	Earthing switches shall be provided to ground the generator at the first stage				
	Additionally, high speed earthing band moved into all stages to ground all the impulse capacitors shall be provided.				
9.22	**Corona rings**: The impulse voltage generator shall be provide the toroidal shaped corona rings of suitable dimensions shall be provided on top of last stage of impulse generator				
9.23	**Trigger Arrangement:** The trigger system shall be provided to trigger the first stage of impulse generator with suitable trigger arrangement				
	The time delay operation of trigger pulse control shall be implemented in range from 0 to 10µsec.				
9.24	**Impulse current measuring shunts**: Impulse current shunts will be used for measurement of impulse current.				
	Cage type design shall be used for impulse current shunts				
	Cage shunts consisting of a metal cylinder with coupling flanges and coaxial measuring LEMO connector shall be provided.				
	No. of Shunts: Five				
	Resistance: 0.05 Ω, 0.2 Ω, 0.5 Ω, 1 Ω and 2 Ω approximately - one for each resistor values				
	Maximum peak current: 20000A for 0.05Ω , 5000A for 0.22Ω, 1000A for > 0.5 Ω respectively				
	Partial response time : < 10 ns for each				
	Accuracy of resistance measurement: ≤ 1%.				

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10.0	**CONTROL SYSTEM**				
10.1	Test sequence: Auto, Semi manual and full manual mode of operations				
10.2	Trigger: Auto trigger mode and manual mode				
10.3	Test charging time shall be controlled about 30 sec to 100 sec range				
10.4	Protective options: Emergency button switch off the system, Test voltage charging limit, door interlocking arrangement system, over current protection, over/under voltage protection at input supply				
10.5	Indications: Input supply voltage, input charging current, charging voltage per stage, fault indication alarm etc				
10.6	Spark gap Adjustment: Semi/Spherical shaped spark gap with suitable dimensions for each stage shall be provided. The three electrode type trigatron arrangement shall be provided inside the spark gap of first stage generator with required triggering mechanism in Auto and manual mode of operations. The precise spark gap adjustment with range of 1 mm shall be controlled from the software through auto mode/ manual mode correspond to pre-set charging voltage. Provision for manual control of spark gap distance also provided.				
10.7	AC Synchronization / Other impulse voltage Synchronization: This feature mainly used during combined test on switchgear and control gear (Circuit breakers, Disconnectors & GIS equipment) across open switch contacts				
10.8	The synchronization control of phase angle shall be in the range from 0 to 360 degrees				
10.9	Isolation: The control equipment shall be provided with isolated power supply and necessary EMI filters at specified locations.				
10.10	Protective grounding control: The control of protective grounding system shall be provided in the control system and able to operate from the control desk				
10.11	Control system for multiple chopping gap arrangement: The necessary control system shall be included in the control desk of the impulse generator to trigger the multiple chopping gap and control the gap distance.				
10.12	Trouble shooting operation: display of fault message during the breakdown of system, allow the proper trouble shooting and safe operation of system				
10.13	User Friendly Control System: The charging and discharging process of impulse generator shall be controlled from the PC based user-friendly software system with following capabilities. The computer assisted operation of impulse voltage test system shall be provided with ease of control and built in safely interlocks for the test system. The system should have a high electromagnetic compatibility. All inputs and outputs are protected against over-voltages. All system components are grounded with a suitable material such as copper braid or foil to keep the ground potentials at a safe level. The display shall be wide and presentable for ease of monitor and settings. The control desk shall have high quality wheels with locking mechanism for ease of movement.				
10.14	ON/OFF Switch of the primary power supply				

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10.15	High voltage on/off switch				
10.16	Voltage UP/DOWN				
10.17	Emergency OFF				
10.18	Any other control for functioning of the test system to meet the requirement of reference standards. Provisions shall be made for safety relay driven interlocks to connect the following external devices:				
10.19	Safety external emergency switches. A lockable emergency switch shall be built into a separate case so that the switch can be placed as needed. Safety connecting loop for fences				
10.20	**Controller specifications**				
10.20.1	Operating system: windows based				
10.20.2	Processor: i7 intel processor or equivalent processor				
10.20.3	Hard disk: ≥ 250 GB				
10.20.4	Display unit: ≥ 24" with LCD/LED or any equivalent screen monitor				
10.20.5	RAM: ≥ 8 GB				
11	**Multiple chopping Gap Arrangement**				
11.1	The multiple chopping gap arrangement shall be provided to perform the chopped impulse voltage test. The ratings of multiple chopping gap shall be as follows				
11.2	Rated voltage level: 3000 kVp				
11.3	Type: Indoor and mobile type				
11.4	Time to chopping control range: 2 µsec to 6 µsec				
11.5	Trigger range for time to chop scattering : < ±200 nsec				
11.6	Chopping voltage variation: 40 kVp to 3000 kVp				
11.7	The multiple gaps shall be stacked with capacitors and inbuilt damping resistor				
11.8	The spheres shall be made with copper materials and coated with tungsten / other similar elements to reduce the unnecessary corrosion effects				
11.9	The multiple chopping gap arrangement shall be arranged with corona rings of suitable dimensions				
12	**PART-II: Impulse Voltage Measuring System**				
12.1	**Damped Capacitive Voltage Divider**				
12.1.1	Scope: designed, supply, tested and provide training as per the requirements elaborated in further sections. This divider shall be able to measure the lightning impulse (tail chopped, full wave), switching impulse voltages.				
12.1.2	The Divider shall have the primary arm and secondary LV arm to transmit the voltages through either co-axial cable or fiber optic transmission.				
12.1.3	Rated voltage level : 3200 kVp for Lightning Impulse voltage and 2000 kVp for Switching impulse voltages				
12.1.4	Rated primary arm capacitance : As per the manufacture specification				

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12.1.5	Internal resistance of HV arm : As per the manufacture specification				
12.1.6	External damped resistor : As per the manufacture specification				
12.1.7	Secondary low voltage arms: The secondary low voltage arms shall be designed to reduce the interference voltage level to meet the standard requirements				
12.1.8	secondary LV arms shall be designed in modular nature and easily replace with different type of secondary arms. LEMO type connector shall be provided in each secondary arms for connecting the transmission cable to impulse measuring system				
12.1.9	Type of installation : Mobile type installation				
12.1.10	Application : Indoor type application				
12.1.11	Corona rings : Top of the damped capacitive voltage divider shall be fitted with toroidal type corona rings to avoid the unnecessary discharges during the impulse testing at max voltage levels.				
12.1.12	Supporting Arrangement : The divider shall be supported with suitable insulated guy wire arrangement for long term stability. The arrangement of guy wire system will not influence the stray capacitance of the divider				
12.1.13	Divider ratio stability per 2 year : < ± 1 %				
12.1.14	Response parameters for impulse voltage measurement				
	Partial response time: ≤ 100 ns				
	Experimental response time: ≤80 ns				
	Overshoot : <20%.				

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12.1.16	The Damped Capacitor voltage divider shall have the following capabilities with respect to measurement uncertainty at probability of 95% with coverage factor of k=2				
	Lightning impulse voltage amplitude : <3%				
	Switching impulse voltage amplitude : <3%				
	Time parameters (T1, T2, Tc) : <5%				
12.2.	**Resistive voltage Divider for Steep front impulse voltage applications**				
12.2.1	Scope: Design, Manufracture, tested, supply, transportation, demonstration of restive voltage divider for steep front impulse voltage measurements				
12.2.2	Rated voltage level : 1200 kVp				
12.2.3	Primary resistance : As per manufacture practice				
12.2.4	Secondary resistance : As per manufacturer practice				
12.2.5	External damping resistor : external damping resistance of appropriate value shall be used to get the response parameters				
12.2.6	Applications: Indoor applications				
12.2.7	Installation: Mobile type				
12.2.8	High voltage resistor shall be equipped with cylindrical made epoxy resin structure with Corona rings shall be fitted on the top terminal of divider				
12.2.9	The secondary unit shall be fitted with LEMO connector. It consists of resistors of low inductance arranged in a coaxial design. The unit shall be fixed at the bottom of the divider and can easily be disassembled.				
12.2.10	The complete divider shall be equipped on the wheel arrangement for easy movement.				
12.2.11	Secondary Output voltage : ≥1000 Vp				
12.2.12	Response parameters for impulse voltage measurement				
12.2.13	The experimental response time shall be less than 50 nsec				
12.2.14	The partial response time shall be less than 55 nsec				
12.2.15	The measurement uncertainty for the complete system for full and front chopped impulses shall be less than 10% at 95% probability level with coverage factor of k=2.				
13	**Digital Impulse Analyzing System**				
13.1	Number Channels : Four channels				
13.2	Rated voltage range : ±5 Vp to ±2000 Vp with at least six voltage measurement ranges				
13.3	Rated resolution : ≥14 – bit				
13.4	Analog Bandwidth (- 3 dB) : ≥ 100 MHz				
13.5	Sampling rate : Sampling rate shall be selected for independent channels ranging from 1 MSample/sec to 250 MS/sec				

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13.6	Input impedance : ≤10 pF // ≥1 MΩ				
13.7	Rise time : < 10 nsec				
13.8	Integral Non Linearity : < 0.5 % FSD				
13.9	Differential Non Linearity : < 0.5% of FSD				
13.10	Dynamic scale factor : <0.5% for measurement from 0.5 µs to 100 µsec				
13.11	Internal Noise level : < 0.4 %				
13.12	Disturbance influence : < 0.5%				
13.13	Over voltage protection : 3000 Vp				
13.14	Direct voltage measurement : ≥10 Vp				
13.15	Scale factor of the measuring system : < 0.5%				
13.16	Error in Time base : < 0.1%				
13.17	Software Analysing Applications: The following software analysing application shall be provided				
13.17.1	Lightning Impulse (LI) voltage measurement				
13.17.2	Front chopped impulse voltage measurement				
13.17.3	Tail chopped impulse voltage measurement				
13.17.4	Lightning impulse application for transformer testing				
13.17.5	Switching impulse application for transformer testing				

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13.17.6	Switching Impulse (SI) voltage measurement				
13.17.7	Combined Voltage Test (CVT) for Switch gear and control gear &GIS (LI & AC)				
13.17.8	Superimposed DC voltage test voltage Lightning and switching impulse voltages				
13.17.9	Step Response (SR) measurement system for divider calibration				
13.17.10	Comparative Analysis for transformer testing				
13.17.11	Transfer Function (TF) Analysis for transformers				
13.17.12	Coherence Function (CF) analysis for transformers				
13.18	The overall uncertainty of a digital recorded used in the approved measuring system shall be less than limits specified below with confidence level 95% with confidence level k=2				
	0.7% in the peak voltage measurement of full and standard chopped lightning impulses , switching impulses				
	2% in the peak voltage measurement of front chopped lightning impulses				
	2% in the measurement of front time for all type of waveforms, 1.5% for tail time, 2% for time to chopping, 2% for peak time of switching impulse				
13.19	Report generator : The MS office based report generation application shall be provided with easy extraction of test results and waveforms based on the saved data.				
13.20	Application working platform : PC based system				
13.21	Operating system: 64 bit, Windows built in licensed version				
13.22	Processor : PXI/PCI based embedded controller or Intel i7 processor or equivalent				
13.23	RAM : 8GB or higher				
13.24	Storage/Hard disk : ≥256 GB				
13.25	Microsoft office : MS office 2010 or higher with built in licensed version				

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13.26	Auxiliary Ports :				
	HDMI/Display port – ≥1 No				
	USB ports – ≥ 2 numbers				
	LAN Port – 1 Number				
13.27	Suitable earthing point shall be provided				
13.28	Power supply switches: On/OFF switch at back end				
13.29	Printer : suitable printer shall be provided for printing the oscillograms/test results				
13.30	**Tests to be performed on measuring system**				
13.30.1	Test on the impulse measuring system shall be performed as per the IEC 60060-2:2010 (tests on measuring system) and IEC 61083-1:2010 (requirements of digital processing systems) and IEC 61083-2:2010 (software validation).				
13.30.2	Validation of software: IEC 61083-2:2010 Note: Validation of software and updated version with respect to standard to be released with in 2025 shall be provided as a part of package				
14	**Part-III: Impulse Voltage Calibration System**				
14.1	**Universal Reference Voltage Divider**				
14.1.1	The universal resistive voltage divider shall be designed for calibration of voltage dividers for AC, DC and Impulse full and tail chopped voltages (LI and SI) in accordance with IEC 60060-1, IEC 60060-2 and IEC 61083-3 etc standards				
14.1.2	Rated Lightning impulse voltage level : 800 kVp				
14.1.3	Rated switching impulse voltage level : 600 kVp				

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14.1.4	AC voltage (continuous duty) : 250 kVrms				
14.1.5	DC voltage (continuous duty) : 375 kVDC for both polarities				
14.1.6	Type : Indoor				
14.1.7	Installation : Mobile installation on base frame with castor wheel arrangement				
14.1.8	Primary Arm parameter : As per the manufacturer standard practice				
14.1.9	Secondary lower arm : The secondary unit shall be able to fit for LECO type connector.				
14.1.10	External damping resistor : may be provided to get the step response parameters				
14.1.11	Stability of divider for 1 years : < ±1 %				
14.1.12	The expanded measurement uncertainties for divider along with RMS shall be as per the IEC 60060-1 , IEC 60060-2 standards with 95% of coverage probability				
	Lightning Impulse voltage (full and tail chopped impulses) Um< 1%				
	Switching impulse voltage (at peak value) Um1 ≤ 1 %				
	Time parameters Um ≤ 5 %				
	AC voltage 50 Hz Um ≤ 1 %				
	DC voltage Um ≤ 1 %				
14.1.13	Voltage ripple for DC voltage measurement ≤ 3 %				
14.1.14	Ambient effect : < 0.5% in the range of 10C to 50 C				
14.1.15	Measuring cable length : Co-axial cable/fiber optic with length approx... 50 meters				
15	**AC/DC Peak Voltmeter**				
15.1	Scope: Design, manufacturer, tested, supply and demonstration of standalone AC/DC peak voltmeter shall be used for all measurements of AC and DC voltages				
15.2	Application: Standalone unit and indoor applications				
15.3	Input voltage range : 0 to ±1000 Vp				
15.4	Frequency range: DC, 10 Hz to 500 Hz				
15.5	Input impedance: R≥10 MΩ and C≤50 pF				
15.6	Resolution: ≥12-bit				
15.7	Selectable divider ratio: 1 to 15000				
15.8	Input power supply : Single Phase 230 V, 50 Hz				

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15.9	**Operating conditions:**				
	Ambient temperature: 5 to 40 °C				
	Relative Humidity : 10 % to 80 % RH				
15.10	Enclosure: Metal encapsulated casing				
15.11	Input connectors: N type connector and BNC connector or LEMO				
15.12	AC/DC Peak voltmeter shall be designed as per requirements of IEC 60060-2:2010 standard				
15.13	**The following mentioned Measurement functions to be provided:**				
15.13.1	Positive Peak				
15.13.2	Negative peak				
15.13.3	Positive peak/√2				
15.13.4	Negative peak/√2				
15.13.5	Arithmetic mean				
15.13.6	True RMS value (root mean square)				
15.13.7	Peak factor/√2				
15.13.8	Ripple Amplitude				
15.13.9	Frequency				
15.14	Additional features: The display unit shall be able to display the graphical display of the waveform (AC or DC) atleast one complete cycle of waveform				
15.15	Measurement Uncertainty: The measurement uncertainty of the all measured value mentioned in above sNo. in the range of 10 to 1000 V for AC (frequency range 10 Hz to 500 Hz) and DC values with 95% of probability level with coverage factor of k=2 shall be less than ± 0.3%				
15.16	Analog output voltage connectors; 0-10 V for calibration purpose with BNC connector				
15.17	The peak voltmeter shall be designed with internal calibration check circuit of ±5 V for performance check purpose				
16	**General Points**				
16.1	The Impulse voltage test system shall be designed as per the requirements of the following applicable standards				
16.2	IEC 60060-1:2010 (Ed. 3): High-voltage test techniques - Part 1: General definitions and test requirements				
16.3	IEC 60060-2:2010: High-voltage test techniques - Part 2: Measuring systems				

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16.4	IEC 61083-1:2021: Instruments and software used for measurements in high-voltage and high-current tests - Part 1: Requirements for instruments for impulse tests				
16.5	IEC 61083-2:2013: Instruments and software used for measurements in high-voltage and high-current tests - Part 1: Requirements for instruments for impulse tests				
16.6	IEC 61083-3:2020: Instruments and software used for measurement in high-voltage and high-current tests - Part 3: Requirements for hardware for tests with alternating and direct voltages and currents				
16.7	IEC 60052:2002- voltage measurement by means of standard air gaps				
17	**TYPE & PERFORMANCE TEST (CALIBRATION) CERTIFICATES**				
17.1	The following mentioned type and performance tests (Calibrations) shall be performed at any ISO/IEC 17025:2017 accredited laboratory as per the relevant standards				
17.2	The calibration traceability chain shall be reported in the each calibration report upto highest standardize organization of corresponding country				
17.3	References used for calibration shall meet the requirements of IEC 60060-1:2010, IEC 60060-2:2010, IEC 61083-1:2021, IEC 61083-2:2013 and IEC 61083-3:2020 standards. Evidence shall be submitted for review before calibrating the impulse voltage test system				
17.4	The expanded uncertainty shall be calculated for the complete measuring system for voltage magnitudes and time parameters for LI, SI, tail chopped impulse and front chopped impulses as per procedure mentioned in IEC 60060-2:2010				
17.5	The record of performance of the complete test system (Divider + Transmission cable + Measuring system) shall be provided as per the details given in the IEC 60060-2: 2010				
17.6	**Digital Impulse Measuring System**				
17.6.1	**Type Tests**: Measurement of rise time – clause no 3.4.3 of IEC 61083-1:2021				
	Internal noise level: 5.7 of IEC 61083-1:2021				
	Interference test : Annex A & 5.8 of IEC 61083-1:2021				
	Software validation Test : as per IEC 61083-2:2013				
17.6.2	**Performance tests** : Impulse scale factor and time base (Impulse calibration with two waveforms covering the nominal epoch or step calibration) – clause no. 5.1 of IEC 61083-1:2021				
	Scale factor nonlinearity – clause no. 5.6 of IEC 61083-1:2021				
17.7	**Damped Capacitive voltage Divider**				
17.7.1	**Type tests**				
	Dynamic Behaviour : 5.4, 8.4 & 9.4 of IEC 60060-2:2010				
	Ambient temperature effect: 5.7 & 5.5 of IEC 60060-2:2010				
	Scale factor parameters of converting device: 5.2, 8.3 & 9.3 of IEC 60060-2:2010				
	Long term stability : 5.6 of IEC 60060-2:2010 (based on manufacturer data)				
17.7.2	**Performance tests**				
	Scale factor/time parameters at the calibration: 5.2 & 8.3 of IEC 60060-2:2010				
	Linearity test: 5.3 of IEC 60060-2:2010				
	Interference test – 5.12 of IEC 60060-2:2010				
	Proximity test – 5.8 of IEC 60060-2:2010: This test to be demonstrated at site				

Section IV T -Technical Specification

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Sl.No.	Technical Specifications/Parameters	Qty	To be completed by the Bidder		
			Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
17.8	**Resistive voltage Divider**				
17.8.1	**Type test**				
	Dynamic Behaviour : 5.4 & 8.4 of IEC 60060-2:2010				
	Ambient temperature effect: 5.7 of IEC 60060-2:2010				
	Scale factor parameters of converting device: 5.2 of IEC 60060-2:2010				
	Long term stability : 5.6 of IEC 60060-2:2010 (based on manufacturer data)				
	Linearity test – 5.3 of IEC 60060-2:2010				
17.9	**Universal Reference voltage Divider**				
17.9.1	Measurement of Scale factor by Reference method: 10.2.2 of IEC 60060-2:2010				
	Measurement of scale factor and evaluation of step response parameters : 10.2.3 of IEC 60060-2:2010				
17.10	**AC/DC Peak voltmeter**				
17.10.1	Scale factor & Linearity measurements - IEC 61083-3:2020				
	Internal noise level - IEC 61083-3:2020				
	Reading rate - IEC 61083-3:2020				
17.11	The type and performance test reports of each component of the impulse voltage system as per the applicable standard mentioned shall be submitted before scheduling the pre despatch inspection for review.				
18	**Pre Dispatch Inspections programme**				
18.1	The supplier shall submit the routine, type, special and calibration test reports of the individual components as well as overall system as detailed for review during Inspection to be carried out at the works of the supplier, at the place of end user or at any other specified location as agreed. Further, Inspection and acceptance tests will be carried out subject to the satisfactory compliance of all the test and calibration and performance reports in accordance with the relevant standards mentioned.				
	Two officials from CPRI will be deputed for the duration of one week to complete the pre dispatch inspection programme mentioned in the S. No. 18.0. The expenditure for the officials deputed for pre dispatch inspection will be borne by the CPRI				
18.2	The supplier shall conduct the following tests in the presence of representatives as a part of acceptance tests				
18.2.1	**Power cubicle and controls**				
18.2.1.1	Functional tests of all overload protection devices				
18.2.1.2	operational tests of all devices				
18.2.1.3	Functionality of all control circuits, overloads and safety interlocks, measuring instrument displays according to IEC requirements				

Sl.No.	Technical Specifications/Parameters	Qty	To be completed by the Bidder		
			Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
18.2.2	**Impulse voltage Generator**				
18.2.2.1	Functional tests of all overload and protection devices				
18.2.2.2	Functional test on grounding device				
18.2.2.3	Capacitor withstand at 100% of rated voltage for 5 minutes				
18.2.2.4	The impulse voltage generator shall be completely erected and generate the output voltage atleast 50% of the rated voltage of the generator for 5 impulse for each polarity				
18.2.3	**Damped Capacitive voltage Divider, Resistive voltage divider and Universal reference voltage divider**				
18.2.3.1	Tests on the HV units: Measurement of the capacitance and the dissipation factor or Impedance measurement				
18.2.3.2	Tests on the secondary part - Measurement of the capacitance and the dissipation factor or impedance measurement				
18.2.3.3	Measurement of the unit step response according to IEC 60060-2:2010				
18.2.3.4	Linearity test				
18.2.3.5	Lightning Impulse voltage withstand test @1.1 rated voltage				
18.2.3.6	Switching Impulse voltage withstand test @ 1.1 of rated voltage				
18.2.3.7	Determination of the divider ratio – scale factor for LI and SI voltages				
18.2.4	**Multiple Chopping Gap Arrangement**				
18.2.4.1	Functionality tests of all components				
18.2.4.2	Measurement of capacitance				
18.2.4.3	Automatic trigger check				
18.2.4.4	Manual trigger check				
18.2.5	**Impulse Measuring System**				
18.2.5.1	Step response of the impulse measuring system				
18.2.5.2	Pulse calibration for LI and SI				
18.2.5.3	Linearity				
18.2.5.4	Impulse scale factor				
18.2.5.5	Software check with IEC-TDG as per IEC- 601083-2:2013 for all waveforms of LI, LIC and SI				

Sl.No.	Technical Specifications/Parameters	Qty	To be completed by the Bidder		
			Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
18.2.6	**AC/DC Peak VOLTMETER**				
18.2.6.1	Scale factor determination for at DC, 10 Hz to 500 Hz frequency range				
18.2.6.2	Demonstration of measuring capabilities				
18.2.7	Acceptance of the Impulse measuring system is subject to the compliance of all the test and calibration reports in accordance with the relevant standards and satisfactory completion of acceptance tests mentioned above.				
19	**Installation, Commissioning and Training**				
19.1	The installation and commissioning of all components of the Impulse voltage test system with trial testing at rated test voltage and specified loads (provided by us) shall be carried out by the supplier. The supplier shall provide operation, maintenance and troubleshooting training to our representatives for three man days.				
19.2	**Commissioning tests**				
19.2.1	1. Charging of the Impulse voltage generator from 10% to 100 % of rated output voltages for Lightning and Switching impulse voltages on test sample provided by CPRI				
19.2.2	Performing the Linearity test on Impulse voltage generator				
19.2.3	Demonstration of additional circuitries (overshoot compensation circuit, Glanging circuit, loading capacitors) for transformer tests				
19.2.4	Demonstration of Combined voltage test with LI+AC and SI+AC				
19.2.5	Demonstration of superimposed LI/SI impulse on DC voltage test on DC equipment				
19.2.6	Determination of scale factor of Damped capacitive voltage divider and resistive voltage dividers by reference method (comparison with universal reference voltage divider)				
19.2.7	Demonstration of functionalities and analysis software provided along with Impulse voltage measuring system				
19.2.8	Chopping the impulse voltage from 10% to 100% of rated voltage with different chopping times shall be demonstrated with multiple chopping gap arrangement				
19.2.9	Demonstration of steep front impulse voltage test				
19.2.10	**TRAINING**				
	Two days training programe shall be provided to CPRI officials on the following aspects of complete control and measuring system of the impulse voltage generator. a. Safety aspects b. Operation, maintenance and trouble shooting c. Demonstration of calibration procedures with Universal divider for LI, SI, AC & DC voltage dividers. d. Demonstration of steep front impulse voltage test on insulator with resistive voltage divider e. Operation of impulse analyzing software for measurement of analysis tools f. Demonstration of Step response analysis measurement for the divider (damped capacitive voltage divider) available at site				

Section IV T -Technical Specification

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Sl.No.	Technical Specifications/Parameters	Qty	To be completed by the Bidder		
			Detials of guaranteed technical parameters offered by the bidder	Guaranteed Technical Particulars (GTP)	Deviations from GTP
20	**Accessories and Spares**				
20.1	The following accessories and spares shall be provided as standard package and included in the scope of supply				
20.1.1	Voltage measuring coaxial shielded cables/fiber optic of 40m length with suitable LEMO connectors compatible with divider and recording system - 2 sets				
20.1.3	External mat type resistors – 40 Ω (2no.), 200 Ω (2no.) and 400 Ω(2no.)				
20.1.4	All interconnecting power and control cables of appropriate length between various components of Impulse Test System and control panel. Control room will be about 35 m from the test system. Appropriate spare cable shall be provided				
20.1.5	System earthing material				
20.1.6	Spares comprising of fuses of different ratings, PCB's, connectors of various types, brushes, diodes/thyristors, transistors, resistors, potentiometer, gaskets, drive motors, lightning arresters, varistors etc.				
20.1.7	Any other accessories and spares required for trouble free operation of the overall impulse voltage test system				
21	Technical documents to be provided: The following information shall be provided during the bid: 1. schematic diagram of the test system 2. Mass of the major equipment 3. Dimensions of major components 4. Any other information for installation and commissioning of the test system The following documents shall be provided during the supply: 1. Type, Routine, performance test and acceptance test reports of the complete test system 2. Calibration reports of measuring equipment. 3. Operation and maintenance manual of the test system in triplicate 4. Pre dispatch and commissioning test reports All the documents shall be provided in English Language only.				
22	**Guarantee**				
22.1	The Impulse voltage Test and measuring system shall be guaranteed to perform in accordance with the specifications and against defective material design and workmanship. The guarantee period shall be minimum of 12 months from the date of successful commissioning.				

PN: 1) Mere statement of "Complied" do not suffice the requirement. The details of technical parameters in proof of CPRI requirements shall be furnished along with technical write-up, catalogues, brouchers, literatures, phamplates, or any other documents shall be submitted in hard copy along with technical bid.
2) Calibration reports/certificates, factory test reports/certificates from an accreditated agencies/facilites shall be submitted wherever applicable.
3) CPRI reserves the right to conduct "predispatch inspection" prior to dispatch at the works of the supplier and the expenditure towards PDI shall be borne by CPRI. However information regarding the rediness of the equipment/machinary for the PDI shall be communicated in writing at lease 70 days in advance.