

Standard Specification for Testing Instruments for Substations

00	14/11/2024	Issued as standard specification	RS	MSH/RS	PP
Rev.	Date	Details	Prepared	Reviewed	Approved
Standard Specification for Testing Instruments for substations				Document Number	Rev.
				IGT-SS-SPC-STD-027	00

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1. SPECIFICATION FOR CT ANALYZER:

S. No.	Description	Specifications
1.	Function of the kit	<p>This instrument shall perform the current transformer saturation test, measure the CT winding resistance preferably and CT turn ratios automatically. Shall indicate winding polarity and preferably measure burden of CT. The analyser shall also measure phase angle and indicate errors for ratio and phase angle.</p> <p>The kit shall confirm the name plate details. It shall also help in analysing the CT behaviour in case of change of primary or secondary currents when the revised data is entered in to test data.</p> <p>The kit shall be able to plot the excitation curve and locate the Knee point Voltage and Current in real time.</p> <p>The accessories required for utilization of additional facilities/features if any apart from above shall be quoted separately.</p>
2.	Input Power	230V \pm 10% at 50 Hz
3.	Voltage Range	4kV in steps/automatically controlled. VA rating not less than 300 VA (Continuous). Accuracy 1.0% of reading or better Or equivalent arrangement for testing the CTs with Knee Point Voltage of 4kV or better.
4.	CT Turns Ratio	1 to 5000 @ accuracy 0.2% or better.
5.	Phase Angle	0 to 360 deg @ \pm 1deg (Required only if kit uses Frequency conversion method)
6.	Software	The test record shall be able to download via RS 232 C port to a PC in windows Excel/equivalent format. CT Set and ratio tests can also run on windows NT 2000/XP/latest based software application.
7.	Storage/Memory	It should store/record minimum 140 test records in kit or storage device. Each test record must contain up-to 10 saturation curves, turns ratio reading, polarity and DC resistance reading etc.
8.	Display	If operated through inbuilt LCD screen, it must be Visible in bright sunlight and must have backlight display
9.	Protection	Fuse / MOV / MCB with over voltage and Over current, Thermal overload etc. Zero start and end Interlocks shall also be provided.
10.	Accessories	All testing/measurement cables 20 meter long. PC inter phase cables, Power supply cables, Operating manual, Original CD and software, Application CD etc. Hard carrying case etc.
11.	Repeatability	It should offer repeatability of test results in charged switchyard.
12.	Environment	The kit shall be compatible for EMI / EMC requirement as per relevant IEC
13.	Operating conditions	Shall operate at Temperature 0 to 50 deg C, Humidity not condensing up to 90%.
14.	Testing Standards	IEC600 44- and ANSI C57.13 or 10/50, international and IS 2705
15.	Safety Standards	The test set must meet the international safety standard for a CE Mark being IEC 61010-1 safety and IEC 61326-1 for EMC
16.	Warranty	<p>Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at Indigrid sub-station.</p> <p>All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works.</p>
17.	Calibration certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
18.	Training	Supplier shall have to ensure the kit is made user friendly for all the CTs

		available in Employer. The supplier shall have to arrange necessary training to Employer Engineers.
19.	Commissioning, Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.
20.	Services after Sale	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer.

2. SPECIFICATION FOR CIRCUIT BREAKER ANALYZER WITH DCRM

S. No.	Description	Specifications
1.	Functional Requirement	<p>The instrument should be suitable for measuring the operation timing of main, PIR (suitable with PIR ranging from 200 ohm to 500 ohm) and auxiliary contacts (wet & dry) as well as coil currents.</p> <p>It should measure the Dynamic Contact Resistance of main & arcing contacts as well as travel measurement (with external travel transducer) of operating mechanism.</p> <p>The instrument should be suitable for testing the CBs upto 765 kV as per applicable standards and testing procedure of Employer.</p> <p>The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard upto 765 kV levels.</p>
2.	No. of Channels	<p>Main Contact Channels:24 (4 Main + 4 PIR per pole on 3 pole simultaneously)</p> <p>Aux. Contact Channel:06 wet & 06 Dry</p> <p>DCRM/Test Current Channels:12 set (6 Channel for resistance + 6 channels for current)</p> <p>Travel Channel:06</p> <p>Coil Current Channel:06</p>
3.	Sampling Speed	Upto 20 kC
4.	Accuracy	<p>Timing: ± 1 % of reading</p> <p>Coil Current: ± 1 % of reading</p> <p>R: ± 2 % of reading</p> <p>Travel: ± 1 % of reading</p>
5.	Measurement Range	<p>Timing: 0-4 s</p> <p>R: 0-8 m Ω.</p> <p>Coil Current:0-25 A</p>
6.	Resolution	Timing: 0.1 ms
7.	DCRM Test Current	100A (Minimum)
8.	Test Leads and accessories	<p>One complete set of cables of sufficient length (min 20metre) with suitable clamps & connectors, compatible with all type of CBs should be provided for successfully carrying out the test.</p> <p>Additionally, all the required accessories should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.</p>
9.	Travel Transducers	One set of travel transducers along with clamp/fixtures to suit 400/220 kV GIS CBs of ABB/GE make and 765/400kV AIS CBs of Siemens/GE make
10.	Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
11.	Input Power	230V $\pm 10\%$ at 50 Hz ± 5 %

12.	Operating conditions	Shall operate at Temperature 0 to 50 deg C, Humidity not condensing up to 90%.
13.	Relative humidity	Max. 90% non-condensing.
14.	Protection/ Control	Against short circuit, over voltage, improper ground connection overload & transient surges, the kit should have alarm/cut-off features to protect the instrument. Also, the kit should have facility of stopping automatically on power failure.
15.	Cooling Arrangement	Necessary in-built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/ accessory shall have to be required.
16.	Weight	It should be highly portable, and trolley mounted for smooth movement in live switchyards.
17.	Software	The software should be suitable for automatic testing & report generation, signature as well as trend analysis. The kit should have facility to store and communicate with windows-based computer for exporting the test data.
18.	PC Interface	It shall include supply of one laptop PC of Dell/Lenovo/HP make with latest specifications such as Core i5 Intel Processor, 4GB RAM, 320GB or better HDD, 15" TFT screen, Combo 24xCD R/W Drive i.e. having CD read / write facility complete with required cables and connectors with preloaded operating MS Window 11 professional or better with latest version application software require for storage analysis and record management.
19.	Environment	The test kit shall be compatible for EMI/EMC/Safety environment requirement as per IEC.
20.	Warranty	Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works.
21.	Calibration certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
22.	Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers, where kit is being supplied.
23.	Commissioning, Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.
24.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer.

3. SPECIFICATION OF SF6 GAS QUALITY ANALYSER

S. No.	Description	Specifications
1.	Functional Requirement	<p>1. The instrument should be suitable for online measurement of Moisture (Dew point & ppm), Purity & SO₂ content of SF₆ Gas in gas insulated EHV equipments, in live switchyard upto 765 kV level, as per applicable standard testing procedure of EMPLOYER.</p> <p>2. The Instrument should be able to measure Dew point of N₂ & Dry Air also.</p> <p>3. The measurement should be possible at standard pressure/ sy pressure.</p> <p>4. The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard up to 765 kV levels.</p>

2.	Measurement Parameters	1. SF6 purity - Range: 0-100 %, Accuracy: +/- 0.5 % & Resolution: 0.1 % 2. Dew point - Range: -60 to +20° C, Accuracy: +/- 4° C 3. SO2 - Range: 0-100 ppm, Accuracy: +/- 3 ppm
3.	Input Pressure	0.5 to 9 Bar
4.	Re-circulation/ Pumping Back of SF6 gas	The kit shall have the inbuilt facility of pumping back the measured SF6 gas to the equipment being tested.
5.	Test Leads and accessories	Complete set of Hoses, pipes, coupling, valves etc. for measurement (Min. 10-meter Length) with suitable adaptors for connection with Equipment (BHEL, CGL, ABB, Areva, Siemens, Trench make CBs/CTs etc.)
6.	Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
7.	Power Supply	150 - 240 V AC at 50 Hz or Inbuilt battery with charger/adapter etc.
8.	Operating Temperature	-10 to +50 °C
9.	Relative humidity	Max. 90 % non-condensing
10.	Display/Control	LCD/Keypads.
11.	Environment	The test kit shall be compatible for EMI/EMC/safety environment requirement as per IEC.
12.	Guarantee	Warranty/Guarantee Period: Min 05 year from the date of successful & complete commissioning at Employer sub-station. All the materials, including accessories, cables etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works. If any calibration is required (as per kit manufacturer requirement) within warranty/guarantee period, same is to be done by supplier at free of cost
13.	Calibration Certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
14.	Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers.
15.	Commissioning, handing over the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected and no repairs are allowed.
16.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism in India for prompt after sale services.

4. SPECIFICATION FOR DIGITAL EARTH RESISTANCE METER

S. No.	Description	Specifications
1.	Functional Requirement	The instrument should be suitable for measuring of all type of earth electrode resistance single/multi electrode system, in live switchyard upto 765 kV level, and soil resistivity as per applicable standard testing procedure of Employer. The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard upto 765 kV levels. The instrument should be suitable for four terminal measurements.

2.	Output	Voltage: 30V Peak Min. (At a test frequency different from 50Hz to avoid electromagnetic interference)
3.	Measurement Range	Resistance: 0.01 - 19.99k Ω (Auto Ranging & Digital)
4.	Accuracy	Resistance: 2% upto 200 Ω and 3% above 200 Ω .
5.	Test Leads and accessories	One complete set of cables of sufficient length with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test. Additionally, all the required accessories should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.
6.	Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
7.	Input Power	230V $\pm 10\%$ at 50 Hz $\pm 5\%$ supply with standard socket & Internal Re-chargeable Battery.
8.	Operating conditions	Shall operate at Temperature 0 to 50 deg C, Humidity not condensing up to 90%.
9.	Display/Control	Digital LCD / Keypad
10.	Protection	Against short circuit, over voltage the kit should have cut-off features to protect the instrument.
11.	Weight	It should be easily portable.
12.	Repeatability	It should offer repeatability of test results in charged switchyard
13.	Environment	The kit shall be compatible for EMI / EMC requirement as per relevant IEC.
14.	Warranty	Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works.
15.	Calibration certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
16.	Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers, where kit is being supplied.
17.	Commissioning, Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.
18.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer.

5. SPECIFICATION FOR FULLY AUTOMATIC CAPACITANCE & TAN DELTA MEASUREMENT KIT

S. No.	Description	Specifications
1.	Functional Requirement	<p>The instrument should be suitable for automatic offline measurement of C& Tan δ of the switchyard equipment as well as excitation current of transformers/reactors, in live switchyard upto 765 kV level, as per applicable standards and testing procedure of Employer.</p> <p>The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard upto 765 kV levels.</p> <p>The measurement of ambient temperature & relative humidity with inbuilt/external arrangement.</p>

2.	Output	25V-12kV AC (continuously variable) I: 100mA(min)cont, 180mA (min) intermittent.
3.	Test Frequency	15 Hz to 400 Hz or better, with 12kV output voltage between 45 to 70 Hz & minimum 3.5kV between 15 to 400 Hz.
4.	Accuracy	Cp: 0.5 % of reading \pm 1pF Tan δ : 1 % of reading \pm 0.02%
5.	Phase angle	0 to 360 deg @ \pm 1deg (Required only if kit uses Frequency conversion method)
6.	Measurement Range	Cp: 10 pF to 1 μ F with Resolution of 0.01 pF or better. Tan δ : 0 to 100% with Resolution of 0.01% or better.
7.	Test Leads and accessories	One complete set of cables of sufficient length (min 20metre) with suitable clamps & connectors, compatible with all type of CBs should be provided for successfully carrying out the test. Additionally, all the required accessories, drawing & documents, tools etc. should be provided for the smooth functioning of kit. Original carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.
8.	Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
9.	Input Power	230V \pm 10% at 50 Hz \pm 5 % supply with standard socket.
10.	Operating conditions	Shall operate at Temperature 0 to 50 deg C, Humidity not condensing up to 90%.
11.	Cooling Arrangement	Necessary in-built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/ accessory shall have to be required.
12.	Weight	It should be easily portable, and trolley mounted for smooth movement in live switchyards.
13.	Software	The software should be suitable for automatic testing & report generation, signature as well as trend analysis. The kit should have facility to store and communicate with windows-based computer for exporting the test data.
14.	Display/Control	It shall include supply of one laptop PC of Dell/Lenovo/HP make with latest specifications such as Core i5 Intel Processor, 4GB RAM, 320GB or better HDD, 15" TFT screen, Combo 24xCD R/W Drive i.e. having CD read / write facility complete with required cables and connectors with preloaded operating MS Window 11 professional or better with latest version application software require for storage analysis and record management. If kit is being controlled through inbuilt LCD monitor and kit is having data storage facility, then there is no need to supply laptop.
15.	Repeatability	It should offer repeatability of test results in charged switchyard
16.	Environment	The kit shall be compatible for EMI / EMC requirement as per relevant IEC.
17.	Warranty	Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works.
18.	Calibration certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
19.	Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers, where kit is being supplied.
20.	Commissioning, Handing Over of	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be

	the Instrument	rejected, and no repairs are allowed.
21.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer.

6. SPECIFICATION FOR AUTOMATIC THIRD HARMONIC RESISTIVE CURRENT MEASUREMENT KIT:

S. No.	Description	Specifications
1.	Functional Requirement	The instrument should be suitable for automatic online measurement of Third Harmonic Resistive Current of the Gapless Surge Arrestor, in live switchyard upto 765 kV level, as per IEC standard The measurement should not be affected by the presence of harmonics in the system voltage i.e. compensation of harmonics in system voltage as per IEC 60099-5 B2. The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard upto 765 kV levels. The instrument shall have in built temperature measurement and voltage/temperature correction facility.
2.	Measurement Parameters/ range	Total Leakage Current: 200 μ A To 5mA Resistive Leakage Current: 1 μ A To 5mA
3.	Accuracy	± 5 % of reading
4.	Resolution	1 μ A
5.	Test Leads and accessories	One complete set of cables of sufficient length (suitable for up-to 765kV Lighting Arresters) with suitable clamps & connectors, compatible with instruments should be provided for successfully carrying out the test. Additionally, all the required accessories, drawing & documents, tools etc. should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.
6.	Design/Engg.	The complete equipment along with complete accessories must be designed/engineered by Original Equipment Manufacturer.
7.	Input Power	230V $\pm 10\%$ at 50 Hz ± 5 % supply with standard socket/ Inbuilt battery with charging facility.
8.	Operating conditions	Shall operate at Temperature 0 to 50 deg C, Humidity not condensing up to 90%.
9.	Protection/ Control	Against short circuit, over voltage, improper ground connection over load & transient surges, the kit should have alarm/cut-off features to protect the instrument.
10.	Cooling Arrangement	Necessary in-built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/ accessory shall have to be required.
11.	Weight	It should be easily portable.
12.	Software	The software should be suitable for analysis of test data. The kit should have facility to store and communicate with windows-based computer for exporting the test data.
13.	Display/Control	LCD/Keypad
14.	Repeatability	The instrument should have been proven for repeatability of test results in charged switchyard conditions and same to be confirmed during demo.
15.	Environment	The kit shall be compatible for EMI / EMC requirement as per relevant IEC.
16.	Warranty	Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at sub-station. All the materials, including accessories, cables, laptops etc. are to be covered

		under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works.
17.	Calibration certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
18.	Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers, where kit is being supplied.
19.	Commissioning, Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.
20.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer.

7. SPECIFICATION FOR THERMO-VISION SCANNING CAMERA- LOW END:

S. No.	Description	Specifications
1.	Function & Scope	<p>The infrared Thermal imaging and temperature measurement camera should be fully automated and shall be useful for thermo-vision scanning, having capability to identify hot spots and loose connections in sub-stations and transmission lines up to 400/ 765 kV. Min. Distance of use is 15 mtr. for standard and 60 mtr. for Telephoto lens.</p> <p>The camera shall have the laser pointing facility and shall have built-in high-resolution colour screen (LCD/TFT min 3.5" size). The instrument shall be portable and battery operated.</p> <p>The infrared thermal imaging and measurement system should be based on un-cooled focal plane array (UFPA) technology. It shall also have a built-in digital colour visual camera of minimum 3 Mega pixels, thus creating a colour visual image of corresponding thermal image. It should be possible to store the thermal and visual image together (thermal fusion-merging visual & thermal images).</p>
2.	Thermal Imaging Performance	<p>The thermal detector of the Thermo-vision camera should be based on the Focal Plane Array, un-cooled micro-bolometer technology with minimum 320 x 240 pixels (Infrared pixels to be captured by the camera and not enhance after image capturing).</p> <p>It should have Thermal sensitivity of the order of 0.05° at 30° Centigrade or better. Image frequency should be such that the buffering effect/ delay shall not come on display.</p> <p>The Spectral Range should be of the order of 8 to 13 μ m or better. The Thermo-vision camera shall be supplied with the standard lens and an additional telephoto lens.</p> <p>The minimum focus distance of the camera for the standard lens & telephoto lens shall be such that it does not affect measurement in switchyard & transmission lines.</p> <p>The Thermo-vision camera shall have Automatic as well as manual focus. It should also have electronic/ digital zoom for IR function of 4x or better.</p>
a.	Spatial resolution (IFOV)	<p>Standard lens: 1.7 mrad or less.</p> <p>Tele-photo lens: 0.4 mrad or less.</p>
b.	Lens (Horizontal FOV)	<p>Standard lens: 23° or more.</p> <p>Tele-photo lens: 7° or less.</p>
3.	Temperature	0 to 350°C (minimum), with accuracy of $\pm 2\%$ of reading or $\pm 2^\circ\text{C}$.

	measurement range & Accuracy	
4.	Emissivity Correction	The camera shall have automatic temperature correction facility for emissivity (emissivity range 0.1 to 1).
5.	LCD and Indicators	The system shall have a tilt-able (min.90°) LCD display or tilt-able lens. Display shall be properly visible in sunlight. Camera shall also have status indications to view the status of battery/ power mode indication etc.
6.	Physical Characteristics	The system should be lightweight, hand-held with on-board rechargeable, field replaceable battery. The thermo vision camera shall also operate on 230 V AC supply $\pm 10\%$ and camera battery shall also get charged with this while the camera is in operation. Separate battery charger and spare battery shall also be provided. The equipment shall be well balanced for one hand operation. Hand/ Neck straps should be provided for safety of Camera while using in field. The total weight of the thermo vision camera including battery, memory card, LCD display, laser pointer, and Standard as well as Tele- lens shall not exceed 2.0 kg.
7.	Battery operation time	Camera battery (preferably Li-Ion) shall have sufficient power for 3 hours of continuous operation with LCD display ON.
8.	Output	The camera shall have video output: CCIR/PAL composite video/ S video/ USB.
9.	Voice Recording / Text annotation	The system shall have the voice annotation (voice recording) facility for not less than 30 seconds per image and voice recording shall be tagged to particular image or the system shall have provision to attach pre-defined text on each image file during measurement. Infrared image along with corresponding visual image and voice recording or text annotation shall be linked together.
10.	Image storage capacity	The system shall be supplied with minimum of 2 GB flash memory (internal/ external).
11.	Image storage facilities	<p>The camera should store (in selectable built in flash memory or flash memory card in selectable directory) the image in full radiometric format as well as standard image format e.g. bmp, jpeg, tif, png, gif etc. readable without use of special software indicating marked temp, with date and time stampings along with all technical parameters corresponding to image, in addition to visual image, voice/ text annotation. If required, operator shall have the facility to recall, analyze, save, and delete the images in the field including the replay and edit of its voice/text annotation. It shall be possible for operator to view the live images/ recalled image details.</p> <p>Camera shall have the facility to freeze/ hold the image and store a single image or multiple of images either continuously or periodically. While saving the image, the camera shall automatically prompt for saving of voice or text annotation and visual image. It shall also be possible to store only IR images with or without voice/text annotation or IR image.</p>
12.	Measurement function	The thermo vision camera shall measure absolute temperature of hotspots and have auto spot function (auto placement of cursor at min or max temperature). It shall be possible to create movable cross-hairs/ spots (with temperature) in the live/freeze image. It shall be possible to create different areas with continuously adjustable dimensions and position in an image with their selectable max., min., and average temperature display. All the area shall be movable and shall give maximum and minimum temperature value and its position within the area. It shall be possible to manually adjust emissivity (preferably with an online help table), reflected temperature, distance for individual spot as well as for individual

		area. The laser locator shall be active in IR mode with push button. The camera should have all the required standard palettes/ colour schemes (minimum 4 pallets).
13.	Software	The analyzing software (to be provided along with the Camera) shall be windows based, simple to operate, compatible to IR and visual camera images and capable of providing comprehensive report generation facility in addition to image analysis and post processing. It should also be possible to insert a visual image (photo) as well as text object in the report. The software should include tools for extensive image analysis & reporting.
14.	Accessories	All the required accessories like PC/ video interface cables, Power supply cables, Battery, Battery Charger (in addition to the AC adopter), Standby battery set, Operating manual, Original CD and software, Application CD, Hard carrying case etc. should be provided.
15.	Operating conditions (with all accessories)	Shall operate at Temperature 0 to 50°C, Relative Humidity: 10 to 90% non- condensing.
16.	Safety Standards	Thermo vision camera shall have minimum protection grade of IP-54. The unit shall meet all EMC emission, immunity standards as per IEC/ EN 61000-4-4, IEC/ EN 61000-4-2 and IEC/ EN 61000-4-8 respectively or equivalent latest standards, with CE marking to work in EHV areas without any interference. Copy of relevant certificates shall be furnished along with the bid.
17.	Demonstration	The acceptance of the Instrument shall be subject to the successful demonstration by supplier to the satisfaction of Employer. During the demonstration, if the instrument is found not up to the mark/ not meeting working requirements of Employer, the same shall be summarily rejected and repeated attempts shall not be permitted.
18.	Warranty	Warranty/Guarantee Period: Min 05 years from the date of successful & complete commissioning at sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/ works. Kit after repair needs to be returned within thirty (30) days from the date of despatch.
19.	Training	Supplier shall have to ensure that the kit is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers, where kit is being supplied.
20.	Commissioning, Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.
21.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer.

8. SPECIFICATION FOR SF6 GAS HANDLING PLANT:

S. No.	Description	Specifications
1.	Functional Requirement	Equipment shall be able to evacuate, filter and fill the sf6 gas in breakers, from CB pole to cylinder and vice versa etc. SF6 recovery shall be more than 99.5%. It shall also filter and dry sf6 during the process to achieve the desired properties. The unit shall be portable mounted on a cart with min. 12" size pneumatic wheels so that it can freely move on metal spread switchyard.

2.	Assembly parts	<p>The equipment shall be inbuilt with following components operating on 240V 50 Hz power supply.</p> <ol style="list-style-type: none"> 1. Vacuum pump of capacity 40m³/h or more and shall be able to create vacuum less than 1mbar. 2. High pressure direct drive oil less compressor of capacity 5.5 m³/h or more to build up pressure up-to 50 bar. 3. Vacuum Compressor of capacity 4.5 m³/h or more which shall create vacuum less than 5 mbar. <p>The mimic diagram shall be provided showing the circuits of Gas flow. The unit shall also have vacuum and pressure gauges, particle and dry filters, three-way valves., anti-suck back valve, SF6 bottle balance, set of tools, working hour counter, Dew point measuring instrument and hoses of minimum 15 Mtr. Length with couplings for connecting to SF6 gas cylinder and to equipment etc.</p> <p>The vacuum and pressure gauges shall have the resolution to measure the minimum vacuum (0.1 mbar / 10 pascal) and maximum pressure (50 bar).</p> <p>The equipment shall have on board cylinder having storage capacity of minimum 300 ltr/280 kG along with facility to measure weight of SF6 gas present in cylinder.</p>
3.	Filtration Capacity	Filtration up to 1 micron or less during recovery and filling.
4.	Dew Point Measuring Instrument	<p>The dew point measuring instrument shall consist of the following:</p> <ul style="list-style-type: none"> • Measuring Sensor: Range +30 °C to (-) 60 °C • Operating Temp. 0-50 °C <p>Panel Mounted Indicator</p>
5.	Maintenance Tool Kit	A Tool kit comprising of all tools required for Operation and Maintenance of the plant shall be supplied along with the plant.
6.	Power Supply	<p>The machine shall operate with I/P supply: 3-Phase, 415V, 50Hz AC or 1-Phase, 240V, 50Hz AC</p> <p>The unit shall be equipped with a Phase Sequence relay for ensuring the correct sequence of rotation of the compressor / Vacuum Pump.</p>
7.	Maximum Filling Pressure	50 Bar and above.
8.	Input Power	230V ±10% at 50 Hz ±5 % supply
9.	Warranty	<p>Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at sub-station.</p> <p>All the materials, including accessories etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, transportation of kit for repair at test lab/ works.</p>
10.	Commissioning, Training and Handing over of the Instrument	<p>Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.</p> <p>Supplier will have to provide training to Employer's engineers for safe operation and maintenance of the instrument before handing over the instrument. Instruction and operation manuals should be supplied along with the instrument</p>
11.	Packing and transport cases	The kit and accessories shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit.
12.	After sales service	Bidder will have to submit the documentary evidence of having established

		mechanism for prompt services as and when required by Employer.
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9. SPECIFICATIONS FOR TRANSFORMER WINDING RESISTANCE METER:

S. No.	Description	Specifications
1.	Function	The instrument shall be used for measuring DC winding resistance of all Transformers & Reactors up to 765 KV class Transformer/ Reactors where high inductance is present. The test kit shall be able to withstand inductive kicks from transformer winding and shall be capable of working in inductive atmosphere of 765/400kV Substation. It should employ four wire methods, and no lead compensation shall be required for the measurement. Shall have minimum two independent measuring Channels and quick stabilisation period.
2.	Test current	50 Amp DC continuous then open circuit voltage ≥ 50 V or If 30 A DC continuous then open circuit voltage ≥ 100 V,
3.	Display	Digital LCD display with backlight viewable in bright sunlight.
4.	Resolution and accuracy	Resolution: $1 \mu\Omega$ up to $1000 \mu\Omega$ range and 0.02% of FS above $500 \mu\Omega$ range Accuracy: $0.5 \% \pm 5$ Count
5.	Range	0 to 1000Ω Auto reading.
6.	Demagnetization	The equipment shall have Built-in demagnetization circuitry which shall allow the operator to manually/automatically demagnetize the transformer core, either before or upon completion of resistance testing, or as a standalone feature.
7.	Temperature correction	The kit should have the facility to have correction of resistance value to a reference temp. i.e. provide temp. compensate reading of resistance (for Cu and Al)
8.	Keyboard	Front Panel, interactive
9.	Power Supply	It shall work on single-phase $230 \pm 10\%$ V, $50 \pm 5\%$ Hz, supply with variations in voltage and frequency respectively on standard sockets
10.	Protection of Kit	Kit should have all necessary protections against transient voltages, induction, short circuits etc. Built-in-discharge circuit should be provided to discharge the specimen when test is completed or when current lead accidentally disconnects or when instrument power supply is lost.
11.	Storage	Internal, non-volatile memory for storing up to minimum 1000 sets of readings.
12.	Repeatability	It should offer repeatability of test results in 400 kV/765 kV charged area.
13.	Protection/Control	Against short circuit, over voltage, overload & transient surges, induction. The kit should have facility of discharging the specimen when test is completed or when current cable accidentally disconnected or when instrument power supply lost. Also, the kit should have built in rapid discharge circuit for automatically discharging the stored energy in the transformer at the end of each test.
14.	Cooling arrangement	Necessary in-built cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant/accessory shall have to be required.
15.	Software	The software should be suitable for automatic testing & report generation including temperature compensation. The kit should have facility to connect with windows-based computer/laptop for exporting test data.
16.	Accessories	Complete set of test leads of min. 20-meter length, combination plugs clamps and connectors, power-supply cables, original hard carrying case for main kit

		and cables (which should be robust/ rugged enough for proper safety of the kit during transportation), manual (both in soft copy & hard copies) etc, required for carrying out all types of testing. All the accessories for desired monitoring, operation & control of instrument shall have to be provided.
17.	Design/Engg.	The complete equipment along with complete accessories must be designed/ engineered by Original Equipment Manufacturer.
18.	Calibration certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit. However, party will have to submit the calibration certificate from/traceable to, NABL accredited lab or internationally reputed lab. Date of calibration shall not be older than two months from the date of supply of Kit.
19.	Environment	<ul style="list-style-type: none"> • The test kit shall be compatible for EMI/EMC/ safety environment requirement as per IEC. • Temp 0 to 50°C, • Humidity not condensing-up to 90%,
20.	Warranty	Kit shall have Warranty for minimum 3 years for smooth and reliable operation of the kit. The warranty includes: <ol style="list-style-type: none"> a) Calibration of instrument (annually till completion of 3 years) b) As much as visits for repairs to site. c) If the kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of spares, softwares, transportation, transit insurance (To & Fro), etc of kit for repair at test lab/works. Kit after repairs need to be returned within thirty days from the date of despatch. d) All the expenses for maintaining the supplied instrument “Healthy and in working condition” is to be borne by Successful bidder as per LOA
21.	Transit Case	The kit and accessories shall be robust and rugged enough, so that it can be transported safely at different locations. The transportation and packing cases of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement of kit
22.	Services after Sales	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer. Bidders need to submit their organization service chart along with bid
23.	Demonstration and Handing over of Instruments.	The contractor shall have to demonstrate the instrument to the satisfaction of Employer. The Supplier shall have to ensure the kit is made user friendly apart from the detailed demonstrations at each site. The instrument failed during the demonstration shall be rejected, and no repairs are allowed.
24.	Training	Supplier shall have to ensure that the instrument is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer’s engineers

10. SPECIFICATION OF TRANSFORMER OIL BDV TEST SET:

S. No.	Description	Specifications
1.	Function	1. The instrument should be suitable for Automatic Measurement of Electrical Breakdown Strength of transformer oil as per relevant standards. 2. The test results should have repeatability, consistency in laboratory condition.
2.	Test Output	0-100 kV rms (Rate of rise: 0.5 to 5 kV/ Sec)
3.	Accuracy ± 1 kV	Accuracy ± 1 kV
4.	Resolution	0.1 KV
5.	Switch off Time	≤ 1 ms

6.	Display/Control	LCD/Keypads.
7.	Printer	Inbuilt/External
8.	Measurement Programmes	Fully Automatic Pre-programmed/User programmed Test Sequences including as per latest IEC & other national/international standards.
9.	Test Lead/ Accessories	One complete set of electrodes, gauge etc. compatible with the instruments should be provided for successfully carrying out the test in Employer S/S. Additionally all the required accessories, tools, drawing, documents should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided.
10.	Design/Engg.	The complete equipment along with complete accessories must be designed/ engineered by Original Equipment Manufacturer.
11.	Power Supply	It shall work on input supply variations, V: 230 \pm 10 %, f: 50 Hz \pm 5% on standard sockets.
12.	Operating Temperature	0 to +50 °C
13.	Relative humidity	Max. 90% non-condensing.
14.	Protection/ Control	Against short circuit, overload, transient surges etc. Also, the instrument should have facility of stopping automatically on power failure. Also, the kit should have facility of HV chamber interlocking as well as zero start interlocking.
15.	Display/Control	LCD/keypads.
16.	Environment	The test kit shall be compatible for EMI/EMC/Safety environment requirement as per IEC.
17.	Guarantee	Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at Employer sub-station. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, transportation of kit for repair at test lab/works.
18.	Calibration Certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two months from the date of supply of Kit.
19.	Training	Supplier shall have to ensure that the instrument is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer's engineers.
20.	Commissioning, handing over the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected and no repairs are allowed.
21.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services.

11. SPECIFICATION OF AUTOMATIC TRANSFORMER TURN RATIO METER:

S. No.	Description	Specifications
1.	Functional Requirement	<p>1. The instrument should be suitable for automatic offline measurement of 3-phase turns ratio or single phase turns ratio, phase angle deviation as well as detecting vector group in transformer, up to 765 kV, in live switchyard up to 765 kV level, as per applicable standards/ testing procedure of Employer.</p> <p>2. The test results should have repeatability, consistency & immunity to interference in live switchyard up to 765 kV levels.</p>
2.	Measurement Ratio Range	<p>1. Ratio: 1-1000 Auto Ranging</p> <p>2. Excitation Current: 1mA to 0.5 Amp.</p>

3.	Accuracy	1. Ratio:0.1 % 2. Phase Angle:0.5°
4.	Phase angle measurement	up to 360 °
5.	Excitation Voltage	up to 80 Volts in suitable steps
6.	Test Lead/ Accessories	One complete set of cable of sufficient length (Min 20Mtr) with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test in Employer S/S. Additionally all the required accessories should be provided for the smooth functioning of kit. Further hard carrying case (which should be robust/ rugged enough) for ensuring proper safety of the kit during transportation shall have to be provided. All the standard accessories for desired monitoring, operation & control of instrument shall have to be provided. The kit should be provided with built in printer and interface with PC for data downloading.
7.	Design/Engg.	The complete equipment along with complete accessories must be designed/ engineered by Original Equipment Manufacturer.
8.	Power Supply	It shall work on input supply variations, V: 230 ±10 %, f: 50 Hz ±5% on standard sockets.
9.	Operating Temperature	0 to +50° C
10.	Relative humidity	Max. 90% non-condensing.
11.	Protection/ Control	Against short circuit, overload, induction, transient surges etc.
12.	Cooling Arrangement	Necessary in-built cooling, if required, arrangement should be provided to dissipate the heat generated during use. No external coolant/ accessory shall have to be required.
13.	Weight	It should be easily portable.
14.	Software	The software should be suitable for report generation. The kit should have facility to connect with windows-based computer for exporting the test data.
15.	Display/Control	LCD(Backlit)/Keypads
16.	Environment	The test kit shall be compatible for EMI/EMC/Safety environment requirement as per IEC.
17.	Guarantee	Warranty/Guarantee Period: Min 01 year from the date of successful & complete commissioning at Employer substation. All the materials, including accessories, cables, laptops etc. are to be covered under warranty/guaranty period. If the kit needs to be shifted to supplier' s works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, software, and transportation of kit for repair at test lab / works.
18.	Calibration Certificate	Unit shall be duly calibrated before supply and the date of calibration shall not be older than two month from the date of supply of Kit.
19.	Training	Supplier shall have to ensure that the instrument is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to Employer engineers.
20.	Commissioning, handing over the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected and no repairs are allowed.
21.	After sales service	Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services.

12. SPECIFICATIONS FOR PRIMARY INJECTION KIT:

S. No.	Description	Specifications
1.	Maximum Current Output	1phase, 2000Amp.
2.	Current Ranges	Current Ranges: 0 - 1000 - 2000 Amp or Single Auto Range of Minimum 0 - 2000 Amp Duty Cycle as per following 0 - 1000 Amp, 50 Hz AC Continuous 0 - 2000 Amp, 50 Hz AC Intermittent (minimum 2.5 minutes ON & 15 minutes OFF)
3.	Open circuit Voltage	At 12Volts (minimum)
4.	Resolution	Continuous Current control by variable Auto Transformer/Digital microprocessor control Resolution: 1A
5.	Accuracy	Current measurement of accuracy less than or equal to 1%
6.	Timer	0 to 999 second with resolution of 1 second(min.)
7.	Display	Digital display preferably in LCD / LED /TFT or better, for Display of Current, Voltage
8.	Power supply	Input Power Supply: 1phase, 230 V \pm 10% ac 50 \pm 5%Hz.
9.	Enclosure	Provided with hard & robust enclosure for field use.
10.	Mobility	Kit should be sturdy, easily portable and modular type and each module weight should not exceed 50Kg for easy handling.
11.	Test Leads	Kit shall be supplied along with all accessories including Copper cable set (2X10 mtr length), clamps, connectors, spare fuses, indipower supply cable, etc (as applicable). all that is required for carrying out measurement for one unit.
12.	Accessories	Multiple copper cables to deliver the rated current of 2000A with each cable of Minimum Diameter of 120sq.mm. Suitable extension board (with minimum 8-meter cable length) to connect the Input Power Supply cable of the kit is to be provided to suit current injection upto 765kV AIS Substation Equipments.
13.	Operating temperature	0 - 50 °C
14.	Relative Humidity	90% RH or better.
15.	Safety	Kit shall have safety features like fuses/MCBs, ON indications, etc (as applicable).
16.	Demonstration & Commissioning at site	Successful Bidder has to carry out the demonstration/commissioning at all site after supply of the kit.
17.	Warranty	Minimum 1 years from date of successful demonstration / commissioning at site.

13. SPECIFICATIONS FOR INSULATION/DIELECTRIC DIAGNOSTIC ANALYSER:

S. No.	Description	Specifications
1.	Function of the kit	Instrument shall accurately carry out following, a) Analysis of Water content in Oil-Paper, and insulation of Power and Instrument Transformer. b) Diagnosis of all type of bushings and CB insulation. c) Diagnosis of Cable and Motor Insulation. The kit shall be based on Frequency Domain Spectrograph (FDS) as well as Dielectric Frequency Response (DFR) technique for analysis. The

		measurements shall be at lower frequencies and effected through Tan delta and capacitance measurement of insulation.
2.	Mains Input Power	230V \pm 10% at 50 Hz
3.	Voltage out put Current Out put Frequency range	0-200V, 0-50mA 0.1mHz to 5KHz min
4.	Measurements	Capacitance- 10pF to 10 μ F Dissipation Factor -0 to 10 @ accuracy of 2% max
5.	Measurement Channels	Channel 1, Channel 2.
6.	Measurement Modes	UST, GST, GSTg. minimum
7.	PC requirement	A reputed laptop with latest specifications such as Core 2 Duo processor, 2GB DDR RAM 320GB HDD DVD writer, 15" TFT screen or with better specs. Preloaded with MS Windows XP, /VISTA/latest with antivirus. Original CDs etc The cost of PC shall be quoted separately.
8.	Software	The test record should download via RS 232 C port to a PC in windows Excel/equivalent format. Software shall be able to assist in analysing the measurements and its reporting in user friendly manner. Software upgradation shall be done as and when applies with no cost to Employer.
9.	Accessories	All testing/measurement low noise cables 18 meter long. PC inter phase cables, Power supply cables, USB cables, Operating manual, Original CD and software, Application CD etc. Hard carrying case etc.connectors.AC power adapter.
10.	Repeatability	It should offer repeatability of test results in charged switchyard.
11.	Operating conditions	Shall operate at Temperature 0 to 50 deg C, Humidity not condensing up to 95%,
12.	Safety Standards	The test set shall meet international safety standard for IEC 61010-1 safety and IEC 61326-1 EMC
13.	Warranty/AMC	Kit shall be guaranteed for minimum 3 years. Supplier will have to execute AMC for five years for smooth and reliable operation of the kit after the completion of guarantee period. The rates shall be quoted along with the bid and it shall be taken into consideration during evaluation of bids. The AMC shall cover, a) Calibration of instrument (annually) b) As much as visits for repairs to site. If the kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of, spares, software up gradation, transportation, transit insurance (to&fro), etc of kit for repair at test lab/works. kit after repairs, need to be returned within thirty days from the date of despatch. All the expenses for maintaining supplied instrument "Healthy and in working condition to be born by Successful bidder during the AMC period of 5 years within the charges of AMC as per LOA.
14.	Training	Supplier shall have to ensure the kit is made user friendly. Apart from the detailed demonstrations at each site, the supplier shall also have to arrange necessary training to Employer Engineers. It will be the responsibility of the supplier to ensure that the testing at any point of time is not held up, for want of "technical know how" .
15.	Commissioning, Handing Over of the	Successful Bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the commissioning shall be

	Instrument	rejected and no repairs are allowed. The acceptance of the kit shall be subjected to the successful demonstration by supplier to the satisfaction of Employer at 400KV as well as 765 KV switchyard/sites
16.	Services after Sale	Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer. Bidders need to submit their organisation service chart along with bid

14. SPECIFICATIONS FOR D.C. EARTH FAULT LOCATOR:

S. No.	Description	Specifications
1.	Functional Requirement	Kit shall be able to locate earth faults on live Floating 220V/110V DC system in EHV Sub-station (upto 765kV) up to length of 1km without isolating any circuits. Instrument shall have noise/harmonics free performance. Instrument should be able to work reliably in charged 765kV Substation.
2.	Special Features	Portable. Light weight, in-built transmitter. Based on low frequency sine wave/ coded pulse injection into energized system. Detection by receiver instrument during operation shall not cause an interference with the operation of sensitive protection of the relay.
3.	Fault Resistance sensitivity Range (Minimum)	Upto 250 K Ω
4.	Display	Analogue or Audio-visual alarm or equivalent indication for fault detection.
5.	Power Supply	240 V 50 Hz A.C. or Battery Operated with built in charger
6.	Repeatability & Reliability	The instrument shall be proven for Repeatability & Reliability of test results in charged switchyard conditions.
7.	Accessories	Clamp on sensor suitable for cables and bus bars upto 45 sqmm. Test leads, Power supply leads, carrying case, Manual etc (as applicable) required for all testing.
8.	Environment (Ambient Working/ Operating Condition)	Temp- 0 to 50C. Humidity- 90% non-Condensing. The test kit shall meet EMI/EMC requirement as per relevant IEC/IS/equivalent standard.
9.	Guaranty/Warranty	<p>Guarantee period for kit shall be one (01) year. Supplier will have to execute a comprehensive AMC for four (04) years for smooth & reliable operation of kit after expiry of guarantee period. The rates shall be quoted along with the bid, and it shall be taken into consideration during evaluation of bids. The AMC shall cover:</p> <p>a. Calibration of Instrument: Annually or as per Instruction Manual b. As much as visits for repairs to site</p> <p>If kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of repairs including spares, F&I etc. Kit after repair should be supplied back to site within 45 days effective from date when information of kit going defective is communicated to supplier by Employer (except for the case for which kit needs to be shifted outside India for repairs) All the expenses for maintaining supplied instruments in "Healthy and in working condition" is to be borne by successful bidder as per LOA.</p>
10.	Calibration certificate	Calibration certificate from/traceable to NABL accredited lab or any other national/internationally reputed lab, shall be submitted. Date of calibration shall not be older than three months from the date of supply of kit.
11.	Service after sale	Bidder should have a well-established after sale service support network in India. Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by

		Employer. Bidders need to submit their organization service chart along with bid.
12.	Commissioning, Training and Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected and no repairs are allowed. Bidder will have to provide training to Employer engineers for safe operation and maintenance of the instrument before handing over the instrument.
13.	Packing and transport cases	The kit and accessories shall be robust and rugged enough so that it can be transported safely at different locations. The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement/working of the kit.

15. SPECIFICATIONS FOR SF6 LEAKAGE DETECTOR

(Applicable Only for Gas Insulated Substations)

S. No.	Description	Specifications
1.	Functional Requirement	Instrument shall be used for detection of SF6 Leakage from SF6 filled Circuit Breakers, Current Transformers, Gas Compartments of Gas Insulated Substations. It shall operate successfully without any influence of induction of electrically charged switchyard upto 765kV & 400kV. SF6 gas leak detector shall be free from induced voltage effects and shall not be sensitive to moisture, any other gases & vapour.
2.	Method of operation & Principle	Continuous leak detection & leak measurement operation during leak measurement operation during leak check without limitation with audible/visual indication. Based on Non Dispersive Infrared technology
3.	Range & Operation	Range: 0 - 1000 ppm by volume (minimum) Accuracy: 0 - 100 ppmv : +/- 5 % or better & 100 - 1000 ppmv : +/- 2 % or better
4.	Sensitivity	3.5 gm SF6 per year or less. No cross sensitive to other gases
5.	Response Time	Immediately
6.	Alarm	Visual as well as Audio
7.	Power Supply	Lithum-Ion batteries or equivalent power supply with charger & having operating time of 6 hours (minimum)
8.	Operating Temperature	0 to 50°C.
9.	Accessories	Battery Charger, Manual, Hard Carrying Case, Power Cord, Adopter for 220 V, Software CD & other mandatory accessory (as applicable) ect required for successful operation of kit
10.	Guarantee & AMC	<p>Guarantee period for kit shall be one (01) year. Supplier will have to execute a comprehensive AMC for four (04) years for smooth & reliable operation of kit after expiry of guarantee period. The rates shall be quoted along with the bid, and it shall be taken into consideration during evaluation of bids. The AMC shall cover:</p> <p>a. Calibration of Instrument: Annually or as per Instruction Manual</p> <p>b. As much as visits for repairs to site</p> <p>If kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of repairs including spares, F&I etc. Kit after repair should be supplied back to site within 45 days effective from date when information of kit going defective is communicated to supplier by Employer (except for the case for which kit needs to be shifted outside India for repairs)</p> <p>All the expenses for maintaining supplied instruments in "Healthy and in working condition" is to be borne by successful bidder as per LOA.</p>

11.	Calibration certificate	Calibration certificate from/traceable to NABL accredited lab or any other national/internationally reputed lab, shall be submitted. Date of calibration shall not be older than three months from the date of supply of kit.
12.	Service after sale	Bidder should have a well-established after sale service support network in India. Bidder will have to submit the documentary evidence of having established mechanism for prompt services as and when required by Employer. Bidders need to submit their organization service chart along with bid.
13.	Commissioning, Training and Handing Over of the Instrument	Successful bidder will have to commission the instrument to the satisfaction of Employer. The instrument failed during the demonstration shall be rejected and no repairs are allowed. Bidder will have to provide training to Employer engineers for safe operation and maintenance of the instrument before handing over the instrument.
14.	Packing and transport cases	The kit and accessories shall be robust and rugged enough so that it can be transported safely at different locations. The transportation case and packing of the kit shall be such that the transportation from one station to other will not affect the performance and accuracy of measurement/working of the kit.

16. SPECIFICATIONS FOR PORTABLE PARTIAL DISCHARGE MEASUREMENT KIT:

(Applicable Only for Gas Insulated Substations where Online PDMS is not available)

1. The equipment shall be used for detecting different types of defects in Gas Insulated Stations (GIS) such as Particles, Loose shields and Partial Discharges as well as for detection of Partial discharges.
2. It shall be capable for measuring PD in charged GIS environment as EHV which shall have bandwidth in order of 300 MHz - 1500 MHz with possibility to select a wide range of intermediate bandwidths for best measurement results. The principle of operation shall be based on UHF principle of detection.
3. Detection and measurement of PD and bouncing particles shall be displayed on built in large LCD display and the measurement shall be stored in the instrument and further downloadable to a PC for further analysis to locate actual source of PD such as free conducting particles, floating components, voids in spacers, particle on spacer surfaces etc. In case offered equipment does not have inbuilt LCD Display/ inbuilt storage then suitable laptop (having latest configuration) with required software for display & diagnosis of PD signals shall be supplied along with equipment. Software for display and diagnosis of PD signals and an expert software system for accurate interpretation of cause of PD shall also be supplied and installed by the contractor on Employer Laptop/PC and licensed copy of software to be handed over to Employer in a CD.
4. The equipment shall meet the following requirements
 - a. Measurement shall be possible in noisy environment.
 - b. Stable reading shall be possible in presence of vibrations within complex GIS assemblies, which can produce signals similar to PD.
 - c. Equipment should have necessary synchronizing circuits to obtain PD correlation with power cycle and power frequency.
 - d. The equipment shall be battery operated with built-in-battery charger. It shall also be suitable for 230V AC/50 Hz input.
 - e. Measurement shall be possible in the charged switchyard in the presence of EMI/EMC.
 - f. Kit shall be used for measurement for partial discharge measurement in GIS by using UHF sensors already installed in our Gas Insulated Substation
 - g. Instrument shall be supplied with standard accessories like i.e. four numbers duly screened connecting

cable (with each cable having minimum 10 10-meter length) to be used for connecting installed UHF sensors with kit, carrying case, rechargeable battery pack with charger suitable for 230V AC, 50Hz supply, noise sensor etc (as applicable).

- h. Kit should have minimum three number channels for connecting UHF sensors input to kit so that partial discharge measurement can be carried out at UHF sensors installed in GIS. Simultaneous partial discharge measurement should be possible on these three channels.
- i. Kit should have minimum one number noise channel (in addition to three number channels mentioned at 4(h) above) for giving noise feedback to kit.
- j. The function of software shall be covering the following:
 - Data recording, storage and retrieval in computer
 - Data base analysis
 - Evaluation of PD measurement i.e, Amplitude, Phase Synchronization etc.
 - Expert software system for accurate interpretation of cause of PD like corona, free particle, protrusion etc.
 - Report generation.
- k. To prove the suitability in charged switchyard condition, practical demonstration shall be conducted before acceptance.
- l. Bidder shall have “Adequate after sales service” facility in India and shall provide the document in support of this.
- m. Necessary training may be accorded to personnel to make use of the kit for operation of kit, analysis of different partial discharge signals, patterns & locating PD sources inside the GIS
- n. Instrument shall be robust and conform to relevant standard.
- o. Pulse generator shall be supplied as a standard accessory Calibration report of Pulse Injector also to be submitted along with supplied Pulse Injector.
- p. Operating Temperature: 0 to 50 °C
- q. Guarantee period for kit shall be one (01) year. Supplier will have to execute a comprehensive AMC for four (04) years for smooth & reliable operation of kit after expiry of guarantee period. The rates shall be quoted along with the bid, and it shall be taken into consideration during evaluation of bids. The AMC shall cover:
 - Calibration of Instrument: Annually or as per Instruction Manual
 - As much as visits for repairs to site

If kit needs to be shifted to suppliers works for repairs, supplier will have to bear the cost of repairs including spares, F&I etc. Kit after repair should be supplied back to site within 45 days effective from date when information of kit going defective is communicated to supplier by Employer (except for the case for which kit needs to be shifted outside India for repairs)

All the expenses for maintaining supplied instruments in "Healthy and in working condition" is to be borne by successful bidder as per LOA.

17. SPECIFICATIONS FOR PRECISION GRADE DIGITAL MULTIMETER:

Precision grade (+/- 0.5 % Accuracy for AC RMS Voltage)