TECHNICAL SPECIFICATION
FOR
SUBSTATION- CONDITION MONITORING INSTRUMENTS

Table of Contents

1. 12kL Oil Filtration Machine

Mounting Arrangement	1.Mobile Type mounting on wheels with spring, an axle & Tow bar and with weather proofing in mild steel frame.
	2. Doors in CRCA sheet
	3. Door Hinges should be Stainless Steel.
Performance	Before filtration Oil Parameters
	a. BDV - 30 KV
	b. Moisture Content - 50 PPM
	c. Gas Content- 10 % by Volume
	d. Suspended Particle - Many Particle/Micron
	After filtration Oil Parameters
	a. BDV > 70 KV
	b.Moisture Content < 5 PPM
	c.Gas Content- 1 % by Volume
	d.Suspended Particle < 1 Micron
Oil Inlet Pump	a. Positive Displacement Gear Type with Electric Motor , Flow Control Valve with Pressure Safety Valve
	b. Automatic Protection againt over pressure
	c. Interlock arrangement to be provided for Inlet Pump & Heater to minimise energy loss unless Inlet Pump is On .
	*Interlock arrangement to be provided between Inlet pump and high level float switch to avoid axcesive Rise of Oil in Degassing Chamber
	* Flow Control valve to be provided across gear Pump.
	* Motor Capacity - 3 HP
Electric Heater	a. Total Heater Load - 144 KW to 200KW. Dividend into three/ four groups.
	b. Independently Auto & Manually switchable.
	c. Thermostat to be Provided for controlling for Temp of Oil.
	c. Interlock to be provided for Inlet Feed Pump & Heater Unless Pump is on Heater Cant not be switch On.
	d. PRV to be provided in heater vessel to take care of any accidental care if any pressure increase in heater vessel .
Filtration System	Cartridge Filter - 12 KL ,Rating- 1 Micron
	Course/Press Filter - 12 KL , Rating- 10 Micron
Degassing Column feature	a.Two stage Chamber with Rasching Ring
	b.Sight Glass & Lamp shade
	c.Foam Level Control for 1st stage of Degasser
	d. Low level & High-Level flow switch
	e. Siphon seal separate both degassing chamber
Vacuumed System (Degassing)	* Combination of Rotary & Roots Vacuumed System

	# Rotary Pump
	a. Nominal Pumping speed- 300 m3 / Hrs
	b. Ultimate Vaccume - 5X10 -1 Torr
	c. Type of cooling - Air Cool
	d. Make- Busch Germany
	# Root Pump
	*Nominal Pumping Speed- 1000 M3/Hr
	*Ultimate Vaccume-10 -3 Torr
	*Type of Cooling - Air Cooled
	*Make- Busch Germany
	# Vaccume Guage
	Bourdon Type -0 to 760 Torr
	Digital Type- 0 to 250 m Bar
	Airing Valve & Isolation Valve
Valves & Piping	* Oil & Vaccume Valve- Ball Type
	* Piping- Normal Steel
	* Oil Sampling Valve
	* Electro - Magnetically Operated Isolation Valve at Inlet & Outlet
	*One NRV shall be provided to prevent mixing of processed Oil and nOn Procesed Oil in case of Power Failure .
	*Airring Valve to be Provided to admit air in to oil filtration plant & Bring in to Atmospheric pressure.
	* One Airing valve Provided in vaccume line of Rotary Pump to admit the air and bing the oil to atmospheric pressure & then switch off the
	pump . This prevent the Suck Back of the Pump Oil.
Electrical Control Panel	* separately Provided
	* Electric Supply - 415 V , 3 Phase, 4 Wire , 50 Hz A.C
	*Equipped with all Lamps, Contactor , Overload Protection for Motors
	*Mimic Diagram to be provided
Hose Pipe	* 2 Nos with length of each 10 Meter having flange mounted on both side.
	*Type- Nitrile Rubber Hose
	*Sustainable Capacity - 100 deg. C (Maximum) and Full Vaccume
Minimum Requirements	1.Preliminary Filter with Magnetic Strainer
Instruments & Accessories	2 Oil inlet Gear pump
	3 Heater Tank
	4 Press Filter
	5 Filter Chamber with Micro Filter.
	6 Two Stage Degassing Chamber with Rasching Rings
	7 Discharge Pump
	8 Trap

	9 Vacuum Pump (For degassing)
	10 Roots Pump (for degassing)
	11. High Level Float Switch
	12 Low Level Float Switch
	13 Temperature Gauge
	14 Vacuum Gauge(Bourdon type)
	15. Pressure Gauge
	16 Compound Gauge
	17 Oil Sampling Valve
	18 Oil Flow Control valves
	19 Airing valve
	20 Pressure Relief Valve
	21 Non-Return Valve
	22 Digital Temperature Controller
	23 Safety Thermostat
	24 Sight Glasses with illuminating Lamp
	25 Drain valves
	26 Vacuum Valve
	27 Flow meter with Totalizer.
	28 Oil Inlet & Outlet Valve
	29 Inlet & Outlet oil Hoses(15 meter each)
	30 Electric Control Panel
	31 Audio Annunciation
	32 Mimic diagram
	33. Vaisala make PPM Meter to be provided in Inlet & Outlet .
Height	maximum height of any part of the complete assembly shall not exceed 4.0 meter above road top

2. Vacuum Plant

Vacuum Pump Capacity	Should be able to cater 500MVA transformer oil tank
Vacuum Level	≤ 0.5 Pa Ability to achieve and maintain a deep vacuum for thorough insulation drying
Features	Automatic control function, the roots pump automatically starts.
	Vacuum pump with self-check valve, vacuum pump interlock.
	Digital vacuum gauge to facilitate the detection of the vacuum transformer.
Control system	Protection and alarm functions with phase sequence, phase, overvoltage, under-voltage, leakage detection and protection of all faults. User-friendly control panel with precision control over key parameters: Vacuum level Temperature (if applicable) Drying time Intuitive interface for ease of operation and monitoring.
Cooling type	Natural air-cooled-Advanced cooling system to prevent overheating during extended operation
Portability	on-site use
Data Logging and Connectivity	Data logging capabilities for tracking the drying process and performance
Compliance	Ensure compliance with relevant international safety and efficiency standards for electrical equipment.
Height	maximum height of any part of the complete assembly shall not exceed 4.0 meter above road top

3. Dry Air Plant

Required Dry Air Flow Rate	Adequate airflow to a 500MVA transformer.
Dew Point Requirement	100% Oil & Moisture free air with Dew Point of (-) 40℃ (<80ppm) to (-) 70℃ (0.3ppm).
Operating Pressure	0.7～0.8 Mpa
Air Filtration	Comprehensive air filtration system to remove particles, contaminants, and moisture from the air supply.
Control System	User-friendly control panel with the ability to set and adjust key parameters: Air flow rate Dew point
Portability	on-site use
Safety Features	Integrated safety measures for reliable operation, including emergency shutdown functionality.
Fault Protection	Overcurrent protection to prevent motor and component damage. Overvoltage and undervoltage protection to safeguard the system from voltage fluctuations. Automatic shutdown in case of abnormal temperature rise
Height	Maximum height of any part of the complete assembly shall not exceed 4.0 meter above road top

4. Oil Tank (20kL) with Tires

Capacity	20kL
Standard	The oil storage tank shall be designed and fabricated as per relevant standards e.g. IS 803 or BS 2594 or other internationally acceptable standards.
Specification	transformer oil storage tanks shall be towable on pneumatic tyros and rested on manual screw jacks of adequate quantity & size. The tank shall be cylindrical in shape and mounted horizontally
	The tank shall designed for storage of oil at a temperature of 100 Deg. C
	maximum height of any part of the complete assembly of storage tank shall not exceed 4.0 meter above road top
	The tank shall have adequately number of jacking pad so that it can be kept on jack while completely filled with oil. The tank shall be provided with suitable saddles so that tank can be rested on ground after removing the pneumatic tyres.
	The tank shall also fitted with manhole, outside & inside access ladder, silica gel heather assembly, inlet & outlet valve, oil sampling valve with suitable adopter, oil drainage valve, air vent dust filter, Pulling hook on both ends of the tank shall be provided so that the tank can be pulled from either end while completely filled with oil. Bidder shall indicate the engine capacity in horse power to pull one tank completely filled with oil. Oil level indicator shall be provided with calibration in terms of liter so that at any time operator can have an idea of oil in the tank. Suitable arrangement shall also be provided to prevent overflow in the tank.
	The tank shall also fitted with manhole, outside & inside access ladder, silica gel heather assembly, inlet & outlet valve, oil sampling valve with suitable adopter, oil drainage valve, air vent dust filter, Pulling hook on both ends of the tank shall be provided so that the tank can be pulled from either end while completely filled with oil. Bidder shall indicate the engine capacity in horse power to pull one tank completely filled with oil. Oil level indicator shall be provided with calibration in terms of liter so that at any time operator can have an idea of oil in the tank. Suitable arrangement shall also be provided to prevent overflow in the tank.
Coating and Protection	Internal and external coating to prevent corrosion. Cathodic protection (if applicable) to enhance durability.
Painting and Labeling	Clear labeling indicating tank capacity, oil type, and safety information

5. Handheld PPM & Dew Point Meter

Power supply	90-264 VAC, 47-63Hz 12 V DC car adapter/internal battery
Electrolysis control	"ACE" control system
End point detection	AC polarization
End point indication	Visual display / print out / acoustic beep
Measuring Range	1 microgram to 10 milligram
Moisture Range	1 ppm – 100 %
Max. sensitivity	0.1 µg
Max. titration speed	2 mg per minute
Max. current	400 ma
Drift compensation	Automatically controlled
Precision	Precision 10-100 µg ± 3 µg, 100 µg - 1 mg ± 5 µg, above 1 mg ± 0.5%
Stirrer speed	Microprocessor controlled
Calendar / clock	Analysis time & date print out
Keypad/User controls	Non tactile membrane
display	40 character alphanumeric backlit display
Battery life	8 hours running time
Calculation modes	Weight/weight Volume/density Weight/dilution ratio Preset values Volume/volume Volume/density User programmable
Display format	µg, mg/kg, ppm, % mg/kg, ppm
Print format	µg + mg/kg, ppm, %
Weight	Should be less then 3.5kg
Statistics	Upto 99 runs Preset up to 99 runs User programmable
Start delay time	0-30 mins. selectable Preset
Min. titration time	0-30 mins. selectable

Software	free data capture and retrival & Retrival

6. BDV Test Kit

Sr. no	Specification required
1	The OEM should have more than 10 years' experience in Manufacturing Oil BDV kit.
2	Quoted model should be older then 5 years date of lunch by the OEM.
3	Test Output Voltage: 0-100kV (Rate of Rise 0.5 to 5kV/S)
4	Measurement Resolution: 0.1kV or Better
5	Measurement Accuracy: +/- 0.1kV
6	Temperature Measuring Range: 10 C to 65 C
7	Switch off Time: 10 µs
8	Display/Control: 320 x 240 QVGA colour display with Alphanumeric Keypad
9	Printer: Inbuilt
10	Operating Temperature: 0 to 50 Deg
11	Storage Temperature: 30 to 65 Deg
12	Humidity: 90 % Non-Condensing
13	Weight: Not More than 30 .5 kg
14	Safety: Designed as per IEC61010 \
15	EMC : Light industrial IEC 61326-1 Class B, CISPR 22,CISPR 16-1 and CISPR 16-2

7. CT & CVT Analyzer

Sl. no.	Description	Specifications
1.	Application	1.CT Testing 2.PT Testing 3.CVT testing Above all application should be built-in in single instrument.
2.	Input power	230V ±10% at 50 Hz.
3.	Features	A) CT Testing: 1) Ratio, Phase angle, Polarity, Knee point voltage, Winding resistance, CT secondary connected burden, Insulation resistance, demagnetization. 2) The instrument should test ratio of 5taps simultaneous at one stretch without changing connections at CT. 3) Ratio measurement up to 20000. 4)Manual operation with Knob for voltage control 4)Knee-point voltage checking should be done with the help of injecting AC rms voltage @50Hz at2kV in case of knee point voltage above 2kV Kit should be capable to perform knee point up to 30kV using indirect method. 5)Kit Should have nameplate guessing feature and also it should have name plate assessment capability. 6)Software should be capable to show %Error at different VA and Different %rated current error. 7)Unit should be capable to test 0.1class,0.2Class PS class, TPS, TPY, TPZ class and turret CT also. 8)Kit should be capable to perform test on Turret CT. B)PT Testing 1) Ratio, Phase angle, Secondary winding resistance up to 400kV class PT. C) CVT Testing Ratio, Phase angle deviation, polarity up to 400kv Class CVT. E) All application like CT.PT, CVT, testing shall be integrated in single unit only, individual instrument for each application shall not be acceptable. F) Kit should have feature to upgrade the single phase relay testing feature in

		the same unit in future if required.
4.	Technical requirement.	**CT Testing:** a)Ratio measuring range 0.8 to 2000 with accuracy of 0.05% Max or better, 2000-5000 with accuracy of 0.1% Max or better & 5000-20000 with accuracy of 0.2% Max. b)Automatic CT's VI curve plotting up to 2000 volt, Test frequency 50HZ,also kit should have indirect method to plot knee point upto 30kV. c)CT's secondary winging resistance measurement range 0.5 to 30 ohms with 1% accuracy. d)Phase angle measurement 0-360 deg with accuracy of ±3 mins typ. e) Current accuracy ±0.2% or better. f)Voltage reading accuracy ±0.2% or better. g)Unit should follow standard testing procedure like IEC60044-1, IEC 60044-6,ANSI C57.13.,IEC61869-2 g) Insulation Test Test Voltage 1000 VDC, 500 VDC Measuring Range 20 GΩ, 10 GΩ Short Circuit Current 1.5 mA nominal Test Current on Load 1 mA at min. pass values of insulation (as specified in BS7671, HD 384 and IEC 364) Accuracy 1000 volts ±3% ±2 digits ±0.2% per GΩ 500 volts ±3% ±2 digits ±0.4% per GΩ **PT Testing:** Output Voltage 0 to 300 V AC Output Current 0 to 1 A eff Output Power 300VA Ratio up to 400kV PT ±0.05% typical ±0.5%maximum. Resistance: Resolution 1m Ω Guaranteed Accuracy (at 20° C) ±0.2% + 1m,Ω **CVT Testing:** Output Voltage 0 to 2000 V AC Output Current 0 to 1 A eff Ratio: Ratio up to 400kV CVT ±0.05% typical ±0.5%maximum
	Communication Port	Ethernet ports for connecting with external PC/Laptop.
5.	Repeatability	It should offer repeatability of test results at presence of high interference/high voltages.
6.	Operating conditions	Shall operate at temperature 0-50 Deg C.

7.	Safety standards	The kit shall meet international safety standard for IEC 61010 or equivalent.
8.	Training	The supplier shall also have to arrange necessary training to the end customer
9.	Software	Party has to supply complete software with license to end customer. The software should be windows based, this software shall be able to assist in analyzing the measurements and it's reporting in user friendly manner. Software allows printing of test results along with VI curve.
10.	Accessories	a) All testing leads required to test 5taps CT at a time. b) All the attachments to main equipment to fulfill above specifications. c) PC interface, power supply & grounding, tap changing interface cables. d) Operating manual, e) Application software CD and hard carrying case.

8. DCRM -6 Channels with Timing Card

S No	Description	Specification
1.	Functional Requirement	1. The instrument should be suitable for measuring the operation timing of main, PIR and auxiliary contacts (wet &dry) as well as coil currents. It should measure the Dynamic Contact Resistance of main & arcing contacts as well as travel measurement (with external travel transducer) of operatingmechanism. 2. The instrument should be suitable for testing the CBs upto 245 kV as per applicable standards. 3. The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard upto 245 kV levels. 4. The equipment should be able to calculate opening & closing timings along with bounce timings in a tabular format. 5. Kit should have grounding feature. 6. The analyzer should have provisions for recording different functions of the circuit breaker as under: i. Closing (C) Time ii. Opening (O) Time iii. C-O Time iv. O-C Time v. O-C-O Time vi. Contact Bounces vii. Simultaneity of Contacts viii. Auxiliary Contact Time **Polarity insensitive** ix. Closing Coil Current Characteristics x. Tripping Coil 1 & Tripping Coil 2Current Characteristics xi. Travel Speed (During CB Closing &Opening)

		xii. Total Travel xiii. Contact Gap xiv. Contact Insertion xv. Over Travel xvi. Re-bounce xvii. Dynamic Contact Resistance Measurement (Current & Resistance Graph) xviii. The analyzer should be able to perform various operations on breaker under test with the facility to introduce time delays between composite operationslike C-O or, O-C or, O-C-O. **xix. Main and parallel resistor contact timing** **xx. The kit should measure coil current , resistance & voltage in single operation.** xxi) **Kit should able to perform DCRM measurement during C-O, O-C OR O-C-O operations.**

2.	No. of Channels	1. Main Contact Channels: Min 12 2. Aux. Contact Channel:04 Dry & 04 Wet 3. DCRM/Test Current Channels:12 (6 Channel for resistance + 6 channel for current) 4. Travel Channel:06
3.	Sampling Speed	**40 kHz sampling or better**
4.	Accuracy	1. Timing : ± 1 % of reading 2. Coil Current: ± 1 % of reading 3. R : ± 2 % of reading 4. Travel: ± 1 % of reading
5.	Measurement Range:	1. Timing: 0-200 s 2. Coil Current:0-80 A
6.	Resolution	**Timing: 0.05 ms**
7.	DCRM Test Current	**200A instantaneous & 140 after 1 sec**
8.	Test Leads and accessories	One complete set of cables of sufficient length (min 20metre) with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test. Two sets of AVS (Automatic Voltage Stabilizer) shall be supplied with each test set for overvoltage protection. Additionally all the required accessories should be provided forthe 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.

9.	Travel Transducers	One set of travel transducers along with clamp/fixtures to suit 36 KV/145 kV/245 kV CB of SIEMENS/GE/ABB/CGL
10.	Design/Engg.	**The complete equipment along with complete accessoriesmust be designed/engineered by Original Equipment Manufacturer.**
11.	Power Supply	**100 – 240 V AC, 50 / 60 Hz** **125 – 340 V DC ,200VA MAX**

14.	**Display**	**(touch screen)** **The display should be an 8-inch trans-reflective screen that enhances the use in direct sunlight.**
15.	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. Also the kit should have facility of stopping Automatically on power failure.
16.	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.
17.	Weight	**<12kg portable & rugged**
18.	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. The software should be suitable for automatic testing & report generation, signature as well as trend analysis. The Supplier should provide all essential software's required for proper functioning of the kit free of cost with license for the complete life of the test equipment with future update if any.
19.	PC Interface & kit communication	It shall include supply of one laptop PC per DCRM test set of Dell/Lenovo/HP make with latest specifications such as Core i7 Intel Processor,4GB RAM, 320GB or better HDD, 15'' TFT screen, complete with required cables and connectors with preloaded operating MS Window 10 professional or better with latest version application software require for storage analysis and record management. **Test Kit must have** **.1.Ethernet- 100 base-Tx Fast Ethernet port** **2. USB interfaces enable easy backup and data storage for transport from one system to another by using memory sticks or portable CD/RW etc.**
20.	Environment	Application field For use in high-voltage substations and industrial environments Temperature Operating -20°C to +50°C (-4°F to +122°F) Storage & transport -40°C to +70°C (-40°F to +158°F) Humidity 5% – 95% RH, non-condensing
21.	Standards	CE-marking EMC 2004/108/EC LVD 2006/95/E
22.	Other terms	OEM must have manufacturing & service support unit in India.

9. CRM

S.NO	Parameter	
1	Environment	**Application** - The instrument is intended for use in **high-voltage substations and industrial environments**
		Temperature
		Operating -20°C to +50°C (-4°F to +122°F)
		Storage & transport -40°C to +70c (-40°F to +158°F)\
		Humidity- 5% – 95% RH, non-condensing
2	CE marking	LVD 2014/35/EU
		EMC 2014/30/EU
		RoHS 2011/65/EU
3	General	**Mains voltage-** 100 - 120 / 200 - 240 AC, 50 / 60 Hz
		Input current (max) - 39 A at 100 V, 18 A at 230 V (3 sec)
		Protection -Fuses (200 mAT and 400 mAT)
		Thermal fuse, Software
		Shut off temperature: 70ºC (158ºF)
		internal temperature
		Encapsulation:
		opened lid IP40
		closed lid IP63
		Dimensions -486 x 392 x 192 mm (19” x15” x 7.5”)
		Weight -13.8 kg (30.4 lbs)
		21kg (46.3lbs) incl. cables and soft case
		Display- LCD
		Available languages- English, Deutsch, Français, Espagñol, Svenska
		Printer :Thermal printer
		Thermal paper roll - Width 57 mm, diameter 32 mm
4		**Range- 0 – 999.9 mΩ**
		Resolution- 0.01 µΩ below 100 µΩ
		0.1 µΩ below 1.0 mΩ
		1 µΩbelow 10 mΩ
		10 µΩ below 100 mΩ
		100 µΩ below 1000 mΩ
		Current shunt -600 A, 60 mV

		Sense ranges- 0-2 mV, 0-20 mV, 0-200 mV, 0-5 V
		Inaccuracy Typical maximum 1)100 A, ta 25ºC, ±0.2 µΩ ±1 µΩ R < 1 mΩ
		2)50 – 600 A, ta 10 – 40ºC,±0.3 µΩ ±2 µΩ 50 – 600 A, ta 0 – 50ºC, ±0.7 µΩ ±3 µΩ R < 1 mΩ
		3)50 – 600 A, ta -20 – 50ºC, ±1.1 µΩ ±4 µΩ R < 1 mΩ 4)600 A, ta 10 – 40ºC, ±6 µΩ ±50 µΩ 1 mΩ < R < 8.4 mΩ
		5)50 A, ta 10 – 40ºC, ±80 µΩ ±500 µΩ 10 mΩ < R < 100 mΩ
		6)5 A, ta 10 – 40ºC, ±1 mΩ ±10 mΩ 100 mΩ < R < 500 mΩ
		7)5 A, ta 10 – 40ºC, ±2 mΩ ±20 mΩ 500 mΩ < R < 1000 mΩ
5	Output	**DC+ / COM –**
		Range- 600 A DC (steps of 1A)
		Max. output voltage - 5.25 V at 600 A
		Max. ripple- 80 mVpp, 28.3 mVrms at 0 - 50°C (+32°F to +122°F)
		OUTPUT 100 µV/A
		Shunt output -From internal shunt 60 mV at 600 A
		Inaccuracy - ±1%
6	Input	**SENSE-** Max. 20 V between terminals and to
		protective earth(ground)
		INPUT DC current clamp
		Max. 20 V between terminals and to protective earth(ground)
		Input sensitivity- Adjustable 0.1 – 20 mV/A
		Input impedance ->1 MΩ
7	Other terms	OEM must have manufacturing & service support unit in India.

10. Earth Resistance Meter with Clamp

Earth resistance range	0.01 ohm to 200K ohm with Very high resolution.
Resistance Accuracy	2% ±3 digits
Instrument output	
Voltage	±25 V or ±50 V at 94 Hz, 105 Hz, 111 Hz and 128 Hz
Current	4.5 mA or 0.45 mA or 0.045 mA Ground current range
With clamp	0.5 mA to 19.9 A
Ground current accuracy	5% ±3 digits
Ground voltage range	0 to 100 V ac
Ground voltage accuracy	2% ±2 V
Noise Rejection	40V Pk to Pk
Display	31⁄2 digit high contrast liquid crystal, backlit
Battery type	8 off AA (LR6) NiMH rechargeable cells Should work for 3 hours, 700 consecutive tests
Temperature Coefficient	< ±0.1% per °C over the temperature range -10 To +40°C 0, 05% per °F from 14 to 104°F
Environmental Protection	The instrument should be waterproof to IP54
Operating Temperature	-15 to + 55°C
Storage Temperature	- 40 to + 70°C
Safety	Complies with the requirements of EN61010-1 100V CAT IV between terminal pairs and
EMC	In accordance with IEC61326 including amendment No.1
Standards Compliance	Complies with the requirements of KEMA K85B EN61557,
Following parts to be provided:	1) 1 no's of earth tester equipment 2) 1 no's of v clamp 3) 1 no's of I clamp 4) 4 Right angled terminal adapter 5) Field Calibrator 6) External AC/DC adapter 7) User manual 8) Leads (49 ft, 33 ft, 33 ft, 10 ft) and Spikes 9) Carrying case 10) Rechargeable batteries

11. Protection Relay Test Kit with Advanced Distance, Advanced Differential & Transplay

A	**Functional requirement**
1	The equipment is required functionally to test the following electromechanical, solid state and numerical protection relays in a Single unit and unit shall be less than 14KGs
2	Distance relays (ground and phase distance), Over current relays (directional and non-directional, definite time and inverse time), Frequency relays (over-and under),Voltage relays (over and under), Power relays (directional), Differential relays (including harmonic restraint feature), Other associated protection relay functions: auto-reclose function, power swing etc.
3	The amplifier stages are to be fully electronic. Modular design for plug-in and removal from test kit of system configuration and maintenance, Voltage outputs shall be protected from short circuits and prolonged overloads. Current outputs shall be protected from open circuit and overloads. During Open Circuit & short circuit, kit should stop injection automatically with Alarm as safety precautions.
4	The testing system must generate at least 4 independent/Convertible voltages and 6 currents (3 Independent channels + 3 voltage channels convertible as a current channel) with the facility to control their amplitudes and phase angles independently. The kit should have df/dt facility (i.e. frequency variation with respect to time). The setting range of voltage generators shall be as under or better. Setting ranges 0-300 V for 4-phase AC (ph-N), 0-600V for 1-phase AC (Ph-Ph), 0-300V for DC (L-N) or more than the mentioned values. Output power- Setting range 100VA for 4-phase AC (Ph-N) for voltage and for current should have 200VA @ 5A minimum to test electromechanical relays without adding any external amplifier.The setting range and output of current amplifiers shall be as under or better of Setting of current 3 x 30A @ 200VA + 3 x 15A @ 120VA for performing differential test. Auxiliary DC voltage range 5-250V to Power all types of relay @ 100Watts maximum. Shall be able to generate continuous sine waves with a frequency between 0.1 and 1000 Hz and to generate transient files with a bandwidth from dc up to 10 kHz. Minimum number of out puts shall be 6 and are completely independent from internal amplifier (voltage & current Source) outputs.Minimum number of binary inputs shall be 10nos, Should sense both Potential (Upto300V AC/DC) and potential free contacts.
	Kit shall have 3 nos of Ethernet ports & USB for communication.All the above facilities should be in single unit.
B	**SOFTWARE SPECIFICATION**
1	Should be provided with basic licensed software along with licensed software containing all advance options for distance, differential, Directional, Non-Directional, Ramping, State sequencer, Frequency, Comtrade/AdvanceTransplay, Power swing module, OCC/Predefined test for whole life period of the

	kit. In future, if any upgradation required in software then it shall have to be at upgraded free of cost.

12. Battery Discharge Kit

1	The instrument able to discharge the substation battery set of 12Volts to 220V DC system with automatic facility of regulating discharge rate.
2	The discharge current can be settable at every voltage, subject to maximum current value.
3	The kit has been the facility to operate on constant current, constant power, constant resistance modes for effective discharge of Battery sets.
4	The kit has been display the running parameters during discharges; discharge currents (A), Running discharge capacity (AH), present Voltage (V), discharge time elapsed.
5	The kit has Internal current measurement and When higher current discharges, instrument measures external current measurement through current clamp on meter
6	Automatic Warning Limit of AH, Time, Voltage.
7	Automatic Stop Limit of AH, time, Voltage.
8	When Power failure happens and when power returns, the instrument test resume facility on return of power automatically.
9	The unit should adjust itself to include load currents in the test parameters.
10	Load unit cable can discharge current maximum at 76A at 12Volts; 170Amps at 24Volts; 220Amps at 48volts; 135Amps at 110volts; 124amps at 120volts; 68Amps at 220volts, 50A at 300V, 42A at 350V, 37A at 400V, and 31A at 480V.
11	The instrument should have additional accessory instrument of same make that will help discharging procedure by measuring cell impedance, cell voltages, cell temperature, cell ripple voltage, AC/DC current with cell temperature measurement facility. Instrument should also be able to use separately for periodic (quarterly/monthly) measurements for same parameters. The equipment should be able to measure cell impedance up to 200V with whole string or individually.
12	Above mentioned accessory instrument should have 1000 V DC and 600 V AC voltage measurements for battery charger/UPS routine maintenance. The equipment should be light weight, portable and have display to see all records/compare with base line or previous values with free software to import data and create reports with different chart.
13	The instrument should be able to connect with extra load unit to discharge higher current capacity batteries with external current measurement features for future use.

14	Against short circuit protection, overload & transient surges control by the instrument and automatically cuts off from battery.
15	Instrument has internal cooling arrangement with air flow block detection.
16	Voltage/ Battery Capacity vs Time plot curve available in test report future reference.
17	View test parameters/results “real time” as testing progresses using software
18	Easily save results to a PC for analysis, report generation and storage.
19	The instrument has to work on single phase supply.
20	Test leads and necessary cables should be provided.
21	Unit should be have the following Safety standard EN61010-1-2001, IEC61010-1-2001 and EMC 61326-1997+A11998+A2-2001.
22	The equipment will supply with carry case, user manual and software.
23	Successful Commissioning and Training will be provided free of cost.
24	After sales service provided free of cost with in warranty period.

13.SF6 Gas Handing, Evacuating, Storage & Refilling kit

	The service cart shall be for liquid storage equipped with the well-proven components for the recovery, filling and purification of SF6 gas as well as the evacuation of air and venting of gas compartments. This service cart should be semi-automatic operation via a 3.5" touch screen with protective cover shielding from sunlight and dust. It should be designed for emission-free gas handling with DILO couplings DN20.
A	**Specification Requirements:**
1	15 m3/h delivery rate of compressor for recovery of SF6 to atmospheric pressure.
2	15 m3/h delivery rate of vacuum compressor/suction pump for recovery of SF6 from atmospheric pressure to less than 1 mbar with zero emissions.
3	63 m3/h delivery rate of vacuum pump for evacuation of air to achieve final vacuum < 1mbar.
4	dry filter (water absorption capacity 175 g at a dew point of -36 °C)
5	particle filter 1 µm.
6	indication units in bar / mbar, kPa or psi / torr to be selected on the touch screen.
7	standard cylinder connections
8	300l pressure vessel with pneumatic rubber wheels for suitable use in outdoor substations.
9	dew point control for checking the filter condition
10	digital weighing scales for SF6 cylinders (with automatic shutdown), 0 - 120 kg with tare function, accuracy ± 0.02 %
B	The performance of the service cart for SF6 gas handling must be TÜV SÜD certified for a Gas Compartment of pressure: 6bar (abs) & storage tank containing 17.5 kgs, 30kG of SF6 gas and having a Final recovery Vacuum: 1mbar should be as follows: -
1	Recovery time: 55 mins

2	Evacuation time: 15 mins
3	Filling time: 5 mins

14. Megger Make Multifunction trans kit for transformer testing

1	Construction	Portable, suitable for rough handling, easily transportable Transformer And Substation Test System etc.
2	Standard	IEC or equivalent
3	Display	Inbuilt 10 inch touch screen TFT display
4	Power Supply	230V ± 10%, 50Hz, AC
5	Power Consumption	<3500 VA
6	**Voltage Measurement**	
	Output Voltage	0 to 12KV AC
	Accuracy	≤0.5%
	Current	100 mA continuous @ 12kV
		500 mA intermittent @ 12kV
	Frequency	1 to 505Hz
7	Current Output	0-800A/6V AC
		100A/50V DC
8	Voltage Output	2200V/1A AC (1 min.)
		250V/10A AC
9	Auxiliary Voltage	0-300V DC
10	**Voltage & Current Measurement**	

	Input	4 x 0 to 10Amps AC & DC
		4 x 250/350 V AC & DC
		2 x 50 V DC (R1 & R2)
	Resolution	1µA
	Accuracy	≤0.2% of reading + 0.2% FS
11	**Test Frequency**	
	Range	1 – 505Hz
	Resolution	0.01Hz
	Accuracy	≤0.2% of reading + 0.2% FS
12	**Capacitance Measurement**	
	Range	0-100 mF
	Resolution	0.01PF
	Accuracy	±0.5% of Reading + 1 pF
13	**Inductance**	
	Range	6H to 10MH
	Resolution	1 mH
	Accuracy	±0.5% of Reading
14	**Dissipation Factor (tan ð)**	
	Range	0 to 10000%
	Resolution	0.001%(Max)
	Accuracy	±0.5% + 0.02%
18	**Power Factor (CosΦ)**	
	Range	0 to 10000%
	Resolution	0.001%(Max)
	Accuracy	±0.5% + 0.02%
	Range	0.5µΩ to 20k Ω
	Resolution	<0.5%
18	**Primary injection**	
19	Current Range	0 to 800A AC and 0 to 100 A DC
20	Accuracy of AC	0.2%+ 0.2% of full-scale phase 0.2°
21	Accuracy of DC	0.1% of reading+0.1% FS
22	Voltage Range	0 to 2200VAC
23	Accuracy	0.20%
24	Operating Temperature	-20°C to +55°C
25	Storage Temperature	-20°C to +70°C
26	Humidity	<90%RH, Non-Condensing
27	Standard	To be supplied following accessories:

	Accessories to be supplied	**a) Transformer Testing SW with :**
		1. Transformer turns ratio
		2. Winding Resistance
		3. Inbuilt Demagnetization
		4. Excitation Current
		5. Magnetic Balance
		6. True Dynamic OLTC testing includes ripple, slope, timing, true transient resistor values, motor current.
		7. FRSL
		8. Short Circuit Impedance
		9. Capacitance and Tan delta test
		b) **CT/VT SW with the following Tests:**
		1. CT Ratio, Polarity
		2. CT Phase & Magnitude error
		3. Ct Burden (Automatic/Manual)
		4. CT Knee point minimum 2.2 Kv or better
		5. CT Voltage Withstand test
		6. VT Ratio & Polarity
		7. VT Phase & Magnitude error
		8. Voltage withstand test
		9. Capacitance and Tan delta test
		d) 12 KV High voltage unit for tan delta,
		capacitance with 500mA, Variable Freq. 1-505 Hz and excitation current measurements
		a) Automated 3-phase/6-winding
		switchbox for automated turns ratio (250V), winding resistance (16A), Dynamic OLTC test & Adaptive demagnetization
		b) Three phase Circuit breaker timing test & Contact resistance up to 100 Amps
		c) Primary current injection unit - 800 A

15.DCRM Kit

Sr. No.	Name of the Device	Specs/ Preferred or Equivalent Make or Model
1	GIS Breaker testing instrument i.e. DCRM, Time measurement	EGIL 200 or **Equivalent**

16.Tan Delta Kit

Sr. No.	Name of the Device	Specs/ Preferred or Equivalent Make or Model
1	Capacitance ten delta instrument (CPC100 multi testing kit)	Preferred make of instruments are OMICRON, MEGGER, SCOPE **ONLY**

17.DC Earth fault locator

Sr. No.	Name of the Device	Specs/ Preferred or Equivalent Make or Model
1	DC Earth fault locator	Megger make MGFL 100 or **equivalent**

18.LCM Kit

Sr. No.	Name of the Device	Specs/ Preferred or Equivalent Make or Model
1	LCM Measurement instrument	Scope make SA30i or equivalent