**SECTION- I – XIX**

**TECHNICAL SPECIFICATIONS FOR DIAGNOSTIC TOOLS UNDER RENOVATION AND UPGRADATION OF PROTECTION SYSTEM OF**

**132kV SUB-STATIONS IN THE STATE OF MIZORAM**

The following describes the main technical requirements pertaining to various diagnostic tools for carrying out Renovation and Upgradation of Protection System in various Sub-Stations of Mizoram under PSDF.

It is not the intent to specify completely herein all the details of the specifications and features of the instruments/tools. However, they shall conform in all respect to high standard of engineering, design and workmanship and shall be capable of performing in a manner acceptable to the purchaser.

The bidder should ensure supply of the following items from the **Preferred Make** list mentioned or equivalent **reputed brand** as well as followed by the technical specifications attached:

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| **Sl. No.** | **Description of items** | **Preferred Make** | **Quantity** |
| 1.A | Transformer Winding Resistance Meter. | Megger/Omicron/TETTEX | 1 set |
| 1.B | Transformer Turns Ratio meter. | Megger/Omicron/TETTEX | 1 set |
| 2. | Insulation Resistance (IR) tester (10kV) (Portable & Fully Automatic) | Megger/ Omicron /Megabras | 1 set |
| 3. | Automatic Capacitance & Tan delta Measuring Instrument (Portable) | Megger/ Omicron / Doble | 1 set |
| 4. | Breakdown Voltage (BDV) Test Kit for oil (60kV) (Portable & Automatic) | Megger / Omicron / Baur | 1 set |
| 5. | Dissolved Gas Analyzer (Portable) | GE/MYRKOS/Doble | 1 set |
| 6. | Frequency Response Analyzer (FRA)test set | Megger/ Omicron | 1 set |
| 7. | CT. PT Analyzer | Megger/ Omicron/ SCOPE | 1 set |
| 8. | SF6 Gas Handling Plant (for evacuation, filling, filtering of SF6 Gas including leakage detector) | Kaji/ Dilo | 1 set |
| 9. | Static Contact Measuring Instrument | Megger/ Omicron /Programma | 1 set |
| 10. | Leakage Current Meter (LCM) for surge Arrester | SCOPE/ Doble | 1 set |
| 11. | Earth Tester for measurement of soil resistivity & ground resistance. | Megger/ Omicron /Megabras | 1 set |
| **Sl. No.** | **Description of items** | **Preferred Make** | **Quantity** |
| 12. | Automatic Relay test kit suitable for testing electromechanical /static /numerical relays. | Megger/ Omicron /Doble | 1 set |
| 13. | Thermo Vision Camera for detection of hot spots. | Megger/Fluke/FLIR | 1 set |
| 14. | Thermal Scanner (For Transformer/ Reactor) | Megger/Fluke/FLIR | 1 set |
| 15. | Transmission Line Response Analyzer | Omicron/ Taurus | 1 set |
| 16. | Puncture Insulator Detector (PID). | SCOPE/ Positron | 1 set |
| 17. | Portable multifunctional Primary CT Injection kit. | Megger/ Omicron /Programma | 1 set |
| 18. | Leakage Current Detector | Megger/Fluke | 1 set |
| 19. | Transformer Oil Filtering machine. | NIRMAL/CEE DEE | 1 set |

**I. A. TECHNICAL SPECIFICATION FOR TRANSFORMER WINDING RESISTANCE METER**

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| **Technical Specification For Transformer Winding Resistance Meter** | | |
| Sl.No | Parameters | Specifications |
| 1 | Functional Requirement | 1.    The instrument should be suitable for offline measurement of winding resistance of transformer, including OLTC, and reactors etc. upto 400 kV, in live switchyards upto 400 kV level, as per applicable standards/ testing procedure. |
| 2.    It should have min. 03 nos. measuring channels for Winding Resistance, 1 for Test Current measurement and 1 for external temperature input. |
| 3.    The test results should have repeatability, consistency & immunity to interference in live switchyard upto 400 kV levels. |
| 2 | Test Current | 25 A DC Continuous current with selectable current range facility in the range of 10 mA, 100mA, 1A, 5A, 10A, 25A) |
| 3 | Measurement Range | 0-2000 Ω, Auto Ranging. |
| The instrument shall be capable of measuring resistance up-to 800 milli-ohms at 25 Amp current and up-to 2 ohms at 10 amp current. |
| 4 | Resolution & Accuracy | Resolution: 0.1 µΩ in lowest resistance range. |
| Accuracy: Value ± 0.5 % ± 2 Digits |
| 5 | OLTC Testing | The kit should be capable of checking the current v/s time characteristics during the tap change at 25A. It should be able to display the magnitude of current variation during tap change operation in %.The kit should present the transition time from one tap to the next tap in the test results. |
| 6 | Temperature Sensor | Kit should have facility to measure the temperature with RTD sensor. It is to be supplied with kit. |
| 7 | Open Circuit Voltage | 50 V DC. |
| 8 | Temperature Correction | The kit should have the facility to have correction of resistance value to a reference temp. i.e. provide temp. compensated reading of resistance (For Copper & Aluminum) |

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| 9 | Test Lead / Accessories | One complete set of cable of sufficient length (Min 20 Mtr) with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test in substation. 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. |
| 10 | Design/Engineering | 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, Voltage: 230 ±10 %, Frequency: 50 Hz ± 5 % on standard sockets. |
| 12 | Operating Temperature | 0 to + 50 deg C. |
| 13 | Relative humidity | Max. 95% non-condensing. |
| 14 | Protection/ Control | The instrument should have facility of automatically discharging the specimen when test is completed or when current cable is accidently disconnected or when instrument power supply is lost. The kit should have built in rapid discharge circuit for automatically discharging the stored energy in the transformer at the end of each test. Kit should also have indication to show the status of discharging. |
| 15 | Weight | It should be portable for easy movement. |
| 16 | Software | The software should be suitable for automatic testing & report generation including OLTC testing. The kit should have facility to conduct the test through laptop as well as in stand-alone mode. |
| 17 | Display/Control | Onboard, large back lit graphic LCD Display. Operation through built-in keypad as well as through external laptop. |
| 18 | Printer | In-built thermal printer |

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| 19 | PC Interface | Kit should have RS 232 or USB port for PC interface. Kit shall include supply of one Laptop PC of Dell / Lenovo / hp make with latest specifications such as Min Specs will be as 500GB HDD, 4 GB RAM, Windows 8 64 Bit, Core i3, USB - 2 Nos, Ethernet, 14" display, antivirus software. |
| 20 | Memory | Built-in non-volatile memory to store minimum 5000 results. |
| 21 | Type Testing | Kit should be suitably type tested for Environmental Tests as per relavent IEC in NABL accredited lab. Copy of Type test report shall be submitted along-with the bid. |
| 22 | Warranty / Guarantee | 12 months form the date of successful & complete commissioning at site. |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee 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 repairs, spares and transportation of kit for repair at service center/works. |
| 23 | 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 inspection/supply of the kit. |
| 24 | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to end user. |
| 25 | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

I.B. **TECHNICAL SPECIFICATION FOR TRANFORMER TRUNS TATIO METER**

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| **Technical Specification For Transformer Turns Ratio Meter** | | |
| **Sl.No** | **Parameters** | **Specifications** |
| 1 | Functional Requirement | Automatic Transformer Turns Ratio Test Kit with Phase Angle Measurement |
| 2 | Ratio Range | It should have min range from 0.8 to 20000 with 5 Digit resolution or better. |
| 3 | Ratio Accuracy | Value+/-0.1% or better |
| 4 | Indication | Kit should have minimum 5 Digit LCD display of ratio. And LCD display of minimum 4 line x 20 characters alphanumeric controlled by processor for interfacing with keyboard. |
| 5 | Phase Angle | Value+/-90 degree |
| 6 | Accuracy | Value+/-0.5 degree |
| 7 | Excitation Voltage | 10V, 40V, 100V AC, Selectable |
| 8 | Excitation Current | In the range of 1mA-2A |
| 9 | Accuracy | Value+/-0.1mA |
| 10 | Resolution | Minimum 0.1mA |
| 11 | Storage Memory | Kit should have inbuit facility to store upto 100 test results. |
| 12 | Port | It should have RS232 Port or better for PC connectivity. |
| 13 | Software | It should come with Windows based software. |
| 14 | Protection | It should have inbuilt Short circuit, over load, transient surge induction voltage. |
| 15 | Operating Temp. | 5deg-50deg |
| 16 | Three Phase Test Cables | Minimum 15 meters long |
| 17 | Power supply Cord | Minimum 2 meters long |
| 18 | Ground cable | Minimum 7 meters long |
| 19 | Safety specifications | As per IEC specifications |
| 20 | EMI/EMC  specifications | As per IEC specifications |
| 21 | Warranty / Guarantee | 12 months form the date of successful & complete commissioning at site. |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee 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 repairs, spares and transportation of kit for repair at service center/works. |
| 22 | 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 inspection/supply of the kit. |

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| 23 | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to the end user. |
| 24 | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**II. TECHNICAL SPECIFICATION FOR INSULATION RESISTANCE (IR) TESTER.**

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| **Technical Specification For Insulation Resistance (IR) Tester (Portable & Fully Automatic)** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | For the measurement of IR, PI, DAR,SV and DD for Insulation Resistance Analysis of Various equipments’ insulation |
| 2. | Voltage selection | 50…1000V at 10V steps  1…10kV at 25V steps |
| 3. | Measurement Range | Up to 35 TΩ with max resolution f0. 1 TΩ |
| 4. | Short Circuit Current | 5mA |
| 5. | Step Voltage Test | 50…1000V with 10V steps  1000…10kVwith 25V steps |
| 6. | Guard | 2% error guarding |
| 7. | DC and AC voltage  Measurement range | 50 to 600V |
| 8. | Capacitance  Measurement | 10 nF to 50 µF |
| 9. | Capacitor Charge time | < 1.5 Seconds per F |
| 10. | Test time | Upto 99 Min.59Sec |
| 11. | Modes Available | T1, T2 and T3 test times for measuring one or two  absorption coefficients from the range of 1…600 s  Polarization Index (PI) Absorption coefficients Ab1, Ab2  Di electric Absorption Ratio(DAR) Step Voltage Test(SV) Di electric Discharge calculation(DD) |
| 12. | Data storage | Internal storage with USB / RS232 download |
| 13. | Display | Graphic LCD |
| 14. | Operating  Temperature | -10ºC to 50ºC |
| 15. | Environmental  Protection Instrument | IP65 |
| 16. | Standards | EN61010-1 and IEC61557, CAT – IV 600V (CAT-III1000V),  EN61326-1:2006 and EN 61326-2-2:2006 |
| 17. | Power supply | Built-in rechargeable battery pack  Charger:85V to 265V 50Hz/ 60Hz |
| 18. | Scope of supply | Instrument with 15m Test Lead Set, Power Supply cable,  Calibration Certificate, USB Cable, Crocodile Clip, Pin Probe, Operation Manual, Software. |
| 19. | Type Testing | The test kit shall be type tested for Environmental Tests,  EMI-EMC& Safety Tests as per relevant IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 20. | Calibration certificate | Unit shall be duly calibrated before supply and the date of  Calibration shall not be older than two months from the date o delivery/supply of the kit to the consignee. |
| 21. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 22. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department  (P&ED) engineers |
| 23. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**III. TECHNICAL SPECIFICATION FOR AUTOMATIC CAPACITANCE & TAN DELTA MEASURING INSTRUMENT.**

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| **Technical Specification For Automatic Capacitance & Tan delta Measuring Instrument (Portable)** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | Automatic Measurement of Capacitance &Tan Delta as per the test plan by auto-balancing No need of manual balancing. Automatic voltage setting through software. |
| 2. | Requirements | Indication of Leakage current. |
| Suitable for extraneous conditions in 132kV switchyard under heavy induction |
| Automatic Interference Suppression. |
| 3. | Display | Large colour back lit LCD high resolution graphical display on laptop / Front Panel. Graphical representation of voltage vs Tan Delta to know the Tan δ gradient & data analysis for comparison with old results and manufacturer’s data |
| 4. | Memory | More than 10000 Results Data-storage |
| 5. | Print out | ON site print out with USB printer/ Inbuilt Printer |
| 6. | Temperature  Correction | Temperature correction as per IEC for Tan delta |
| 7. | Test | Executes all the test modes automatically |
| 8. | Voltage Setting | Fully Automatic through software |
| 9. | Analysis Software | Windows based analysis software for Tan d Vs Time, Tan d Vs  Voltage |
| 10. | Inbuilt Standard  Capacitor | 100pF/ 200pF ± 0.5%, T and < 0.0001, Max. Voltage Rating:  14KV rms |
| 11. | Protections & Safety  Features | 1. Open Ground Protection  2. Zero Start Protection  3. HV inter lock  4. Over Voltage Protection  5. Over Current Protection  6. Over Temperature Protection. |
|  | Measurement Parameters | |
| 12. | Capacitance | Range:1pF-1.1μF  Resolution:0.01pF  Accuracy: ± 0.2% of the reading ± 1pF |
| 13. | Tan Delta | Range:0%-200% Resolution:0.00001  Accuracy: ± 1% of the reading ± 0.05% |
| 14. | Voltage  Measurement | Range:0-12KV Resolution:1.0V Accuracy: ± 1% ± 1digit |
| 15. | Current  Measurement | Range:0-200mA Resolution:1mA Accuracy:± 1% ± 1digit |
| 16. | Power Factor | Range:0.01% - 100% Resolution:0.00001  Accuracy: ± 1.0% of the reading ± 0.05% |
| 17. | Essential  Accessories | 1. Calibrator Box with one C & three Tan Delta Taps Test  Voltage 2KVAC  2. Cables: HV Cable – 20 Meter, LV Cable- 20 Meter, Ground  Cable,  3. Inter connecting cables  4. Temperature & Humidity Meter.  5. Carrying Cases: Foam Padded Carrying Cases for Bridge  & Power supply, Carry Bag for Cables  6. Laptop with accessories supplied  7. Windows based software CD  8. Operational Manual CD  9. Application Notes CD |
| 18. | Type Testing | The test kit shall be type tested for Environmental Tests, EMI- EMC& Safety Tests as per relevant IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 19. | 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 delivery/supply of the kit to the consignee.. |
| 20. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 21. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 22. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**IV. TECHNICAL SPECIFICATION FOR BREAK DOWN VOLTAGE (BDV) TEST KIT FOR OIL (60 KV).**

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| **Technical Specification For Break Down Voltage(BDV)Test Kit for oil(60KV)–Portable & Automatic Oil test set** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | Automatic Oil Break Down Voltage Test Kit suitable for testing of Transformer Oil as per IEC 156, IS6792, ASTMD 877, ASTMD 1816, UNE21,With stand A, With stand B, 5Min Test & Custom Mode. |
| 2. | Voltage Range | 0 to 60 KV AC |
| 3. | Trip Current | 10m A |
| 4. | Indication | 3½ Digit Panel Meter |
| 5. | Resolution | 100V in Manual Mode & 400V in Auto Mode |
| 6. | Accuracy | + / -3% ± 2 digits |
| 7. | Control | Auto / Manual Mode |
| 8. | Kit Should have separate switches for HT on & OFF | Yes/No |
| 9. | Kit should have BDV hold facility with reset switch | Yes/No |
| 10. | It should have Safety lock with indication | Yes/No |
| 11. | Protected against overloads & short circuits | Yes/No |
| 12. | The instrument should have Option to set | Stand time: Select able  Stir Time: Select able |
| 13. | Rate of rise of voltage | In the range of 0.5kV to 5kV adjustable |
| 14. | Safety | Safety interlock on high voltage test chamber. |
| Open Ground & inter lock indication & protection on front panel. |
| It should have facility for Time & Dated result print or download via RS 232 inter face with 100 test result memory. |
| Should have built-in-printer. |
| Should have option for Quick test selection through Keypad. |
| 15. | Required accessories | Oil test vessels with lid–1no.  Spherical electrodes fitted to test set–1Pair Mushroom Types Electrode–1Pair Cylindrical electrodes–1Pair  Plate Type Electrode–1Pair  Padded transport case–1no. Users / instruction manual–1no. |
| 16. | Power Supply | 230V AC + / - 10 %, 50Hz + / - 3 % 230V / 110V AC |

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| 17. | Type Testing | The test kit shall be type tested for Environmental Tests, EMI- EMC &Safety Tests as per relevant IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 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 delivery/supply of the kit to the consignee. |
| 19. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 20. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 21. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**V. TECHNICAL SPECIFICATION FOR DISSOLVED GAS ANALYZER.**

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| **Technical Specification For Portable DGA** | | |
| **Sl. No.** | **Parameters** | **Specifications** |
| 1 | Functional Requirement | The equipment should be capable to analyses dissolved gases, both organic & inorganic, in the transformer oil. The equipment should be suitable to perform the analysis of gases which have been extracted from transformer oil. It should be able to record and maintain the results of tests carried out in the computer based data station which should be supplied along with the machine |
| 2 | Main Characteristics | The instrument should be suitable for indoor use and operate satisfactorily in coastal areas under normal polluted atmospheric conditions and subjected to normal vibrations and shocks encountered in a machine testing shop. It should operate satisfactorily up to a temperature of 50ºC and relative humidity of 100%. |
| 3 | Application &Construction | This equipment should be used to detect the incipient fault in the transformer and to arrest deterioration/damage to the transformer insulation by analyzing gases dissolved in the transformer oil and adopt preventive measures. The process involved should be separation, identification and quantitative determination of gases. |
| The Gas Chromatograph should be calibrated by injecting known amount of standard gas and after that extracted gases of known sample will be injected in gas chromatograph for Separation and analysis. Our Gas Chromatograph will determine Hydrogen, Oxygen, Nitrogen, Methane, Ethane, Ethylene, Acetylene (C2H2), C3+, CO2 & CO using argon as carrier and Hydrogen, Methane, Ethane, Ethylene, Acetylene (C2H2), CO2 & CO using Nitrogen as carrier gas which has to be selected by user prior to ordering / selecting the carrier gas. |
| Some of the lower limit detection of our Gas Chromatograph for dissolved gases in oil are Hydrogen 10 ppm, Hydrocarbon 1ppm +, Carbon monoxide 25ppm and Carbon dioxide 25ppm. |
| For determination of above gases Argon / Nitrogen carrier gas and columns should be used. The out put of the column should be connected to Thermal Conductivity Detector and Flame Ionization Detector, and the amplified signals generated by TCD and FID should be passed on to a Data Processor for calculation of the results and report generation. The instrument should be suitable for indoor use and operate satisfactorily in coastal areas under normal polluted atmospheric conditions and subjected to normal vibrations and shocks encountered in a machine testing shop. It will operate satisfactorily up to a temperature of 50ºC and relative humidity of 100%, however, for long life of system a controlled ac environment is recommended. |
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| The detector modules, power supply units, are in one compact unit. The gas circuit should be designed as to have four separate inlet connections, for carrier gases and fuel gases. Only one recorder should be to be used by inter-changing the connecting leads with the help of selector switch. To ensure sturdy and leak proof operation, stainless steel gas tubing connections are used for internal gas circuit. |
| System offered must be an industrial catalog product. The Bidder must provide valid type test reports (tests conducted within past 5 years) for EMC as per IEC 61000 & Environmental test reports for Temperature & Humidity. |
| 4 | Basic Unit – Main Frame | The system should be a portable type micro system built especially for DGA applications and is a compact system built using latest microcontroller design. The system should have all the components integrated within it and offers unrivalled performance and stability. TCD and FID have separate controls therefore no switching is required for analysis |
| Micro FCV - Manual - Micro Flow Controller – Five Numbers For FID Carrier, TCD1 Carrier, TCD2 Carrier, FID Hydrogen & FID Air. These should be specially manufactured valves used for flow control of gases in GC system. Each valve is connected to a Pressure gauge for easy readability and display. |
| 5 | 2 Temperature zones | Two Isothermal Zones For The Mol. Sieve & Porapak N Column & Methanizer Using Heating Technique |
| 6 | Dual Packed Injector | Dual Packed Injector With One Specialized Splitter System For Single Injection Profile. The Other Injector should be for stand by using a Mol. Sieve. Our injectors use a standard 9.5 mm by 3.5 mm Silicon Septa. It should be having Low Volume Injectors designed for horizontal Injections. |
| 7 | Sensitive Methaniser Optimized For DGA Application For Doing CO & CO2 Analysis. | Without Methanizer low level CO & CO2 cannot be analyzed as per IS 10593. The methanizer should be connected in series with the FID to give CO & CO2 along with hydrocarbons. |
| 8 | FID – Single - High Sensitivity FID Built For DGA Application | It is of parallel plate type for high collection efficiency, and ease of maintenance. Material of construction Block should be made of stainless steel with Quartz Jet. This should be connected with Silica Gel or Haysep A or Porapak N column for analysis of CO, CO2 & Hydrocarbons. The FID utilizes an OP AMP with input impedance greater than or equal to 10E14. It should have two Pressure Gauges and two Flow Control Needle Valves – one each for Hydrogen and Carrier. |
| 9 | TCD1 | High Sensitivity TCD With Pre Set Gain For Low Hydrogen Detection In DGA Using Nitrogen Carrier Gas Or H,O, N Using Argon Carrier Gas. The Column should be Mol. Sieve 5A. Optimized for analytical performance |
| It is flow through type for high sensitivity and internal volume is less than 300 micro liters. Tungsten / Rhenium (RH) Filaments (GOW-MAC USA MAKE) is used. Material of construction stainless steel |
| 10 | TCD2 | High Sensitivity TCD Used As a Spared Channel With Porapak Q or Mol. Sieve Or Silica Gel Column |
| 11 | Column | i. 2mtr X 1/8” OD SS Porapak N / Haysep A. ii. 2mtr X 1/8” OD Mol. Sieve 5A. iii. 2mtr X 1/8” OD SS Porapak Q / Silica gel. |
| 12 | Dual Channel Data Processor With Computer And Laser Printer | Dual Channel Chromatography USB Power Interface, PC, UPS for PC, Laser Printer with Application Software having following features: i. Real time collection and processing of data from GC. ii. Interface to be connected with USB 2.0 Port of PC. iii. Snap shot features during real time analysis of all channels. iv. Direct conversion of data files to .pdf and .xl format post run analysis. v. Inbuilt facilities to add/subtract two runs post run analysis. |
| 13 | Calibration Gas Mixture, 0.5 Liter WC Canisters | Methane 1000ppm, Ethane 1000ppm,Ethylene 1000ppm, Acetylene 1000ppm, Hydrogen 1000 ppm, Carbon monoxide2500 ppm , Carbon dioxide 2500 ppm each Balance Nitrogen. |
| 14 | Standard Accessories for GC installation: | Tubing for gases - 10 meter Brass nut & ferrule - 20 Nos. Soap bubble flow meter - 1 No. Set of Tools - 1 set UHP grade Hydrogen with regulator – 1 set UHP grade Nitrogen with regulator – 1 set  UHP grade Zero Air with regulator – 1 set Servo Controlled Stabilizer of 3 KVA - 1 Set |
| 15 | Scope of supply | Gas Extraction Apparatus Along With Pump, Stand, Mercury, Magnetic Stirrer And Syringe Is Provided Or Alternatively Manual Head Space System With Pump, Stirrer, Syringe And Vials Should Be Provided |
| 16 | Type Testing | The test kit shall be type tested for Environmental Tests, EMI-EMC & Safety Tests as per relevant IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 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 delivery/supply of the kit to the consignee. |

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| 18. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 19. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 20. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**VI. TECHNICAL SPECIFICATION FOR FREQUENCY RESPONSE ANALYZER (FRA).**

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| **Technical Specification For Frequency Response** **Analyzer (FRA)(Portable &Automatic)** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional Requirement | Should inject sinusoidal excitation voltage with a continuously increasing frequency into one end of the transformer winding and measures the signal returning from the other end. The comparison of input and output signals generates a unique frequency response, which can be compared with reference data. Thereby, deviations can be directly related to different sections of the frequency range and they can be discerned from each other. |
| 2. | Frequency range | 1 Hz…. 25 MHz |
| 3. | Output impedance ( 20Hz – 2MHz) | 50 Ω± 2% |
| 4. | Connector | BNC |
| 5. | Wave form | Sinusoidal Signal |
| 6. | Voltage Output/ Amplitude | 0.1 Vpp to 10 Vpp (at 50 Ω) |
| 7. | Input impedance (20Hz to 2MHz) | 50 Ω± 2% |
| 8. | Connectors | BNC |
| 9. | Input sensitivity | 10 Vpp |
| 10. | Dynamic range (20Hz to 2MHz) | >120 dB |
| 11. | Accuracy (20Hz to 2MHz) 0dB…-50 dB  -50 dB…-100 dB | ±0.1 dB  ±1 dB |
| 12. | Phase accuracy (20Hz to 2MHz) | ±1º |
| 13. | Input voltage | 100 V…240 V AC |
| 14. | Input frequency | 50 Hz…60 Hz |
| 15. | Environmental Conditions | –10 ºC…+55 ºC, 95%, non-condensing |
| 16. | Standards | IEC/EN 60068-2-27, IEC/EN 60068-2-6, IEC 61326-1, IEC 61010-1 |
| 17. | Laptop Specs | Min Specs will be as 500GB HDD, 4 GB Ram, Windows 8 64 Bit, Core i5, USB - 2 Nos, Ethernet, DVD Drive |
| 18. | Scope of Supply | Main Instrument, Test Manager Software, Laptop Computer, Test Lead Set of 20 Mtr, Carrying Case, Laptop with Carry bag. |
| 19. | Type Testing | The test kit shall be type tested for Environmental Tests, EMI-EMC & Safety Tests as per relevant IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |

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| 20. | 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 delivery / supply of the kit to the consignee. |
| 21. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 22. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 23. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**VII. TECHNICAL SPECIFICATION FOR CT-PT ANALYZER**

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| **Technical Specification For CT-PT Analyzer** | | | |
| **Sl.No.** | **Parameters** | **Specifications** | |
| 1. | Functional requirement | The test set shall be suitable for acceptance testing, commissioning, trouble shooting and routine testing on all types of current transformers classified under IEC 61869-2, IEC 60044-1 and 60044-6 and under IEEE C57.13 inclusively C57.13.6 for high accuracy CTs. The test set shall be suitable for operation in laboratories, manufacturing plants as well as in high voltage substation environment without degradation in accuracy, and shall be able to operate continuously for up to 8 hours or more. | |
| 2. | Testing Capabilities | The test shall be performed automatically however the capability to enable or disable individual test sequences shall be possible to provide highest flexibility. Following test capabilities shall be included.  a) Re manence test b) Name plate Guesser  c) Primary Resistance test d) Secondary Resistance test  e) Secondary (operative) Burden test f) Excitation test  g) Ratio test h) Demagnetization | |
| 3. | Test Application | The test set shall be able to test single ratio and multi ratio current transformers as standalone version as well as current transformers installed in power transformers or gas insulated switches. The test set shall be able to perform test and verification for current transformer used for protection and metering (billing) purposes.   1. Automated testing of single ratio current transformers 2. Automated testing f multi ratio current transformers up to 6 taps (S1-S6 / X1-X6) 3. Automated testing of bushing current transformers installed in Power Transformer 4. Test current transformer up to 0.1 accuracy for metering (billing) 5. Test current transformer considering transient behavior for protection 6. Test current transformer excitation curve up to 30.000 Volt Knee-point level. 7. Demagnetization of the CT shall be performed automatically at the end of the test sequence and if the measurement is interrupted by the user. | |
| 4. | Measurement | The test set shall be designed to test a wide range of parameters of the current transformer to verify their designated usage according to its specifications.  a) Ratio measurement and accuracy considering nominal and operative Burden: **Ratio Accuracy**  0.2 – 1 type: 0,05% (guaranteed 0,1%)  >1 – 2000 type: 0,02% (guaranteed 0,05%)  >2000 -5000 type: 0,03% (guaranteed 0,1%)  >5000 – 10000 type: 0,05% (guaranteed 0,2%)  b) Phase Displacement considering nominal and operative Burden phase measurement accuracy:  typ: 1 rad min. (guaranteed 3 rad min.)  c) Secondary Winding Resistance Measurement with range of 1mΩ to 3kΩ with accuracy better than 0.1%+1mΩ  d) Primary Winding Resistance Measurement with range of 1mΩ to 3kΩ with accuracy better than 0.1%+1mΩ  e) Secondary Burden Test with range of 1mΩ to 1kΩ with accuracy better than 1%  f) Re manence measurement in Vs and in % in reference to max. possible flux  g) Saturation measurement with graphical and tabular reporting, tests currents up to 15A pk, effective saturation voltage up to 30.000V and higher.  h) Plot excitation graph and calculation of knee-point according to IEC 61869-2 / IEC 60044-1 / IEC 60044-6 / IEEE C57.13  i) *Measurement parameter acc. IEC 60044-1 / 61869-2,*   * V-kn (knee point voltage acc. standard) * I-kn (knee point current acc. standard) * Ls (saturated inductance) * Lm (non-saturated inductance) * Ts (secondary time constant) * Kr (re manence factor) * εi(indirect error) * ALF (accuracy limiting factor) * ALFi (accuracy limiting factor indirect) * Kx (dimensioning factor) * Ek (accuracy limiting voltage) * Ie (accuracy limiting current) * E1 (user defined e.m.f.) * Ie1 (excitation current @ E1) * FS (instrument security factor) * FSi (instrument security factor indirect)   j) *Measurement parameter in addition to all Standards*   * Residual Flux (residual flux in Vs) * Residual magnetism (residual mag. in %) * N (turns ratio) | |
| 5. | Nameplate Guesser | The test set shall be able to evaluate Name plate data from the measured data to support Name plate indication if the nameplate data are not given or not readable.   1. Ipn (primary current) b) Isn (secondary current) 2. Protection or metering (application) d) Current transformer class 3. Nomination burden value assigned according to IEC/IEEE Standard to the current transformer class f) Rct (secondary winding resistance)   g) Kssc (rated symmetrical short circuit h) Ktd (transient dimensioning factor)  current  i) Ts (secondary time constant). | |
| 6. | Analyze and Evaluate | The test set shall be able to support the user with additional functionality to analyze and evaluate the current transformer under test according to its specification and application.  a) Direct comparison of different excitation curves on equipment (GUI) and PC  b) Ratio error Matrix (table) over different primary current and burden levels on equipment (GUI) and PC  c) Phase displacement Matrix (table) over different primary current and burden levels on equipment (GUI) and PC  d) Comparison of the test results between nominal Burden assigned to the current transformers and actual burden connected to the current transformer | |
| 7. | Assessment | The test set shall provide an automated Assessment of all class relevant parameters according to the relevant standard selected for the test. The test set shall indicate if one or more parameters are out of the limits defined by the standard. | |
| 8. | Reporting | The test shall be able to deliver adequate tools to report the received results and allow the user to design own report sheets   1. Test files generated from the test equipment shall be protected for any manipulation 2. Test files changed or manipulated shall indicate this clear in the report 3. Test results shall be able to import into Microsoft® Word and Excel 4. Report templates shall be user customizable in terms of design and data content 5. Test preparation on a PC in advanced shall be possible | |
| 9. | SW Specification | The test set must be operating on PC Software and shall be able to operate on actual Windows Software as well as on older versions to assure backwards compatibility.  The test set PC Software shall support the Operating systems : Windows XP or higher | |
| 10. | **Hardware Specifications** | | |
|  | Hardware General | | 1. Front panel control with 6 inch graphical user interface – operation in bright sunlight has to be possible 2. PC control shall be possible. Software shall be provided to allow control of the test device via PC. 3. Data storage shall be on removable flash memory card 4. Outputs of the test device shall not be affected by interference on power supply 5. Rugged housing for outdoor use   The CT Tester shall be lightweight, weighing less than 25lbs (without cables and accessories) |
|  | Power Supply | | 1. Nominal input voltage: 100… 240 Vac, 1-phase 2. Permissible input voltage: 85 ... 264 Vac. Supply via a portable generator without ground connection shall be possible without any effect on specified accuracy. 3. Permissible frequency range. 45 … 65 Hz |
|  | Output Modes | | 1. Output current shall have a range of 0-5Arms (15A pk) 2. Output voltage shall have a range of 0-120Vac 3. Output power shall have a range of 0-400VArms (1500VA pk) |
|  | Measurement inputs (secondary) | | 1. Input shall have range of 0-0.3 / 3 / 30 / 300Vac (auto-ranging) 2. Input shall have an accuracy of better than 0.1% 3. Inputs shall be electrically insulated from other circuits |
|  | Measurement inputs (primary) | | 1. Input shall have range of 0-0.03 / 0.3 / 3 / 30Vac (auto-ranging) 2. Input shall have an accuracy of better than 0.1% 3. Inputs shall be electrically insulated from other circuits |
|  | Environmental Condition | | 1. *Climate* 2. The test device shall have an operating temperature range of -10°C to +50°C (14°Fto 122⁰F) 3. The test device shall have a storage temperature range of -25°C to +70°C (-13°F to 158⁰F) 4. The test device shall operate up to 2.000m (6.560 ft) altitude 5. The test device shall have an operating humidity range of 5% to 95% R.H. (non-condensing) 6. Tested acc. to IEC 60068-2-78, 7. Cab, Damp Heat: Temp. 40°C (104°F), duration 48h,   iii) Re. humidity 95%   1. *Shock and Vibration* 2. Tested according to IEC 60068-2-6; 3. frequency range 10 to 150 Hz; acceleration 4. 2g continuous (20 m/s2); 20 cycles per axis 5. Tested according to IEC 60068-2-27 6. (operating mode); 15g / 11ms, half-sinusoid, 7. 3 shocks in each axis |
|  |  | | 1. *EMC – Emission*   The test device shall have valid certificate stating that it has satisfied the following standards:   1. Europe EN 61326-1 Class A 2. International IEC 61326-1 Class A 3. USA FCC Subpart B of Part 15 Class A 4. *EMC – Immunity*   The test device shall have valid certificate stating that it has satisfied the following standards:   1. Europe EN 61326-1   International IEC 61326-1 |
| 11. | Quality & Sub stain ability | | 1. Manufacturer of test set shall be ISO9001 2008 certified 2. Type test report from vendor shall be made available on request 3. Manufacturer shall be ISO 14001 (environmental management system) certified 4. Manufacturer shall be OHSAS 18001 (Occupational Health- and Safety Assessment Series) certified |
| 12. | Documentation | | 1. Printed user manual shall be supplied 2. Electronic version of the user manual shall be supplied 3. Electronic version of remote interface description shall be supplied 4. Application notes shall be supplied |
| 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 delivery/supply of the kit to the consignee. |
| 14. | Warranty/Guarantee | | 12months from the date of successful & complete commissioning at site |
|  |  | | All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 15. | Training | | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 16. | After Sales Service | | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**VIII. TECHNICAL SPECIFICATION FOR SF6 GAS HANDLING PLANT.**

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| **Technical Specification For SF6 Gas Handling Plant** | | |
| **Sl** | **Functional Requirement** | **Specifications** |
| 1 | Functionality | Filling, Evacuation, Recovery and purification of SF6 gas |
| 2 |  | 14 m3/h vacuum pump for air |
| compressor capable of 1000 psig (70 barg) of pressure |
| Purifies, dries, and filters SF6 to 0.1 microns during recovery and re-pressurization. |
| On-board vacuum pump evacuates equipment to less than 1.3 mbar / 1 Torr and features a special valve preventing gas path reversal. |
| Oil free compressor (1.3m3 /h, final pressure 65 bar) |
| On-board storage for liquefied SF6 max. 22.5kg. |
| Automatic shut off feature when storage tank is full of liquefied gas or if it has reached maximum allowable pressure |
| SF6 gas liquefaction available at temperatures up to 45°C (114°F) via a high pressure, oil-less compressor |
|  |
| 3 | Hose | 5 Mtr |
| 4 | Power Supply | 230V AC 50Hz |
| 5 | Weight | 100kg (Approx) |
| 6 | Power Supply Cord | Minimum 10 meters long |
| 7 | Type Testing | The test kit shall be type tested for Environmental Tests, EMI-EMC & Safety Tests as per relavent IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 8 | 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 delivery/supply of the kit to the consignee. |
| 9 | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 10 | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 11 | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**IX.**

**TECHNICAL SPECIFICATION FOR STATIC CONTACT RESISTANCE MEASURING INSTRUMENTS:**

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| **Technical Specification For Static Contact Resistance Measuring instrument** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | The instrument should be suitable for automatic off line measurement of contact resistance of the switchyard equipments i.e. CB, Isolator, clamp/connectors, joints in live switchyard up to400 kV level, as per applicable standard testing procedure of P&E Dept. Govt. of Mizoram. |
| The test result shall have repeat ability, consistency and immunity to electro magnetic interference in live switchyard up to132 kV levels. |
| The instrument shall perform properly in both side ground open as well as one side ground open condition. |
| 2. | Measurement  Range | 0-199.9 µΩ, 1999.9 µΩ, 19.99 mΩ Auto ranging |
| 3. | Test Current | 200A or higher |
| 4. | Resolution | 1. 0.01µΩ for up to 199.9µΩ  2. 0.1 µΩ for 1999.9 µΩ  3. 1µΩ for 19.99 mΩ |
| 5. | Accuracy | 1% of the reading+/-resolution |
| 6. | Display | 4Line X 20 character back-lit LCD. 4-1/2 digit LCD for display of results. |
| 7. | Operation Mode | Standard one & PC Control |
| 8. | Memory | Minimum 1000 results to be stored. |
| 9 | Printer | Inbuilt thermal printer |
| 10. | Communication  Port | USB for communication with PC |
| 11. | Test lead and accessories | One complete set of cables of sufficient length (Min15 meter) with suitable clamps &connectors, compatible with the instruments should be provided for successfully carrying out the test in P&E Dept. Govt. of Mizoram 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 & test leads during transportation shall have to be provided. |
| 12. | Battery Operation & Charging Supply | Kit shall work on built-in rechargeable Li-Ion battery. Battery should be chargeable on single phase 230Volts ± 15 %, 50 Hz ±5 % AC supply with standard socket |
| 13. | Operating temperature | 0to + 50deg.C |
| 14. | Relative humidity | Max 95 % non-condensing |
| 15. | Cooling arrangement | Necessary inbuilt cooling arrangement should be provided to dissipate the heat generated during testing. No external coolant / accessory shall have to be required. |
| 16. | Ruggedness | Instrument should be housed in heavy duty moulded case for long durability |
| 17. | Weight | It should be highly portable for easy movement. Weight of instrument should be less than 7kg |
| 18. | Software | The software should be suitable for automatic testing &report generation and trend analysis. The kit should have facility to store data and communicate with windows based computer for operation and exporting the test data. It should be possible to create the DUT Identification Library in software & upload the same to instrument. The tests done by instrument for specific DUT should be stored in same ID. |
| 19. | Type Testing | The test kit shall be type tested for Environmental Tests, EMIEMC  &Safety Tests as per relevant IEC Standard. The type test report form NABL accredited lab should be submitted along-with the offer. |
| 20. | Calibration certificate | Unit shall be duly calibrated be for supply and the date of calibration shall not be older than two months from the date of delivery / supply of the kit to the consignee.. |
| 21. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works. |
| 22. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 23. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**X. TECHNICAL SPECIFICATION FOR LEAKAGE CURRENT METER (LCM) FOR SURGE ARRESTER.**

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| **Sl.**  **No.** | **Specification** | **Requirement** |
| 1 | Functional Requirement | The instrument is suitable for leakage current analysis of gap less metal oxide, station class surge arresters in outdoor location of upto 132kV and above system. |
| 2 | Parameters to be  measured: | The instrument shall be capable of measuring and direct is play  On the instrument, (without the requirement of external PC / Laptop) the following parameters in charged switchyards of up to132KV and above:-  Third harmonic resistive component of leakage current through the L.A.  Total leakage current through the L.A.  Along with system voltage, harmonic & temperature compensation in accordance with method B2 of IEC 60099-5 |
| 3 | Range of measured parameters : | Total leakage current & Resistive leakage current up to 10mA |
| 4 | Accuracy of measured parameters : | + / - 5 % or less. |
| 5 | Resolution of measured parameters : | Total leakage current:1micro Amp  Third harmonic resistive component of leakage current: 1 micro Amp |
| 6 | Accessories:  (Note-List of accessories is tentative, supplier may quote for standard product along with standard accessories) | Carrying case  PC ford at a management  Clip-on CT  Field Probe  Field Probe rod  Rod Adapter  Power cable and test cables.  Any other accessory required for proper functioning of the system. |
| 7 | Dimension &  Weight: | Dimension : Not more than 415 X 330 X 200 mm  Weight of instrument: Not more than 7.5Kg. |
| 8 | Power Supply: | Rechargeable Battery powered (additional operation on 240V AC mains  supply–optional).  Battery Charging : Through 240V AC, 50Hz,single phase supply. |
| 9 | PC Software  package: | The instrument should come along with required software Package which should perform the following functions:  Preparing measurement by defining each arrester and arrester type with operational parameters /arrester system data.  Storing and down loading record leakage current data.  Keeping track of the arrester history by presenting recorded data, eg. by statistical analysis in tabular and/or graphical form.  Evaluating groups of surge arresters, eg., arresters of the same type and arresters in the same region. |

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| 10 | Data Management system minimum  requirement: | Processor 2.8GHz or more,4GB or more RAM ,hard disk space  320GB or more, LCD/LED color monitor of size 14",standard size QWERTY keypad, CD/DVD drive, USB port and any other port required for interfacing with the Leakage Current Analyzer. |
| 11 | Data base  requirements: | It should be possible to define the name of sub station, location and name/number of arrester, arrester type with system data, etc.  The kit should have memory to store at least 1000 such IDs of arresters.  The stored data should not be lost when power is switched off.  After measurement has been performed, the recorded data should be stored on the right location in the data base when The kit and data base are synchronized. The kit should have real time clock supported by battery back-up to ensure date and time stamping of the measurements. |
| 12 | Environmental  requirements: | The kit should be housed in a weather proof case adhering to IP  54 or higher. Suitable for Operating temperature: 0 or below to + 50 deg C or higher. Storage temperature: 0 or below to 70 deg C or higher. |
| 13 | General  requirements: | Accessories including current probe, field probe, connecting leads, etc should be properly screened to nullify All the effect of interference in charged switchyard. Analyzer should be suitable to measure and analyze leakage current of surge arresters in charged outdoor condition without any need for shutdown. The instrument should have a direct and real-time display of the measured parameters without the requirement of any PC/laptop.  USB or equivalent port need to be present on the kit along with data cable for interfacing the kit with PC.  The analyzer kit should be easy for transportation.  The kit should have self calibration check facility to verify the results.  The supplier should provide calibration certificate & user’s Instruction manual with the kit. |
| 14. | 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 delivery/supply of the kit to the consignee. |
| 15. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit for repair at service center/works |
| 16. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 17. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XI. TECHNICAL SPECIFICATION FOR EARTH TESTER FOR MEASUREMENT OF SOIL RESISTIVITY& GROUND RESISTANCE.**

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| **Technical Specification For Digital tester for measurement of soil resistivity&**  **Ground resistance** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | The instrument should be digital &automatic electronic Micro processor based Earth Resistance Meter, which will be used to measure earth resistance of lightning conductors, sub stations earthings, lightening rods, building rods, primary cabins etc. & soil resistivity by Wenner’s 4 terminal method. |
| 2. | Measurement | Earth Resistances (three pole) and Ground Resistivity by the  Wenner's (four pole) method |
| 3. | Resistance range | 20,000Ω in the selectable steps of 20Ω, 200Ω, 2,000Ω &  20,000Ω |
| 4. | Accuracy | ± 2 % of the measured value ± 1 % of the full scale value |
| 5. | Resolution | 0.01Ω |
| 6. | Spurious voltage measurement | 0 – 200V |
| 7. | Accuracy | Resistance Measurement -± 2 % of the measured value ± 1 % of the maximum value of the selected range. Voltage Measurement -± 2 % of the measured value ± 1 % of the end of scale value. |
| 8. | Resolution | 0.01Ω for Resistance measurement & 0.1V for Voltage  measurement. |
| 9. | Frequency range | 1470Hz |
| 10. | AC Current | Internal generator to inject AC current |
| 11. | Display | 3½ digit LCD |
| 12. | Power Supply | Internal rechargeable battery or,12V external Battery. Battery charging should be possible on 230 VAC Mains Supply Battery status checking facility |
| 13. | Power | Less than 0.5W |
| 14 | Out put current | Less than 15mA(peak to peak) |
| 15 | Special feature | The meter should give intermittent audible signal to indicate anomalies on the circuit, like current lower than required value  Due to high resistivity of soil or cabled is continuity |
| 16. | Safety | CE marking |
| 17. | Accessories | 4 auxiliary electrodes (30cm long rods, hexagonal shape, galvanized steel).AC adapter for the battery charger(universal mains supply, 220-240V~)Connection cable to use an external 12V battery(car battery or similar)to charge the internal battery 40m lead (on spool)-1No.20 m leads(on spool)–2 Nos.5m leads- 2Nos. Carrying bag User's guide |

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| **Sl.No.** | **Parameters** | **Specifications** |
| 18. | Ruggedness | Instrument should be housed in heavy duty moulded case for long durability |
| 19. | Environment | Temperature range upto 50°C & relative humidity up to 95% |
| 20. | Weight | Less than 3Kg |
| 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 delivery/supply of the kit to the consignee. |
| 22. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 23. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 24. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XII. TECHNICAL SPECIFICATION FOR AUTOMATIC RELAY TEST KIT SUITABLE FOR TESTING ELECTRO MECHANICAL/STATIC/NUMERICAL RELAYS.**

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| **Technical Specification For Automatic Relay test kit suitable for testing electro mechanical/**  **static/numerical relays.** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | The instrument should be suitable for testing all types & models of relays(used in protection schemes of transmission lines, transformer, reactor and bus bar etc. ) of all the major manufacturers in fully automatic mode(including high-burden electro mechanical relays) as well as transducers having accuracy class of0.25 or better. The test kit should be suitable for dynamic and transient testing, with facility of transient (COMTRADE format) record playback for both analog and digital channels. |
| The kit shall be suitable for testing of the relays in the substations having conventional protection as well as protection based on IEC61850 protocol using GOOSE. The test results should have repeat ability, consistency in results. |
| 2. | Output | All out puts shall have over-voltage and short Circuit protection. Specifically, all the voltage and current generators shall have short- circuit/over voltage protection. The instruments should not get over heated, while supplying threaded out put continuously. Further, the kit should be stable even during extensive continuous usage and should not get hanged or restarted. |
| V/I Generators: |
| Current Out puts |
| Software controlled/configurable six out puts |
| Current outputs:0-32A(r.m.s) minimum, each output |
| Resolution:1mAorless. |
| Output Burden:400VA minimum per output |
| Voltage Outputs |
| Soft ware controlled/configurable four voltage outputs. |
| Voltage output:0-300VoltsAC/DC(Ph-N), |
| Resolution:10mVorless. |
| Output Burden:50VA minimum per output |
| The total current /voltage output channels should be 10Nos. |
| Aux. DC Output |
| Software controlled,0-300 V and 85Wmin. (Continuous rating), with continuous/step-less control. The DC supply should have short circuit protection, galvanically isolated and over load indication. Battery backup auxiliary DC output is not Acceptable. |
| 3. | Measuring Input | 1.Voltage range:-10V to + 10V DC |
| 2.Current range:-20mA to + 20mA DC |
| 3.Accuracy: 0.05 % or better |

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| **Sl.No.** | **Parameters** | **Specifications** |
| 4. | Test Frequency | V/I Generator/Amplifier shall have controlled frequency range from DC,1Hz to 1kHz for sine and DC to 3kHz (minimum) for transients with resolution of 1mHz or better and accuracy 0.01 % or better. |
| 5. | Phase Angles | 0 to 359.9° lag/lead with resolution of 0.001 degree or better, with accuracy of 0.1 deg.(min.) |
| 6. | Accuracy of Current & Voltage Outputs | Accuracy shall be ≤ ± 0.2 % for voltage and current sources through out The range. The total distortion shall also be less than 0.1%. |
| 7. | Binary I/O Configuration | Minimum four binary outputs and eight in puts with galvanic isolation. Software controlled input should be capable of sensing potential free relay contacts(NO/NC)as well as potential of 0 to 400VDC. Associated timers should have time resolution of 50 micro-second. The software controlled outputs should have potential free contacts (NO/NC) with breaking capacity of 8Amp,300VAC/DC. |
| 8. | Fault Replay | It should also have the facility of Transient data playback, by accepting transient fault data in COMTRADE format along with the facility to extend pre-fault/ post-fault durations. **Also the comtrade software should be able to repeat the same fault multiple times in the same fault file as per user**. It should accurately simulate disturbance signal along with DC and high frequency components (with sampling rate of 3kHz or better) as well as Binary signals. Further, it should offer repeatability of results, e.g. same fault location for a particular fault etc. |
| 9. | Communication ports IEC61850 compatibility | Shall have the ETHERNET **and USB** connectivity as a standard feature. The ETHERNET port shall be suitable for control through external PC as well as for IEC 61850 protocols. GOOSE configuration software module should be provided with the kit for effective checking of protection relays / IEDs based on IEC 61850 protocol.  **Apart from the GOOSE configuration software which shall be used for testing of relays the relay test kit software should include the additional facility for IEC 61850 process bus testing. The software shall read** poll and check data models / values in detail. It shall have the facility to transfer GOOSE information to suitable modules during testing of IEDs. Specifically, it will be the responsibility of the supplier to demonstrate the working of IEC 61850 module for input & output GOOSE messaging and capturing of live data. **Additionally, the working software of this IEC 61850 module should be possible to be used independently in any IEC 61850 based substations without the need of the relay test kit.** |
| 10. | Test Leads and accessories | Complete set of test leads, PC cables, Licensed OS software &anti virus for PC, Licensed software of the testing kit, combination plugs, power supply cables, original carrying case(which should be robust/rugged enough for proper safety of the kit during transportation),manual(both in soft copy & hard copy) etc. required for carrying out all types of testing. |
| 11. | Design/ Engg. | The complete equipment along with complete accessories must be designed / engineered by Original Equipment Manufacturer. |
| 12. | Power Supply | It shall work on single phase 230Volts ± 10 %,50Hz ±5 %supply and standard AC socket. |
| 13. | Operating  Temperature | 0 to + 50 °C |
| 14. | Relative humidity | Max. 90 % non-condensing |
| 15. | Protection  Control | Against short circuit, over voltage ,transient surges etc. |
| 16. | Cooling  Arrangements | 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. | Portability | It should be easily portable for smooth movement. Carrying case with wheels & pulling handle should be provided. |
| 18. | Software | The relay test kit software should be life time free and any update related to the software should also be free of cost for the life time. The supplier shall provide a declaration along with the guarantee certificate of the test kit which shall clearly mention this point.  The software must be capable of testing all types of relays. The software should be capable of ramping fault quantities (minimum two) in the automatic mode. The ramping of fault quantities should be visible in the graphical waveform viewer for the user. It shall also be possible to ramp the fundamental and the harmonic component of the same waveform in the ramping software.  The software should be capable of simulating multiple fault states using automatic method. For several states implemented there should be facility for user defined termination as well as automatic termination of states.  The software must be capable of testing over current and earth fault relays automatic. The necessary software for the same shall be provided. The desired software should have the IEC/IEEE/ User defined curves inbuilt inside the software for easy testing. The test kit software should be capable of automatic distance relay testing. The distance software should have the facility to perform the automatic search test as per user defined. The software should be able to import the distance characteristics using the XRIO/RIO format. It is the responsibility of the supplier to ensure that the all the XRIO/RIO of the all major relay manufactures are provided along with the relay test kit software. Any future update of XRIO library should be free of cost.  The relay test kit software should be capable of testing differential relays in automatic mode using the differential bias and restrain curve. It should be possible to test the stability using the dynamic model including transformer and CT details. There should also provision for the harmonic restraint automatic testing facility in the software. The software should be able to import differential relay characteristics from the XRIO/RIO library for major known relay manufacturers.  The software should be suitable for automatic testing & report generation and analysis. The software of the kit should be windows based and should be operated through suitable Laptop PC. All control tasks and data acquisition, processing and recording of test results shall be performed by the operating software on laptop PC. The software should be capable of creating customized relay characteristics as well as of importing relay characteristics from IED/Relay configuration software. The kit should support GPS receiver with suitable port which shall enable carrying out end to end testing using GPS receivers available at both ends of the local remote substations. Software should have facility to simulate line fault for end to end testing. The software shall be able to get updated with respect to new relays and new operating techniques whenever they are introduced. The updating shall be intimated and done by supplier during the period of guarantee.  Software for energy meter testing shall be provided to TSEL for testing of Energy meters. (if Energy Meter Testing Facility is provided) The kit shall be able to generate proper reports in user friendly formats. |
| 19. | PC Interface | It shall include supply of one reputed laptop either Dell /HP/ Lenovo with latest specifications such as Intel 4th or higher generation i7 processor, 8GBDDR3 RAM, 1- TBSATAHDD, DVD writer, 14/15.6” LEDHD screen with 2GB HD Graphics card,USB2/USB3port,RJ45 port, HDMI port, Memory Card reader, Wi-Fi, Bluetooth facility, Laptop Carry Bag. Pre loaded with original licensed Microsoft Windows 10 or  Later versions including licensed Microsoft Office 2010 or later and latest licensed anti virus. Original DVD/CDs etc. No extra cost for the laptop and the same is included in the price offer. |
| 20. | Type Testing | The test kit shall be type tested for Environmental Tests, EMI-EMC &Safety Tests as per relevant IEC Standard. The type test report from National /International accredited lab should be submitted along with the offer. |
| 21. | On 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 delivery /supply of the kit to the consignee. |
| 22. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 23. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 24. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XIII. TECHNICAL SPECIFICATION FOR THERMO VISION CAMERA FOR DETECTION OF HOT SPOTS.**

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| **Technical Specification For Thermo vision camera for detection of hot spots** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | Thermo Vision Camera for detection of hot spots of Transmission/ Over head Lines |
| 2. | Detector type | Un-cooled FPA |
| 3. | IR resolution | 640 × 480 pixels |
| 4. | Thermal Sensitivity (NETD) | <65 mK (˜0.065°C) @ +30°C |
| 5. | Spectral range | 8 to 14µm |
| 6. | FOC/Mini focus distance | 24° X 18°/ 0.5 m (Standard Lens)  Telephoto Lens (14° X 10.5°/ 1.2 m) |
| 7. | IFOV | 0.65mrad |
| 8. | Display Size & Type | 5” Colour LCD, 270° Tiltable 800 x 480 pixels |
| 9. | View finder | Built-in, 0.6” colour OLED with magnification |
| 10. | Visual Camera | 5 mega pixel |
| 11. | Spotlight | 10 cd/m |
| 12. | Frequency/Refresh Rate | 50Hz/ 60Hz |
| 13. | Focus | Manual/Motor/Auto |
| 14. | Digital Zoom | 1 to 8 X Continuous |
| 15. | Image Modes | Thermal image, visual image, P-I-P, thermal fusion, W-IW |
| 16. | Temperature range | -40°C to 1200°C |
| 17. | Temperature accuracy | ±2°C or ± 2% of reading |
| 18. | Measurement correction | Auto/ Manual |
| 19. | Spot Meter | 10 adjustable spot |
| 20. | Area Profile | 5 adjustable boxes with Max / Min / Avg Temp |
| 21. | Line Profile | Vertical / Horizontal |
| 22. | Isothermal analysis | Capture High/ Low temperature / interval |
| 23. | Emissivity correction | Adjustable from 0.01 to 1.00 or selected from list of material |
| 24. | Delta T | Yes |
| 25. | Alarm | Voice, Colour |
| 26. | Colour Pallets | 12 Nos |
| 27. | Image Adjustment | Contrast & Brightness |
| 28. | Settings | Language, Date, Time, Temp (C / F / K) |
| 29. | Background Temp correction | Automatic |
| 30. | Atmospheric trans  correction | Automatic |
| 31. | Storage Type | Built-in flash card,8GB SD Card |
| 32. | Storage Capacity | Upto 700 images in built-in flash card  Upto 5600 images in 8 GB SD Card |
| 33. | Storage Format | JPEG with Temperature Data (14 bit) |
| 34. | Periodic Image Storage | User defined 10s atleast |
| 35. | Voice Annotation | 60sec Recording/Replay per Image |
| 36 | Laser Pointer | Yes |
| 37. | Bluetooth | Yes |
| 38. | Video O/P | Yes |
| 39. | Audio O/P | Yes |
| 40. | USB | Yes for image Transfer |
| 41. | Tripod Mounting | 1/4" – 20 |
| 42. | AC Supply | 110-240V AC, 50/60Hz, 1Ph |
| 43. | Battery Type | Rechargeable Li-Ion battery |
| 44. | Operating Time | 2.5 Hrs |
| 45. | Operating  temperature | -20°C to 50°C |
| 46. | Interfaces | USB, Bluetooth, Video & Audio output |
| 47. | Standards | IP 54, IEC 60068-2-29, IEC 60068-2-6 |

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| 48. | weight | Less than 1.5 kg. |
| 49. | Laptop Specs | Min Specs will be as 500GB HDD, 4 GB Ram, Windows 8 64 Bit, Core i5, USB - 2 Nos, Ethernet, DVD Drive |
| 50. | Scope of supply | Camera with standard lens, Telephoto Lens (14° X 10.5°/ 1.2 m), 2  rechargable Battery, Battery Charger, Adaptor, USB Cable, SD Card (8GB),SD Card reader (USB), Transport Case, Tripod, Software CD, Laptop with Bag |
| 51. | 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 delivery/ supply of the kit to the consignee. |
| 52. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 53. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 54. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XIV. TECHNICAL SPECIFICATION FOR THERMAL SCANNER( FOR TRANSFORMER/ REACTOR).**

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| **Technical Specification For Thermo vision camera for detection of hot spots** | | |
| **Sl.No.** | **Parameters** | **Specifications** |
| 1. | Functional  Requirement | Thermal scanner for analysis of the Hot spots of Transformers & Reactors |
| 2. | Detector type | Un-cooled FPA |
| 3. | IR resolution | 640 × 480 pixels |
| 4. | Thermal Sensitivity(NETD) | <65 mK (˜0.065°C) @ +30°C |
| 5. | Spectral range | 8 to 14µm |
| 6. | FOC/Mini focus distance | 24° X 18°/ 0.5 m (Standard Lens)  Telephoto Lens (14° X 10.5°/ 1.2 m) |
| 7. | IFOV | 0.65mrad |
| 8. | Display Size & Type | 5” Colour LCD, 270° Tiltable 800 x 480 pixels |
| 9. | View finder | Built-in, 0.6” colour OLED with magnification |
| 10. | Visual Camera | 5 mega pixel |
| 11. | Spotlight | 10 cd/m |
| 12. | Frequency/Refresh Rate | 50Hz/ 60Hz |
| 13. | Focus | Manual/Motor/Auto |
| 14. | Digital Zoom | 1 to 8 X Continuous |
| 15. | Image Modes | Thermal image, visual image, P-I-P, thermal fusion, W-IW |
| 16. | Temperature range | -40°C to 1200°C |
| 17. | Temperature accuracy | ±2°C or ± 2% of reading |
| 18. | Measurement correction | Auto/ Manual |
| 19. | Spot Meter | 10 adjustable spot |
| 20. | Area Profile | 5 adjustable boxes with Max / Min / Avg Temp |
| 21. | Line Profile | Vertical / Horizontal |
| 22. | Isothermal analysis | Capture High/ Low temperature / interval |
| 23. | Emissivity correction | Adjustable from 0.01 to 1.00 or selected from list of material |
| 24. | Delta T | Yes |
| 25. | Alarm | Voice, Colour |
| 26. | Colour Pallets | 12 Nos |
| 27. | Image Adjustment | Contrast & Brightness |
| 28. | Settings | Language, Date, Time, Temp (C / F / K) |
| 29. | Back ground Temp correction | Automatic |
| 30. | Atmospheric trans  correction | Automatic |
| 31. | Storage Type | Built-in flash card,8GB SD Card |
| 32. | Storage Capacity | Upto 700 images in built-in flash card  Upto 5600 images in 8 GB SD Card |
| 33. | Storage Format | JPEG with Temperature Data (14 bit) |
| 34. | Periodic Image Storage | User defined 10s atleast |
| 35. | Voice Annotation | 60sec Recording/Replay per Image |
| 36. | Laser Pointer | Yes |
| 37. | Bluetooth | Yes |
| 38. | Video O/P | Yes |
| 39. | Audio O/P | Yes |
| 40. | USB | Yes for image Transfer |
| 41. | Tripod Mounting | 1/4" – 20 |
| 42. | |  |  | | --- | --- | | AC Supply | 110-240V AC, 50/60Hz, 1Ph | | 110-240V AC, 50/60Hz, 1Ph |
| 43. | Battery Type | Rechargeable Li-Ion battery |
| 44. | Operating Time | 2.5 Hrs |
| 45. | Operating  temperature | -20°C to 50°C |
| 46. | Interfaces | USB, Bluetooth, Video & Audio output |
| 47. | Standards | IP 54, IEC 60068-2-29, IEC 60068-2-6 |
| 48. | Weight | Less than 1.5 kg |
| 49. | Laptop Specs | Min Specs will be as 500GB HDD, 4 GB Ram, Windows 8 64 Bit, Core i5, USB - 2 Nos, Ethernet, DVD Drive |

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| 50. | Scope of supply | Camera with standard lens, Telephoto Lens (14° X 10.5°/ 1.2 m), 2  rechargable Battery, Battery Charger, Adaptor, USB Cable, SD Card (8GB),SD Card reader (USB), Transport Case, Tripod, Software CD, Laptop with Bag |
| 51. | 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 delivery / supply of the kit. |
| 52. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 53. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 54. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XV. TECHNICAL SPECIFICATION FOR TRANSMISSION LINE RESPONSE ANALYSER.**

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| **Technical Specification for Transmission Line Response Analyser** | | |
| **Sl.**  **No** | **Parameters** | **Specifications** |
| 1. | Functional Requirement | The instrument should be suitable to detect and locate the overhead line Fault (including high resistive faults) / inhomogeneous points etc. in offline mode, in multi circuit overhead transmission line up to 220 kV level, as per applicable standards / testing procedure. |
| The test results should have repeatability, consistency & immunity to electromagnetic interference in live switchyard/adjacent transmission lines up to 220 kV levels in all-weather condition. |
| 2. | Range of Operation | 500 Km ( min) |
| 3. | Accuracy | 100 M |
| 4. | Measurement Mode | 03-Phase |
| 5. | Test Leads and accessories | One complete set of cables of sufficient length (min 20 metre) with suitable clamps & connectors, compatible with the instruments should be provided for successfully carrying out the test in J&K PDD sub- station/transmission line. 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 entire equipment along with complete accessories must be designed / engineered by Original Equipment Manufacturer. |
| 7. | Power Supply | It shall work on single phase 230 Volts ±10%, 50Hz±5% supply with standard socket. |
| 8. | Operating Temperature | -25 to +50?C |
| 9. | Relative humidity | Max. 90% non-condensing |
| 10. | 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. |
| 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. |
| 13. | Software | The software should be suitable for report generation and trend analysis. The kit should have facility to store and communicate with windows based computer for exporting the test data. |
| 14. | Display | LCD |
| 15. | Data | 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 |
| 16. | Storage/Analysis | preloaded operating MS Window 7 professional or better with latest version of application software required for storage analysis and record management. |
| 17. | Environment | The test kit shall be compatible for EMI / EMC / safety environment requirement as per IEC. |
| 18. | Type Testing | The test kit shall be type tested for Environmental Tests, EMI-EMC & Safety Tests as per relavent IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 19. | 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 delivery/supply of the kit to the consignee. |
| 20. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 21. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 22. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XVI. TECHNICAL SPECIFICATION FOR PUNCTURE INSULATION DETECTOR.**

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| **Technical Specification For Puncture Insulation Detector** | | |
| **Sl No** | **Parameters** | **Specifications** |
| 1 | Functional Requirement | -Used for Polymer Composite insulators  -Sled Mounted  -Captures up to 15,000 readings  -Light Weight, durable construction. |
| 2 | Features | -Microprocessor based technology  -Compatible with standard field equipment  -Test Composite insulator applications |
| 3 | Maximum insulators / skirts per string | 55 insulators per string |
| 4 | Minimum insulators / skirts per string | 4 insulators per string |
| 5 | Maximum corona protection | 1 million Volts |
| 6 | Minimum electrical field | 10 kV/meter |
| 7 | Maximum memory capacity | 300 strings or 15,000 readings |
| 8 | Maximum scanning speed | 6 insulators per second |
| 9 | Time tag update interval | 16 seconds |
| 10 | Operating temperature | 0°C to 50°C |
| 11 | Size of insulator | 9” to 13” (23 to 33 cm) |
| 12 | Standards | EMI/EMC, Safety as per latest IEC Standards |
| 13 | Type Testing | The test kit shall be type tested for Environmental Tests, EMI-EMC & Safety Tests as per relavent IEC Standard. The type test report form NABL accredited lab should be submitted along with the offer. |
| 14 | 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 delivery / supply of the kit to the consignee. |

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| 15. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
|  |  | All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 16. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 17. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XVII. TECHNICAL SPECIFICATION FOR PORTABLE MULTIFUNCTIONAL PRIMARY CT INJECTION KIT.**

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|  | **Technical Specification for Portable multifunctional Primary CT injection Kit.** | |
| **Sl. No.** | **Parameter** | **Technical Specification** |
| **1.** | **Functional Requirement for CT Testing** | The test set should be able to test EHV Current Transformers by Primary Current Injection method with test current of at least up to 2000A AC. The following parameters shall be tested:  i) Polarity, ii) Ratio, iii) Phase angle errors, iv) Knee-point voltage and Current, v) Secondary winding resistance, vi) Secondary burden etc., vii) Tan Delta measurement of CT (optional, if provided separately).  If external hardware is necessary, the same shall be supplied at no extra cost. For testing of bushing CTs, it shall be possible to perform ratio test with voltage injection. |
|  |  | The instrument should be capable of injecting continuously variable, single phase 50 HZ AC high value current for testing of EHV equipment like Current Transformers. The output of the Test set should be variable in a smooth, continuous, break-less manner. There should be negligible distortion in waveform and power-factor on the output side. |
|  |  | Accessories should include all necessary leads with proper lugs and clamps as well as hoisting arrangement as per requirement of test procedure. |
| **2.** | **Technical Requirement** | |
|  | Current Output: | * Range : up to 2000A AC * Resolution : 10mA or better * Accuracy : 0.2% of reading ± 0.2% of Full scale or better * VA Burden : up to 4.5KVA |
|  | Phase Angle: | * Range : 0 to 180 degree * Resolution : 0.1 degree or better * Accuracy : 0.2 degree or better |
|  | Winding resistance: | * Range : 1m ohms to 100 ohms with automatic range switching * Accuracy : 0.6% of reading or better |
|  | Knee-point voltage: | * Range : Fully automatic up to 2000V, manual upto 12 KV voltage. * Resolution : 1 V or better * Accuracy : 0.5% or better |
|  | Functional Requirement for PT/CVT Testing | The test set should be able to test Voltage Transformers/ Capacitive Voltage transformer for its-  i) Ratio test, ii) Polarity, Ratio, iii) Phase angle errors, iv) Secondary winding resistance, v) Secondary burden etc., vi) Tan Delta measurement of CVT/VT (optional, if provided separately).  If external hardware is necessary, the same shall be supplied at no extra cost. The output of the Test set should be variable in a smooth, continuous, break-less manner. There should be negligible distortion in wave form and power-factor on the output side. |
|  |  | Accessories should include all necessary leads with proper lugs and clamps as well as hoisting arrangement as per requirement of test procedure. |
|  | **Technical Requirement** | |
|  | Turns-ratio: | * Resolution : 0.01 or better * Accuracy : 0.5% or better * Test voltage : up to 2000V * Range : Fully automatic up to 1 to 5000 turns or better |
| **3.** | **Functional Requirement for Testing Power Transformer** | The test set should be able to test Large Power transformers for i) Turn-ratio (three-phase), ii) winding resistance, iii) OLTC continuity check, iv) Excitation Current, v) Leakage Reactance and Frequency Response of Stray Losses etc.  Test set shall be capable of carrying out capacitance and tan-delta measurements of bushings and windings of all types of EHV transformers (optional, if provided separately). |
|  |  | The kit shall be able to measure, record and display the per-tap measurements of turns-ratio, errors of ratio & phase angles and excitation current to avoid manual recording of the test results. There should not be any limitation of the number of taps (minimum of 17 taps) which can be measured. The deviation from nominal ratio for each taps shall be displayed. |
|  |  | There must be facility to connect all the three phases of the power transformer once, and the test equipment should automatically switch over from one phase to another and also change tap-positions, without any requirement of manual intervention. |
|  |  | The kit shall be able to measure and record the per tap measurements of Winding resistance (wherever applicable). It should also be able to detect any problem with On load tap changer & its operation. |
|  |  | The kit should have automatic safe discharge feature after the test for the safety of the operating personnel. The test kit should be protected against any inductive kick-back or during accidental fall-off any current/voltage leads. The test kit should also have audio/visual indication for the current flow or during discharge. |
|  |  | All necessary test leads/ clamps and any other accessories required to perform these tests shall be supplied without extra cost. |
|  | **Technical Requirement** | |
|  | Turns-ratio: | * Range : Fully automatic up to 1 to 2000 turns or better * Resolution : 0.01 or better * Accuracy : 0.5% or better * Test voltage : up to 2000V |
|  | Phase Angle: | * Range : 0 to 180 degree * Resolution : 0.1 degree or better * Accuracy : 0.2 degree or better |
|  | Winding resistance: | * Range : 1m ohms to 100 ohms with automatic range switching * Accuracy : 0.6% of reading or better |
| **4.** | **Functional Requirement for Contact Resistance (μΩ) Measurement Kit** | The test set should be able to measure static contact resistances of circuit breakers, bus bar joints etc. |
|  | **Technical Requirement** | |
|  | Contact Resistance | * Range : 1 μΩ ....10mΩ * Resolution : 0.1μΩ * Accuracy : 1% or better * Test Current : 400A dc |
| 5. | 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 delivery / supply of the kit to the consignee. |
| 6. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 7. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 8. | After Sales Servic | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XVIII. TECHNICAL SPECIFICATION FOR LEAKAGE CURRENT DETECTOR.**

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| **Technical Specification For Leakage Current Detector** | | |
| **Sl No** | **Parameters** | **Specifications** |
| 1 | Functional Requirement | The instrument, DC Earth Leakage (Earth Fault) Detector should be compact, lightweight and easy to use. The instrument should be able to carry out the test in online condition, i.e., no isolation / shutdown of the DC battery system should be required. It should be able to detect, track and locate grounding faults developed in Floating DC systems thereby increasing the reliability of system. |
| 2 | Signal Generator |  |
| Voltage Range | 24V, 48V, 110V, 220V, 500V and 1000V selectable |
| Frequency Range | selectable frequency of 1Hz, 10Hz (Default), 50Hz, 60Hz & 325Hz |
| Frequency Spectrum Analysis | To test the interference available in circuit & correct / adjust the test frequency as per the test requirement. |
| Output Current Range | selectable from 5mA to 40mA |
| Fault Resistance | up to 1MΩ |
| Display | 128 × 64 pixel colour LCD |
| 3 | Receiver Unit |  |
| Indications for pinpointing fault location | a. Direct of current flow  b. Phase Angle difference  c. Comparison of Signal Strengh. |
| Current detection Sensitivity | ≥ 0.5mA |
| Capacitance Range | 0.1µF to 999.9µF |
| Self Calibration / Adjustment of sensitivity | Auto Calibration. Adjustable sensitivity at different locations of circuit |
| Memory | In built Memory of 128MB |
| Multimode | Multiple Receiver units can work simultaneously with single Signal Generator |
| Display | 240×320 pixel 3.5” colour TFT touch screen |
| 4 | USB Connection Port | It should be possible to directly attach the USB Pen Drive to Receiver to save the screen data. |
| 5 | Power supply | Both Signal Generator & Receiver Units should work on built-in rechargeable Li-Ion battery. Battery should be chargeable on AC Mains 230 V, 50 Hz. Battery life should be more than 4 hours. |
| 6 | Working Environment | Up to 50⁰C, <95% RH(Non Condensing) |
| 7 | Weight | 7 kg (Approx) |
| 8 | Accessories for Transmitter and Receiver | Test Leads including Clamp of dual range of 8mm & 20mm, Manual & Carrying Case / Bag |
| 9 | 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 delivery / supply of the kit to the consignee. |
| 10. | Warranty/Guarantee | 12months from the date of successful & complete commissioning at site |
| All the materials, including accessories, cables, laptops (wherever supplied) etc. are to be covered under warranty/ guarantee period. If the kit needs to be shifted to supplier’s works for repairs within warranty/guarantee period, suppliers will have to bear the cost of repairs, spares and transportation of kit |
| 11. | Training | Supplier shall have to ensure that the kit is made user friendly. Apart from detailed demonstration at site, the supplier shall also have to arrange necessary training to Power & Electricity Department (P&ED) engineers |
| 12. | After Sales Service | Bidder will have to submit the documentary evidence of having established mechanism in India for prompt services. |

**XIX. TECHNICAL SPECIFICATION FOR TRANSFORMER OIL FILTER MACHINE(600LPH):**

The filter machine is required to be used at various Power Sub- stations in MIZORAM.

The plant should be suitable for treating transformer and switch gear oil by first heating it and then passing it through special designed filter packs and then subjecting it to vacuum treatment, which dehydrates and degasifies the oil to following specifications in single pass:

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Before Processing** | **After Processing** |
| **Break down voltage** | **Around 20kV** | **70kV or more (Across2.5mmGap)** |
| **Moisture content** | **100ppm** | **5ppm** |
| **Gas content** | **10% by volume** | **0.1% By volume** |
| **Suspended particles** | **Many Microns** | **1 Micron and less** |

The oil filtration should be designed for **HIGH VACUUM – LOW TEMPERATURE**

Processing of oil for achieving better results.

Apart from above the plant shall be suitable for carrying out following operation:

a) To effect continuous hot oil circulation with rated through out capacity of 600 LPH

continuouslyformorethan72hours.’

b) To draw oil from transformer or shunt reactor under vacuum of **0.02 to rr** and to discharge it to storage tank. In this case ,filter, heater and degassing apparatus of the plant maybe capable of being by past.

**CONSTRUCTION**

The oil filtration plant should be mobile, mounted on an irregular **vehicle as specified below:**

* **Axle configuration 4x4**
* **Seating capacity 1+4**
* **Engine displacement at least 2523cc**
* **Payload at least 1.4 tonnes**

While assembly of the plant on the vehicle sufficient area shall be provided for:

a) Seating of at least 4 persons, excluding driver.

b) Necessary provision for placing of instruments such as Moisture content measuring apparatus and Break down Voltage Tester etc., with lockable arrangements.

c) Necessary arrangement for storage of consumables such as vacuum pump oil, flanges, oil hoses, oil drums, cable etc.

There shall be a full length wise seat, in parallel and behind the seating arrangement of the driver, forming a cabin. **This cabin shall be interconnected from the driver cabin as well as truck body to facilitate easy approach to the filtration unit. This additional cabin will be used for seating of operating personnel. Under the seating arrangement provided for the personals, an arrangement shall be provided for keeping the T&P/ Equipments with locking provisions.**

All components should have adequate strength and rigidity to with stand normal conditions of handling, transport and usages and should be free from edges or corners to avoid injury to operational personnel in normal condition of use. The design of the plant should be such that the defective parts would be easily removable in case of replacement/ maintenance. Proper guarding arrangement should be provided on all such parts which due to their position and nature of operation are liable to cause accidents. No part of the plant should hang over out side the truck body/chassis.

**The plant will be suitable for operation on 415volts,50Hz,3Phase 4 wire system**.

All electrical equipments will be connected to a ground copper bus bar on the control panel with 2nos. of copper wires of adequate size. The ground bus bar will have two terminals for receiving external earth connections.

The plant should comprise of the following:

**INLET PUMP:**

The inlet pump should have a capacity of 600 LPH positive displacement gear type with built in relief valve to take care of accidental pressure increase. The pump should be thoroughly tested for vacuum and should be suitable for continuous trouble free operation. The pump should be provided with automatic protection against over-pressure build up. The level of pressure at which this automatic device will operate ,shall be indicated. Details of such protection device may also please be furnished.

Inter locking arrangement should be provided in between the oil inlet pump and the heater so that heater can not be energized unless oil actually flows through the heater tank. An inter lock shall also be provided through flow switch so that pump is stopped automatically when oil flow through plant ceases or does not exist.

For adjustment of flow rate through filter, a flow control valve should be provided across the gear pump. The suction head of the inlet feed pump at atmospheric condition at inlet will be **4-5m**. The inlet gear pump should be tested for a vacuum leak rate of less than **1 x 10-2 torr ltr./sec.**

**DISCHARGEPUMP:**

A centrifugal type discharge pump with a capacity of 600 LPH suitable for sucking oil from a chamber held under vacuum should be provided. This should be fully tested for vacuum, leak and pressure. The discharge head of this pump should be **6-8 m**. The discharge pump should be tested for a vacuum leak rate of **1x10-3 torr ltr./sec.**

Inter locking arrangement should be provided in the filter plant between the inlet pump and inlet valve to prevent mixing of treated and untreated oil in the event of supply failure.

**VACUUM PUMPING SYSTEM:**

**The vacuum pump should be of sufficient capacity and should be imported on your import license.** The vacuum pump should be suitable to remove dissolved water & gases from the oil in the degassing chamber. It should be equipped with mechanical non-return valve for preventing of reversing stroke of oil.

Roots-Rotary combination should be provided. This pumping system should be capable of achieving a vacuum of less than **0.5torr** in the degassing column during filtration and processing of oil. The supply to the motors used shall be through phase sequence reversal preventer so as to avoid the problems related with change of phase sequence.

The minimum specification & attainable vacuum levels in both stages of the vacuum pump shall preferably as under:

First Stage- Rotary oil sealed vacuum pump 1No.

Ultimate vacuum with g.b. closed 5X10-3torr

Ultimate vacuum with g.b open 1X10-1torr

Second stage-Mechanical booster pump(Roots pump) 1No.

Ultimate vacuum 10-4torr

Tenderers should clearly specify the makes of the vacuum pumps quoted and provide relevant catalogues. Both the Rotary oil sealed vacuum pump and Mechanical Booster pumps should preferably be of the same manufacturers.

The offer should be backed up by detailed calculations. All the dates appearing in the calculations must necessarily be supported by the references /catalogues / graphs. The assumption in considering margins in theoretical V/S practical values should be supported by necessary reference /charts/catalogues. Calculations have to be furnished for any system which as been considered by the tenderer suitable for achieving desired oil parameters after filtration.

**HEATERS**

Heaters should be of indirect type so as to avoid localized overheating, hotspot and breaking of oil. Heaters should be capable of raising the temperature of oil maximum up to70Deg.C. Each heater/heater stage shall be thermo statically controlled. Total heater power should be adequately provided to be justified by the calculations.

Control switches /knobs of the thermostat should be housed in the control panel for easy operation and maintenance. Selector switch should be provided for 1/3, 2/3 and full load operation of heaters depending upon the temperature of oil.

Heater elements should be of Nichrome / Kanthal wire filament mounted on re-fractory formers enclosed in steel tubes. Design of the heater should be such that incase of change of heater elements, it should be easier and should not require

any special tools.

Heaters should be interlocked with gear pump and should not be in “ON” position, unless the inlet pump is working. Heater tank should be adequately and thermally insulated to avoid dissipation of heat. Heater surface density should not be more than 1.5watts/ sq.mm.

An additional safety thermostat should be provided to take care of any accidental rise of the temperature of oil and should put off the heaters in such eventuality. This thermostat will be set at high temperature. Thermostat setting shall have accuracy of not more than plus minus 2.0Deg.C.

A dial type thermometer should be provided after the heater for indication of oil temperature i.e. at the outlet of heater tank.

One suitable pressure relief valve should be provided on the heater chamber to prevent any pressure is above the acceptable limit. One drain valve in the heater tank should also be provided.

**DEGASSINGAND DEHYDRATION CHAMBER–TWO STAGES**

The degassing chamber should function as degasser and dehumidifier and will be capable of removing large portion of dissolved impurities from oil. It should be of M.S. welded construction and should be provided with rust proof lid removable for maintenance .Preferably synthetic rubber ‘O’ rings should be provided for the purpose of sealing. The chamber should be able to withstand the vacuum to which it will be subjected.

Efficientlyspreadranchingringsshouldbeplacedinthedegassingcolumn.The surface area for the degassing and dehydration afforded by the Ranching rings should be sufficient and efficiently expose transformer oil to vacuum and at the same time maintain the specified flow rate. A sight glass with illuminating lamp should be provided for observation of oil process Ranching rings arrangement details be furnished.

One floats witch on the degassing chamber should be provided for preventing excess rise of oil level. It should be electrically interlocked with inlet pump. Necessary Control devices for regulating the level of oil in the degassing chamber should be provided. Another low level switch shall be provided and interlocked with the centrifugal pump on discharge side. The plant must have such back prevention incase of supply failure.

**FILTERATION SYSTEM:**

Filtration system should consist of the following:

a) Preliminary filter b) Filter press

c) Edge filter

**PRELIMINARY FILTER:**

The main function of this filter should be to prevent any damage to the inlet pump. It should have strainers capable of retaining all particles above 1 mm size and also magnetic particles. Incoming oil should pass through this filter. Necessary by pass valve arrangement should be provided. Provision should be made for cleaning the strainer elements without dismantling the whole strainer from the pipeline. Duplicate strainer shall be employed so that one can be cleaned while other is in operation.

**FILTER PRESS:**

This will consist of filter papers held between metallic discs. Filter papers should be easily changeable. It should be suitable for removal of particles bigger than 5microns. This should be useful for removal of sludge content in the used oil. A drain valve should also be provided for the filter.

**EDGE FILTER:**

The edge type filter should comprise of treated paper discs mounted to form a candle. Filter packs should be treated, rendering the paper impervious to the action of moisture present in the transformer oil. It will be suitable for removal of particles upto 1micron. Filter elements should be capable of preventing all solid impurities like dust, rust, metallic particles, scales, carbons, oxidation products etc. from entering into the degassing column.

Cleaning of filter candles should be affected either by reverse flow of compressed air or by back flushing. Separate air compressor unit with motor, air reservoir tank, safety valve should be provided for cleaning the edge filter packs. Filter packs should be held under spring compression and arrangement should be provided to adjust the spring pressure.

Pressure gauges on both sides of the filters shall be provided to indicate the need to clean/ change filter paper packs. These pressure limits, at which filters are needed to be cleaned or changed, be indicated specifically. One drain valve to clean the chamber should also be provided.

**ACCESSORIES AND FITTINGS**:

**THERMOMETERS:**

One dial thermometer of 0-150 Deg.C should be provided at the inlet of heater tank and 1No. at the outlet of the heater tank.

**VACUUM GAUGES:**

One capsule type vacuum gauge of range 0-50m bar should be provided for the first stage and one Mc leod type vacuum gauge having arrange of 10 to rr to 0.01mm of Hg should be provided for measurement of vacuum in the second stage of degassing chamber.

**PRESSURE GAUGE:**

One pressure gauge on the edge filter chamber should be provided. Independent drives for oil discharge pump ,oil in let pump, vacuum pump should be provided.

**MOTORS:**

Motors provided should generally conform to IS: 325 and should be of class E/B insulation. Starters should be of direct on line type.

**SOLENOID VALVES AT THE INLET AND OUTLET:**

1No.each solenoid valves at inlet and outlet should be provided. These should open automatically the moment oil inlet and outlet pumps are switched ON. Incase of power failure, these should be capable of preventing the oil from entering into the plant and thus avoiding the possibility of mixing processed oil with unprocessed oil.

**OIL SAMPLING VALVE:**

This valve should be provided to collect the sample of oil for testing, during operation.

**OIL FLOW CONTROL VALVE:**

One oil flow control valve should be provided across the oil inlet pump to control the flow rate of oil.

**AIRING VALVE:**

One airing valve for airing the degassing chamber and vacuum system should be provided. Necessary isolating arrangement, control valve, indicator will be provided to enable the plan to fill the oil from one tank to other. All valves in the oil system should be of piston type and of M.S.

**FLOAT SWITCH AND FLOW INDICATOR:**

High level float switch should be interlocked with inlet gear pump so that when the oil level in the degassing column rises above the pre-set level ,it will automatically switch off the gear pump and when the oil level drops below this level, it will automatically switch on the gear pump. Low level float switch should also be provided which should be interlocked with discharge pump, to avoid dry running of the discharge pump. A flow indicator should be provided at outlet of the plant.

**OIL HOSES–2NOS.:**

2Nos. Nitrile rubber hoses each 15Mtrs. long with flanged end connection on both sides should be provided. These will be suitably used for oil inlet and oil outlet. Oil hoses should be capable for handling the transformer oil at 100deg.C(Max.) and vacuum.

**IONIC REACTION COLUMN:**

An Ionic reaction column made out of M.S. and should have a capacity to put activated alumina, will be provided. This Ionic reaction column should have a provision of online attachment with the plant, when required. Arrangement should be made for by passing the same with the provision of by pass valve. The Ionic Reaction column should be capable of reducing the total acidity level and as per relevant IS for new oil.

**TRANSFORMER EVACUATION SYSTEM:**

A separate transformer evacuation system with necessary vacuum pumps mounted along side the filtration plant shall also be supplied with the plant. The minimum level and attain able vacuum level shall be as under:

Rotary oil sealed vacuum pump 1

Ultimate Vacuum with g.b. closed 5X10-3torr

Ultimate Vacuum with g.b. open 1X10-1torr

Mechanical Booster Pump(Roots type) 1No.

Ultimate vacuum 10-4torr

The vacuum pump shall be of a reputed International/equivalent make. Tenderers should clearly specify the makers of the vacuum pumps quoted & provide relevant catalogues. Both the rotatory oil seal vacuum pump &mechanically booster pump should be of the same manufacturers.

**OIL TESTING INTRUMENTS:**

The plant shall also be equipped with the following oil testing instruments.

a) Moisture contents measuring apparatus. The moisture contents measuring apparatus shall be

suitable to measure the moisture content in transformer oil giving full details/particulars. The instrument shall be of a very good quality.

b) Breakdown voltage tester.

A suitable breakdown voltage tester of range 0-100KV shall be provided. This shall be capable of measuring the breakdown voltage of oil as per the relevant Indian Standard.

**CONTROL PANEL:**

All electrical control gear, main isolating arrangement, motors, starters, contactors, pilot lamp, push buttons, back up protection fuses, relays, indicating lamps and interlocking will be housed in a compact control panel and should be of M.S.

A mimic diagram with indicating lamps should be provided on the control panel.

All wiring should be neatly routed and all wire termination should be suitably identified with ferrules. Bulb should be provided for illumination.

Following visual and audio alarm annunciation have to be provided complete in all respect:

i) Loss of vacuum is degassing chamber. ii) Loss of flow.

iii) High oil temp.in heater outlet.

iv) High oil temp.in vacuum pump.

v) High oil temp. in degassing chamber. vi) Low oil temp. in degassing chamber.

vii) Filter chocked (operated by differential pressure between inlet and outlet of filter).

All HRC fuses should be preferably of ALSTOM Make and switch gear should be of Siemens/L&T Make. Temperature indicting controller should be preferably JN Marshall Make. Mains isolating switch should be preferably of MCCB type and of ALSTOM/L&T Make.

The entire plant along with all components mounted should be tested for a total vacuum leak rate of less than a torr ltr./sec. Tenderers should confirm availability of all testing facility at their works for carrying out the following tests on the oil:

a) Breakdown voltage.

b) Moisture contents.

c) Suspended particles.

**CLEANING AND PAINTING:**

Before dispatch form works ,all exposed surfaces should be cleaned off rust, dirt, scale and foreign matter and should be applied with a coat of rust preventive compound before being painted with suitable colour of paint from outside.

**TESTS:**

Oil Filter Machine & accessories shall be tested and certified in accordance with the relevant I.S.and IEC requirements, or equivalent. A copy of type tests shall be enclosed with the bid documents. Bids without such test reports will be treated as non-responsive.

Routine tests to be carried out during manufacture shall be submitted with the bid and approved by the purchaser prior to delivery.

The purchaser reserves the right to witness all tests and the manufacturer shall provided all facilities for the purchaser authorized representative to have full and free access, at all reasonable times, to the suppliers works. If the supplier is not in a position to given those facilities, tests on such equipment will be arranged at no cost to the purchaser, with an appropriate testing authority in the presence of the purchaser’s representative.

In additional to above tests following tests shall be carried out as acceptance tests on each oil filtration sets.

i) Insulation measurement tests.

ii) Di electric strength measurement of the filtered oil.

iii) Measurement of oil outlet pressure.

iv) Measurement of the flow rate of the oil being oil filtered.

v) Checking the performance of the plant as per guaranteed technical particulars.

vi) Checking the oil parameter as per ItemNo.23 of guaranteed technical particulars.

vii) Checking of vacuum pressure at first pass.

viii) High voltage (2kV) test on electrical control panel wiring.

ix) Switch Board operating tests for contactors, relays thermostats, annunciation system, starters.

x) Checking of interlock.

xi) Checking of Items as per requirement of the purchase order.

**INSPECTION :**

i) The purchaser shall have access at all times to the works and all other places of manufacture, where the material/equipment are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier’s works, raw materials, manufacture of the equipment, all the accessories and for conducting necessary tests as detailed herein.

ii) The supplier shall keep the purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.

iii) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

iv) The acceptance of any quantity equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

**DOCUMENTATION :**

The supplier shall provide, drawings, detailed with important dimensions and construction materials as appropriate, descriptive literature, operation & maintenance instructions and other information for a full understanding of the equipment offered after issuance of LOA.

All drawings shall conform to International Standards Organization (ISO) ‘A’, series of drawing sheet/Indian Standards Specification. All drawings shall be in ink and suitable for microfilming. All dimensions and data shall be in S.I.Units.

**TEST REPORTS :**

i) Two copies of test reports shall be furnished to the purchaser within one month of conducting the tests. One copy will be returned duly certified by the purchaser to the supplier within three weeks thereafter and on receipt of the same supplier shall commence with the commercial production of the concerned material.

ii) Two copies of acceptance test reports shall be furnished to the purchaser. One copy will be returned, duly certified by the purchaser and only thereafter shall the materials be dispatched.

iii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the purchaser.

iv) All test reports of tests conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when requested for by the purchaser.

**PACKING & FORWARDING :**

The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by the supplier without any extra cost.

Each consignment shall be accompanied by the detailed packing list containing the following information:

i) Name of the consignee.

ii) Details of the consignment.

iii) Destination.

iv) Total weight of consignment.

v) Sign showing upper/ lower side of the crate. vi) Handling and unpacking instructions.

vii) Bill of materials indicating contents of each package.

The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.

The material shall be transported within India to the respective destination by road

Transport/Rail Transport as the case maybe at the option of the purchaser.

**SPARE PARTS:**

List of spare parts along with their unit price and full details, required for operation/ maintenance of equipment for a period of 2years are required to been closed with bid document.

Suppliers shall have adequate facilities to repair and maintain the equipment offered and be prepared to supply spare parts and services as and when required. The bidder shall give details of his facilities to support this requirement with his bid.

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