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a) SITE CONDITIONS

| 1. SITE CONDITIONS | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
|  | **General Requirement** |  |  |  |
|  | Substation Name |  | Narok |  |
| 1 | Climate |  | Temperate, no dry season, warm summer (Cfb) |  |
| 2 | Pollution |  | Very Heavy |  |
| 2.1 | Creepage distance (based on Um) | mm/kV | 31 |  |
| 3 | Isokeraunic Level | Thunderstorm days/year | 40 |  |
| 4 | Altitude of Area | m | 2000 |  |
| 5 | Seismic Acceleration | g | 0.25 |  |
| 6 | Air Temperature |  |  |  |
| 6.1 | - Absolute maximum | °C | 40 |  |
| 6.2 | - Absolute minimum | °C | 1 |  |
| 6.3 | - max. mean daily | °C | 25 |  |
| 7 | Humidity (Maximum average per day) | % | 60 |  |
| 8 | Precipitation | Days per year | 153 |  |
| 9 | Wind velocity |  |  |  |
| 9.1 | - Normal wind | m/s | 20 |  |
| 9.2 | - Gust (design basis) | m/s | 40 |  |
| 10 | Maximum Snowy | days per year | 10 |  |
| 11 | Average Annual Intensity of solar radiation | kWh/m2 | 1800 |  |
| 12 | Thickness of ice | mm | 5 |  |
| 13 | Average annual rainfall | mm | 2500 |  |
| 14 | Minimum factors of safety for switchgear |  |  |  |
| 14.1 | Busbars or other connections based on elastic limit |  | 2.5 |  |
| 14.2 | Complete insulators based on electro-mechanical test |  | 2.5 |  |
| 14.3 | Insulator metal fittings based on elastic limit |  | 2.5 |  |
| 14.4 | Steel structures based on elastic limit of tension members and on crippling loads of compression members |  | 2.5 |  |
| 14.5 | Foundations for structures against overturning or uprooting under maximum simultaneous working loadings |  | 2.5 |  |

b) 132 kV OPEN TERMINAL SWITCHGEAR

| 1. 132 kV OPEN TERMINAL SWITCHGEAR | | | |  | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | |  |  | **REQUIRED** | **OFFERED** |
|  | **132KV Circuit Breaker** | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 1.1 | Manufacturer | | |  |  |  |  |
| 1.2 | Place of manufacturing | | |  |  |  |  |
| 1.3 | Type designation for breaker | | |  |  |  |  |
| 1.4 | Type designation for operating mechanism | | |  |  |  |  |
| 1.5 | Type of operation mechanism | | |  |  | Spring Charge  motor operated |  |
| 1.6 | Type of interrupting chamber | | |  |  |  |  |
| 1.7 | Applicable standard | | |  |  | IEC 62271-100, 62271-101, 62271-110, 62271-302, 60376, 60480 |  |
| 1.8 | Rated voltage | | |  | kV | 145 |  |
| 1.9 | System Voltage | | |  | kV | 132 |  |
| 1.10 | Rated current at maximum site temperature | | |  | A |  |  |
| 1.10.1 | For line feeder | | |  |  | 1600 |  |
| 1.10.2 | For Transformer feeder | | |  |  | 1600 |  |
| 1.10.3 | For Bus Coupler feeder | | |  |  | 3150 |  |
| 1.10.4 | For Bus Coupler feeder | | |  |  | 3150 |  |
| 1.10.5 | For Bus Section | | |  |  | N.A. |  |
| 1.10.6 | For reactor feeder | | |  |  | N.A. |  |
| 1.11 | Rated frequency | | |  | Hz | 50 |  |
| 1.12 | Media of breaking chamber | | |  |  | SF6 |  |
| 1.13 | Single pressure, low pressure or others | | |  |  |  |  |
| 1.14 | Quantity of poles per breaker | | |  |  | 3 Poles |  |
| 1.15 | Rated operating sequence | | |  |  | O -0.3 sec- CO - 3 min - CO |  |
| 1.16 | Single pole or three pole operation | | |  |  |  |  |
| 1.16.1 | For line feeder | | |  |  | single pole operated |  |
| 1.16.2 | For Transformer feeder | | |  |  | 3 pole operated |  |
| 1.16.3 | For Bus Coupler feeder | | |  |  | 3 pole operated |  |
| 1.16.4 | For Bus Coupler feeder | | |  |  | 3 pole operated |  |
| 1.16.5 | For Bus Section | | |  |  | N.A |  |
| 1.16.6 | For reactor feeder | | |  |  | N.A |  |
| Note |  | |  | | | | |
| 1.17 | Number of interrupting chambers per pole | | |  |  |  |  |
| 1.18 | Class (indoor / outdoor) | | |  |  | Outdoor |  |
| 1.19 | Circuit breaker type (live tank / dead tank) | | |  |  | Live tank |  |
| 1.20 | Type of system earthing | | |  |  | Solid |  |
| 1.21 | Withstanding in load combinations of earthquake, wind , short circuit , etc as mentioned in Technical Specification | | |  | (Yes/ No) | Yes |  |
| 1.22 | Maximum and Minimum ambient temperature for design | | |  | °C | Acc. to section 1 |  |
| 1.23 | Design altitude above sea level | | |  | m | Acc. to section 1 |  |
| 1.24 | Pollution level | | |  | mm/kV | Acc. to section 1 |  |
| 1.25 | Design seismic acceleration | | |  | g | Acc. to section 1 |  |
|  | **Insulation Rating** | | |  |  |  |  |
| 1.26 | Type of Insulator (porcelain/silicon rubber) | | |  |  | porcelain |  |
| 1.27 | Basic Insulation level (at site condition) | | |  | kV peak |  |  |
| 1.27.1 | Common value (Phase-phase, Phase-ground) | | |  |  | 650 |  |
| 1.27.2 | Across the isolating distance | | |  |  | 750 |  |
| 1.28 | One minute power frequency withstand voltage (at IEC condition) | | |  | kV rms |  |  |
| 1.28.1 | Common value (Phase-phase, Phase-ground) | | |  |  | 275 |  |
| 1.28.2 | Across isolating distance | | |  |  | 325 |  |
| 1.29 | Switching Impulse Withstand Voltage at IEC conditions | | |  | kV peak | N.A. |  |
| 1.29.1 | Phase to ground and across open switching device | | |  |  |  |  |
| 1.29.2 | Phase to phase | | |  |  |  |  |
| 1.29.3 | Across isolating distance | | |  |  |  |  |
| 1.30 | Rated transient recovery voltage for terminal faults | | |  | kV peak | 215 |  |
| 1.31 | Rated recovery voltage | | |  | kV peak |  |  |
| 1.31.1 | Amplitude factor | | |  |  |  |  |
| 1.31.2 | Rate of rise | | |  | kV/µs |  |  |
| 1.32 | Rate of rise of restriking voltage | | |  |  |  |  |
| 1.32.1 | For 30% breaking capacity | | |  | kV/µs |  |  |
| 1.32.2 | For 60% breaking capacity | | |  | kV/µs |  |  |
| 1.32.3 | For 100% breaking capacity | | |  | kV/µs |  |  |
| 1.33 | Maximum recovery voltage on breaking a synchronous system | | |  | kV |  |  |
| 1.34 | Rated characteristics for short line faults | | |  | kV rms |  |  |
| 1.35 | First pole to clear factor | | |  |  | 1.5 |  |
| 1.36 | Whether circuit breaker is restrike free? | | |  |  | Yes |  |
| 1.37 | Maximum overvoltage factor on any switching duty | | |  | pu | 2.3 |  |
| 1.38 | Maximum overvoltage factor when interrupting rated line/cable/capacitor bank charging currents | | |  | pu | 2.3 |  |
| 1.39 | Maximum overvoltage factor when switching small inductive/reactor currents | | |  | pu | 2.3 |  |
| 1.40 | Maximum total break time (trip initiation to final arc extinction) | | |  | ms |  |  |
|  | **Current Ratings** | | |  |  |  |  |
| 1.41 | Rated short time withstand current & duration | | |  | kA rms/sec | 31.5/1 |  |
| 1.42 | Rated short circuit making current | | |  | kA peak | 2.5\*31.5 |  |
| 1.43 | Rated out of phase breaking current | | |  | kA rms | 10 |  |
| 1.44 | Rated small inductive breaking current | | |  | A rms | Acc. To IEC |  |
| 1.45 | Rated capacitive breaking current | | |  |  |  |  |
| 1.45.1 | Rated line-charging breaking current | | |  | A rms | Acc. To IEC |  |
| 1.45.2 | Rated cable charging breaking current | | |  | A rms | Acc. To IEC |  |
| 1.45.3 | Rated Single/Back to Back Capacitor bank breaking current | | |  | A rms | Acc. To IEC |  |
| 1.46 | Rated short circuit breaking current | | |  |  |  |  |
| 1.46.1 | AC component | | |  | kA rms | 31.5 |  |
| 1.46.2 | DC component | | |  | % | Acc. To IEC |  |
| 1.47 | Maximum current on breaking asynchronous system | | |  | kA peak |  |  |
| 1.48 | 180° out of phase switching duty as a percentage of rated  breaking current | | |  | % |  |  |
|  | **Other Characteristics** | | |  |  |  |  |
| 1.49 | Voltage drop across HV terminals of one pole at 100 A dc | | |  | mV |  |  |
| 1.50 | Maximum temperature rise at normal current over maximum  ambient temperature | | |  | °C |  |  |
| 1.51 | Opening time (from trip contact closing to the primary contacts separation in all poles) | | |  |  |  |  |
| 1.51.1 | Without current | | |  | ms |  |  |
| 1.51.2 | With 100% rated breaking current | | |  | ms |  |  |
| 1.52 | Opening time from trip contact closing to primary contact separation | | |  | µs |  |  |
| 1.53 | Closing time (from energization of close coil to latching of circuit breaker in fully closed position) | | |  | µs |  |  |
| 1.54 | Rated break or interrupting time (opening time plus arcing time) | | |  | µs |  |  |
| 1.55 | Making time (energization of close coil to contact touch) | | |  |  |  |  |
| 1.55.1 | Without current | | |  | ms |  |  |
| 1.55.2 | 100% making current | | |  | ms |  |  |
| 1.56 | Maximum break time | | |  | ms | 40 |  |
| 1.57 | Maximum close time | | |  | ms | < 70 |  |
| 1.58 | Dead time (during auto-reclosing) | | |  | ms |  |  |
| 1.59 | Reclosing | | |  | ms |  |  |
| 1.60 | Arcing time | | |  | ms |  |  |
| 1.61 | Maximum time interval between opening of first and last phase of three phase circuit breakers | | |  | ms |  |  |
| 1.62 | Maximum time interval between opening of interrupters of one phase | | |  | µs |  |  |
| 1.63 | Maximum time interval between closure of interrupters of one phase | | |  | µs |  |  |
| 1.64 | Minimum time from extinction of main arc to contact make during auto-reclosing duty | | |  | ms |  |  |
| 1.65 | Closing time from energisation of close coil to latching of circuit breaker in fully closed position | | |  | ms |  |  |
| 1.66 | Making time (energisation of close coil to contact touch) | | |  |  |  |  |
| 1.66.1 | Without current | | |  | ms |  |  |
| 1.66.2 | 100% making current | | |  | ms |  |  |
|  | **Operating Mechanism** | | |  |  |  |  |
| 1.67 | Type of spring | | |  |  | spring operated |  |
| 1.68 | Motor type | | |  |  | DC Motor charged, |  |
| 1.69 | Motor | | |  |  |  |  |
| 1.69.1 | Rated voltage | | |  | V | 110 VDC |  |
| 1.69.2 | Power demand | | |  | W |  |  |
| 1.69.3 | Full-load current | | |  | A |  |  |
| 1.69.4 | Maximum starting current | | |  | A |  |  |
| 1.69.5 | Speed | | |  | rpm |  |  |
| 1.69.6 | Required time by motor to charge the spring completely | | |  | s |  |  |
| 1.69.7 | Type of protection of motor | | |  |  |  |  |
| 1.70 | Hand operating facility | | |  | Yes/No | Yes |  |
| 1.70.1 | Manual spring charging facility to be accessible from ground respectively platform to be provided | | |  | Yes/No | Yes |  |
| 1.70.2 | Manual spring release (suitably positioned to avoid accidental operation) | | |  | Yes/No | Yes |  |
| 1.70.3 | Manual mechanism charging torque | | |  | Nm |  |  |
| 1.71 | Mechanical on/off indicator | | |  | Yes/No | Yes |  |
| 1.72 | Mechanical spring charge/discharge indication | | |  | Yes/No | Yes |  |
| 1.73 | Charging time | | |  | S | ≤12 |  |
| 1.74 | Number of trip coils per phase | | |  |  | 2 |  |
| 1.75 | Number of close coils per phase | | |  |  | 1 |  |
| 1.76 | Reclosing suitable for 1 pole and/or 3 pole | | |  |  | 3pole and 1pole |  |
| 1.77 | Whether circuit breaker is trip free or others? | | |  |  | Yes |  |
| 1.78 | Number and type of spare auxiliary reversible contacts | | |  |  | 12NO+12NC |  |
| 1.79 | Opening and closing nominal control voltage | | |  | V dc |  |  |
| 1.80 | Control cabinet | | |  |  |  |  |
| 1.80.1 | Power Socket in Control cabinet | | |  |  | British Standard |  |
| 1.80.2 | cabinet Light (Compact LED) | | |  | Yes/No | Yes |  |
| 1.80.3 | Number, type & power of cabinet heater | | |  |  |  |  |
| 1.80.4 | cabinet space heaters (thermostat Controlled) | | |  | Yes/No | Yes |  |
| 1.80.5 | Degree of protection (IP) of control cabinet | | |  |  | IP55 |  |
| 1.80.6 | Minimum thickness of steel control cabinet | | |  | mm | 2 |  |
| 1.81 | Tripping and closing coils | | |  |  |  |  |
| 1.81.1 | Number of closing coils | | |  |  | 1 |  |
| 1.81.2 | Number of tripping coils | | |  |  | 2 |  |
| 1.81.3 | Tripping coil current | | |  | A, DC |  |  |
| 1.81.4 | Closing coil current | | |  | A, DC |  |  |
| 1.81.5 | Rated power of trip coil | | |  | W |  |  |
| 1.81.6 | Rated power of close coil | | |  | W |  |  |
| 1.81.7 | Tripping and closing coils' nominal control voltage | | |  | V, DC | 110 |  |
| 1.81.8 | Variation of closing / opening coils' operating voltage | | |  | % | 85-110 / 70-110 |  |
| 1.81.9 | Minimum voltage for proper operation of trip & close coils | | |  | % | 40 |  |
| 1.81.10 | - Pick up range of control voltage | | |  |  |  |  |
| 1.82 | Whether antipumping device is provided? | | |  | Yes/No | Yes |  |
| 1.83 | Whether operating counter is provided? | | |  | Yes/No | Yes |  |
| 1.84 | Whether emergency trip is provided? | | |  | Yes/No | Yes |  |
| 1.85 | Whether circuit breaker is equipped with Local/ remote/ maintenance change over switch? | | |  | Yes/No | Yes |  |
| 1.86 | Whether circuit breaker is equipped with manually spring charge facilities? | | |  | Yes/No | Yes |  |
| 1.87 | Whether Pre-insertion resistor is provided? | | |  | Yes/No | No |  |
| 1.87.1 | Closing resistor value | | |  | Ω |  |  |
| 1.87.2 | Insertion time | | |  | ms |  |  |
| 1.88 | Whether Switching Control Relay is provided? | | |  | Yes/No | No |  |
| 1.89 | Pole discrepancy feature | | |  | Yes/No | Yes |  |
|  | **Insulating Medium** | | |  |  |  |  |
| 1.90 | Insulating medium | | |  |  | SF6 gas |  |
| 1.91 | Rated pressure SF6 at 20°C | | |  | Absolute  bar |  |  |
| 1.92 | Limits of gas pressure for correct operation of breaker | | |  | Absolute  bar |  |  |
| 1.93 | Signal loss of SF6 at 20°C | | |  | Absolute  bar |  |  |
| 1.94 | General lockout at 20°C | | |  | Absolute  bar |  |  |
| 1.95 | Leakage rate of SF6 at rated pressure per annum | | |  | % | < 0.1 |  |
| 1.96 | Type and material of gasket used to gas tightening the joints | | |  |  |  |  |
| 1.96.1 | Metal to metal joints | | |  |  |  |  |
| 1.96.2 | Metal to porcelain joints | | |  |  |  |  |
| 1.97 | Supplier of SF6 gas | | |  |  |  |  |
| 1.98 | Supplier of Density meter | | |  |  |  |  |
| 1.99 | Toxicological test | | |  |  |  |  |
| 1.100 | Storage capacity of each gas cylinder | | |  | m³ |  |  |
| 1.101 | Whether sufficient gas plus 20% supplied for first filling? | | |  | Yes / No |  |  |
| 1.102 | Mass of gas stored cylinder | | |  | kg |  |  |
| 1.103 | Time required to fill the circuit breaker with SF6 gas ready  for operation | | |  | hour |  |  |
| 1.104 | Time required to empty gas of the circuit breaker | | |  | hour |  |  |
| 1.105 | Total mass of transportable gas handling equipment | | |  | kg |  |  |
| 1.106 | Whether SF6 is stored as gas or liguid? | | |  |  |  |  |
|  | **Insulator Columns** | | |  |  |  |  |
| 1.107 | Manufacturer | | |  |  |  |  |
| 1.108 | Type | | |  |  |  |  |
| 1.109 | Color | | |  |  |  |  |
| 1.110 | Creepage distance phase to ground | | |  | mm | 4495 |  |
| 1.111 | Creepage distance between terminals of one pole | | |  | mm |  |  |
| 1.112 | Protected creepage distance (90° shadow) | | |  | mm |  |  |
| 1.113 | Clearance (phase to phase ) | | |  | mm |  |  |
| 1.114 | External striking distance | | |  |  |  |  |
| 1.114.1 | Phase to ground | | |  | mm |  |  |
| 1.114.2 | Phase to phase | | |  | mm |  |  |
| 1.115 | Ultimate strength of columns | | |  |  |  |  |
| 1.115.1 | Cantilever | | |  | N |  |  |
| 1.115.2 | Tension | | |  | N |  |  |
| 1.115.3 | Torsion | | |  | N.m |  |  |
| 1.115.4 | Compression | | |  | N |  |  |
| 1.116 | Permissible force at HV terminals | | |  |  |  |  |
| 1.116.1 | Static at any direction | | |  | N |  |  |
| 1.116.2 | Dynamic at any direction | | |  | N |  |  |
| 1.117 | Washable in service | | |  | Yes / No | Yes |  |
|  | **Miscellaneous** | | |  |  |  |  |
| 1.118 | Mechanical life of CB and mechanism in No. of operations | | |  | time | 10000 |  |
| 1.119 | Electrical contact life in number of operations at: | | |  |  |  |  |
| 1.119.1 | Rated current | | |  | time | 10000 |  |
| 1.119.2 | Breaking current | | |  | time | ≥ 30 |  |
| 1.119.3 | Cumulative ampere rating | | |  | time |  |  |
| 1.120 | Whether a lock out device for preventing circuit breaker to close is provided? | | |  | Yes / No |  |  |
| 1.121 | Whether Switching Control Relay is provided? | | |  | Yes/No |  |  |
| 1.122 | Number and type of free auxiliary contacts for main contact monitoring | | |  |  | >10NO+ >10NC |  |
| 1.123 | Number and type of free auxiliary contacts for SF6 gas pressure monitoring | | |  |  | >10NO+ >10NC |  |
| 1.124 | Number and type of free auxiliary contacts for local/remote selector switch monitoring | | |  |  | >10NO+ >10NC |  |
| 1.125 | Whether circuit breaker is equipped with rings? | | |  | Yes/No |  |  |
| 1.126 | Whether circuit breaker is equipped with grading capacitors? | | |  | (Yes/ No) | Yes |  |
| 1.127 | Mechanical on/off indicator | | |  | Yes/No | Yes |  |
| 1.128 | Gas supervision | | |  | Yes/No | Yes |  |
| 1.129 | Circuit breaker Operating platform (from ground level) | | |  | Yes/No | Yes |  |
| 1.130 | Type and material for main contacts | | |  |  |  |  |
| 1.131 | Material of HV conductor | | |  |  | Aluminum |  |
| 1.132 | Whether contacts are silver plated? | | |  | Yes / No | Yes |  |
| 1.133 | Un-galvanized metal parts shall primed, undercoated and finished with outdoor corrosion-resistant painting | | |  | Yes/No | Yes |  |
| 1.134 | Galvanizing parts accordance with ISO 1461 standards | | |  |  | As per ISO-1461 |  |
| 1.135 | CB weight | | |  |  |  |  |
| 1.135.1 | Weight of single pole breaker | | |  | kg |  |  |
| 1.135.2 | Total weight of complete circuit breaker | | |  | kg |  |  |
| 1.135.3 | Maximum weight of pakage ready for shipment | | |  | kg |  |  |
| 1.136 | CB main dimensions | | |  |  |  |  |
| 1.136.1 | Overall height of assembled circuit breaker | | |  | mm |  |  |
| 1.136.2 | Phase spacing | | |  | mm |  |  |
| 1.136.3 | Minimum vertical distance between upper and lower terminal of the circuit breaker | | |  | mm |  |  |
| 1.136.4 | Minimum vertical distance between lower side of the circuit breaker and metallic support | | |  | mm |  |  |
| 1.137 | Mechanical endurance class | | |  |  | M2 |  |
| 1.138 | Electrical endurance class | | |  |  | E2 |  |
| 1.139 | Restrike probability class due to capacitive current breaking | | |  |  | C2 |  |
|  | **132KV ISOLATOR** | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 2.1 | Manufacturer | | |  |  |  |  |
| 2.2 | Place of manufacturing | | |  |  |  |  |
| 2.3 | Type designation for Isolator | | |  |  |  |  |
| 2.4 | Type designation for grounding switch | | |  |  |  |  |
| 2.5 | Type of Isolator | | |  |  | Horizontal Double Break/Centre break |  |
| 2.6 | Applicable standard | | |  |  | IEC 62271-102 |  |
| 2.7 | Quantity of poles | | |  |  | three pole op. |  |
| 2.8 | Rated voltage | | |  | kV | 145 |  |
| 2.9 | System Voltage | | |  | kV | 132 |  |
| 2.10 | Rated current at maximum site temperature | | |  | A |  |  |
| 2.9.1 | At maximum site temperature | | |  |  |  |  |
| 2.9.1.1 | For line feeder | | |  |  | 1600 |  |
| 2.9.1.2 | For Transformer feeder | | |  |  | 1600 |  |
| 2.9.1.3 | For Diameter | | |  |  | N.A. |  |
| 2.9.1.4 | For Bus Coupler feeder | | |  |  | 3150 |  |
| 2.9.1.5 | For Bus Section | | |  |  | N.A. |  |
| 2.9.1.6 | For reactor feeder | | |  |  | N.A. |  |
| 2.9.2 | At IEC condition | | |  |  |  |  |
| 2.9.2.1 | For line feeder | | |  |  | Acc. to SLD |  |
| 2.9.2.2 | For Transformer feeder | | |  |  | Acc. to SLD |  |
| 2.9.2.3 | For Bus Coupler feeder | | |  |  | Acc. to SLD |  |
| 2.9.2.4 | For Bus Coupler feeder | | |  |  | Acc. to SLD |  |
| 2.9.2.5 | For Bus Section | | |  |  | N.A. |  |
| 2.9.2.6 | For reactor feeder | | |  |  | N.A. |  |
| 2.10 | Rated frequency | | |  | Hz | 50 |  |
| 2.11 | Class (outdoor / indoor) | | |  |  | Outdoor |  |
| 2.12 | Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No) | | |  | Yes / No | Yes |  |
| 2.13 | Hand operating facility is provided? ( Yes / No) | | |  | Yes / No | Yes |  |
| 2.14 | Accessibility to operating mechanism from ground level | | |  | Yes / No | Yes |  |
| 2.15 | Mechanical Endurance Class | | |  |  | M2 |  |
| 2.16.1 | Electrical Endurance Class | | |  |  | E2 |  |
| 2.16.2 | Capacitive switching at maximum temporary  overvoltage | | |  |  | C2 |  |
| 2.17 | Manufacturer quality system in accordance with ISO 9000 | | |  | Yes / No | Yes |  |
| 2.17.1 | Date of issue | | |  |  | Latest |  |
| 2.17.2 | Validity | | |  |  |  |  |
| 2.17.3 | Certificate attached to the offer | | |  | Yes / No | Yes |  |
| 2.18 | Type test certificate to be issued by independent laboratory or independently witnessed type test | | |  | Yes / No | Yes |  |
| 2.18.1 | Certificate to be attached to the offer | | |  |  | Yes |  |
| 2.18.2 | Report to be attached to the offer | | |  |  | Yes |  |
|  | **Insulation Rating** | | |  |  |  |  |
| 2.19 | Basic Insulation level (at site condition) | | |  |  |  |  |
| 2.19.1 | Common value | | |  | kV peak | 650 |  |
| 2.19.2 | Across the isolating distance | | |  | kV peak | 750 |  |
| 2.20 | One minute power frequency withstand voltage (at site condition) | | |  |  |  |  |
| 2.20.1 | Common value | | |  | kV rms | 375 |  |
| 2.20.2 | Across the isolating distance | | |  | kV rms | 325 |  |
| 2.21 | Switching impulse withstand voltage (at site condition) | | |  |  |  |  |
| 2.21.1 | Common value | | |  | kV peak | N.A. |  |
| 2.21.2 | Across the isolating distance | | |  | kV peak | N.A. |  |
| 2.22 | Type of Insulation(porcelain/silicon rubber) | | |  |  | porcelain |  |
|  | **Current Rating** | | |  |  |  |  |
| 2.23 | Rated short time withstand current | | |  |  |  |  |
| 2.23.1 | For Isolator | | |  | kA rms/sec | 31.5/1 |  |
| 2.23.2 | For grounding switch | | |  | kA rms/sec | 31.5/1 |  |
| 2.24 | Rated short circuit making current for grounding switches | | |  | kA rms | 2.5\*31.5 |  |
| 2.25 | Rated peak short circuit withstand current | | |  | kA peak |  |  |
| 2.26 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | | |  | kVA |  |  |
| 2.27 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | | |  | kVA |  |  |
|  | **Other Characteristic** | | |  |  |  |  |
| 2.28 | Rated Supply Voltage | | |  |  |  |  |
| 2.28.1 | For motor, control and interlock | | |  | Vdc | 110 |  |
| 2.28.2 | For AC auxiliaries | | |  | Vac | 240 |  |
| 2.29 | Voltage drop across terminals of one pole at 100 A.dc for Isolator and ground switches | | |  | mV |  |  |
| 2.30 | Maximum temperature rise at normal current over Maximum ambient temperature | | |  | °C |  |  |
| 2.31 | Maximum and minimum ambient temperature for design | | |  | °C | Acc. to section 1 |  |
| 2.32 | Altitude above sea level | | |  | m | Acc. to section 1 |  |
|  | **Operating Mechanism** | | |  |  |  |  |
| 2.33 | Type of operating mechanism | | |  |  |  |  |
| 2.33.1 | For Isolator | | |  |  | DC Motor |  |
| 2.33.2 | For grounding switch | | |  |  | DC Motor |  |
| 2.34 | Motor type | | |  |  |  |  |
| 2.35 | Motor | | |  | V | 110 VDC |  |
| 2.35.1 | Rated voltage | | |  | W |  |  |
| 2.35.2 | Power demand | | |  | A |  |  |
| 2.35.3 | Full load current | | |  | rpm |  |  |
| 2.35.4 | Speed | | |  |  |  |  |
| 2.36 | Type of motor protection | | |  |  |  |  |
| 2.37 | Total time from initiation of opening operation to Isolator in fully open position | | |  | sec | ≤15 |  |
| 2.38 | Time from contact separation to extinct of capacitive arc | | |  | sec |  |  |
| 2.39 | Total time from initiation of opening operation to time when Isolator gap can withstand phase voltage | | |  |  |  |  |
| 2.40 | Breaking and closing of: | | |  |  |  |  |
| 2.40.1 | Magnetizing current of power transformers | | |  | Yes / No | Yes |  |
| 2.40.2 | Mutual inductive/capacitive current of parallel circuit in double circuit line | | |  | Yes / No | Yes |  |
| 2.40.3 | Charging current of unloaded lines and/or cables | | |  | Yes / No | Yes |  |
| 2.41 | Minimum guaranteed no. of operations for Isolators or grounding switches before maintenance | | |  | N |  |  |
| 2.42 | Maximum required force for hand operation with supplied handle | | |  |  |  |  |
| 2.43 | Thickness of steel control cabinet | | |  | mm | Min (2) |  |
| 2.44 | Degree of protection (IP) of mechanism housing | | |  |  | IP55 |  |
| 2.45 | Cubicle space heaters (thermostat Controlled) | | |  | Yes / No | Yes |  |
| 2.46 | Cabinet heater | | |  |  |  |  |
| 2.46.1 | Power | | |  | W |  |  |
| 2.46.2 | Nominal Voltage | | |  | V | 240AC |  |
| 2.47 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | | |  | Yes / No |  |  |
| 2.48 | Whether open/neutral /close control switch is provided? ( Yes / No) | | |  | Yes / No |  |  |
| 2.49 | Whether under voltage relay is provided for motor supply? | | |  | Yes / No | Yes |  |
| 2.50 | Whether all of the heaters are equipped with a M.C.B ? | | |  | Yes / No | Yes |  |
| 2.51 | Rated power of operation coil | | |  | W |  |  |
| 2.52 | Total load of heaters for Isolator | | |  | W |  |  |
|  | **Insulators** | | |  |  |  |  |
| 2.53 | Manufacturer | | |  |  |  |  |
| 2.54 | Place of manufacturing | | |  |  |  |  |
| 2.55 | Type (porcelain /composite) | | |  |  | porcelain |  |
| 2.56 | Color | | |  |  |  |  |
| 2.57 | Creepage distance | | |  | mm | 4495 |  |
| 2.58 | Protected creepage distance | | |  | mm |  |  |
| 2.59 | Permissible cantilever working load | | |  | N | C8 |  |
| 2.60 | Operating handle or lever mounting height above ground | | |  | m | 1.2 |  |
| 2.61 | Permissible tensional strength | | |  | N.m |  |  |
|  | Minimum clearance | | |  | mm |  |  |
| 2.61.1 | Between poles when Isolator is closed | | |  |  |  |  |
| 2.61.2 | Between poles when Isolator is open | | |  |  |  |  |
| 2.61.3 | Between phase and ground | | |  |  |  |  |
| 2.61.4 | Between one pole terminals at open condition | | |  |  |  |  |
|  | **Interlocks** | | |  |  |  |  |
| 2.62 | Type of interlock between Isolator and associated ground switch | | |  |  | Electrical and Mechanical |  |
| 2.63 | Type of interlock between ground switch and related circuit breakers | | |  |  | Electrical |  |
| 2.64 | Type of interlock between Isolator and related circuit breaker | | |  |  | Electrical |  |
| 2.65 | Locking arrangement in on/off position | | |  | Yes / No | Yes |  |
| 2.66 | Automatic isolation of control supplies when lock off | | |  | Yes / No | Yes |  |
|  | **Miscellaneous** | | |  |  |  |  |
| 2.67 | Type of main contacts | | |  |  |  |  |
| 2.67.1 | For Isolator | | |  |  |  |  |
| 2.67.2 | For grounding switch | | |  |  |  |  |
| 2.68 | Material of main contacts | | |  |  |  |  |
| 2.68.1 | For Isolator | | |  |  | Copper |  |
| 2.68.2 | For grounding switch | | |  |  | Copper |  |
| 2.69 | Material of blades | | |  |  |  |  |
| 2.69.1 | For Isolator | | |  |  | Copper |  |
| 2.69.2 | For grounding switch | | |  |  | Copper |  |
| 2.70 | Whether main contacts are silver plated | | |  |  |  |  |
| 2.70.1 | For Isolators | | |  |  | Yes |  |
| 2.70.2 | For grounding switches | | |  |  | Yes |  |
| 2.71 | Quantity and type of free auxiliary contacts | | |  |  |  |  |
| 2.71.1 | For Isolators | | |  |  | 10NO+10NC |  |
| 2.71.2 | For grounding switches | | |  |  | 10NO+10NC |  |
| 2.72 | Permissible force on HV terminals | | |  |  |  |  |
| 2.72.1 | Static in any direction | | |  | N |  |  |
| 2.72.2 | Dynamic in any direction | | |  | N |  |  |
| 2.73 | Weight of maximum package ready for shipment | | |  | kg |  |  |
| 2.74 | Weight of complete | | |  |  |  |  |
| 2.74.1 | Isolator | | |  | kg |  |  |
| 2.74.2 | Isolator with associated grounding switch | | |  | kg |  |  |
| 2.74.3 | Single phase | | |  | kg |  |  |
| 2.75 | Cubicle Light (Compact LED) | | |  | Yes / No | Yes |  |
| 2.76 | Number of grounding switch | | |  |  | 1/2 |  |
|  | | **Note:** The table should be filled and submitted for each of the following equipment separately:  1. Isolator with 2 Ground Switches  2. Isolator with 1 Ground Switches | | | | | |
|  | **132KV EARTHING SWITCH** | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 3.1 | Manufacturer | | |  |  |  |  |
| 3.2 | Place of manufacturing | | |  |  |  |  |
| 3.3 | Type designation | | |  |  |  |  |
| 3.4 | Type of operating mechanism | | |  |  | DC Motor |  |
| 3.5 | Applicable standard | | |  |  | IEC 62271-102 |  |
| 3.6 | Rated voltage | | |  | kV | 145 |  |
| 3.7 | System Voltage | | |  | kV | 132 |  |
| 3.8 | Rated current | | |  | A |  |  |
| 3.8.1 | At maximum site temperature | | |  |  | Acc. to SLD |  |
| 3.8.2 | At IEC condition | | |  |  | Acc. to SLD |  |
| 3.9 | Rated frequency | | |  | Hz | 50 |  |
| 3.10 | Class (outdoor / indoor) | | |  |  | Outdoor |  |
| 3.11 | Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No) | | |  | Yes / No | Yes |  |
| 3.12 | Hand operating facility is provided? ( Yes / No) | | |  | Yes / No | Yes |  |
| 3.13 | Accessibility to operating mechanism from ground level | | |  | Yes / No | Yes |  |
| 3.14 | Manufacturer quality system in accordance with ISO 9000 | | |  | Yes / No | Yes |  |
| 3.15 | Date of issue | | |  |  | Latest |  |
| 3.16 | Validity | | |  |  |  |  |
| 3.17 | Certificate attached to the offer | | |  | Yes / No | Yes |  |
| 3.18 | Type test certificate to be issued by independent laboratory or independently witnessed type test | | |  | Yes / No | Yes |  |
| 3.18.1 | Certificate to be attached to the offer | | |  |  | Yes |  |
| 3.18.2 | Report to be attached to the offer | | |  |  | Yes |  |
|  | **Insulation Rating** | | |  |  |  |  |
| 3.19 | Basic Insulation level (at site condition) | | |  |  |  |  |
| 3.19.1 | Common value | | |  | kV peak | 650 |  |
| 3.19.2 | Across the isolating distance | | |  | kV peak | 750 |  |
| 3.20 | One minute power frequency withstand voltage (at site condition) | | |  |  |  |  |
| 3.20.1 | Common value | | |  | kV rms | 275 |  |
| 3.20.2 | Across the isolating distance | | |  | kV rms | 325 |  |
| 3.21 | Switching impulse withstand voltage (at site condition) | | |  |  |  |  |
| 3.21.1 | Common value | | |  | kV peak | N.A. |  |
| 3.21.2 | Across the isolating distance | | |  | kV peak | N.A. |  |
| 3.22 | Type of Insulation(porcelain/silicon rubber) | | |  |  | porcelain |  |
|  | **Current Rating** | | |  |  |  |  |
| 3.23 | Rated short time withstand current | | |  |  |  |  |
| 3.23.1 | For grounding switch | | |  | kA rms/sec | 31.5/1 |  |
| 3.23.2 | Rated short circuit making current for grounding switches | | |  | kA rms | 2.5\*31.5 |  |
| 3.24 | Rated peak short circuit withstand current | | |  | kA peak |  |  |
| 3.25 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | | |  | kVA |  |  |
| 3.26 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | | |  | kVA |  |  |
|  | **Other Characteristic** | | |  |  |  |  |
| 3.27 | Rated Supply Voltage | | |  |  |  |  |
| 3.27.1 | For motor, control and interlock | | |  | Vdc | 110 |  |
| 3.27.2 | For AC auxiliaries | | |  | Vac | 240 |  |
| 3.28 | Voltage drop across terminals of one pole at 100 A.dc for ground switches | | |  | mV |  |  |
| 3.29 | Maximum temperature rise at normal current over Maximum ambient temperature | | |  | °C |  |  |
| 3.30 | Maximum and minimum ambient temperature for design | | |  | °C | Acc. to section 1 |  |
|  | Altitude above sea level | | |  | m | Acc. to section 1 |  |
| 3.31 | **Operating Mechanism** | | |  |  |  |  |
| 3.32 | Type of operating mechanism | | |  |  | DC Motor |  |
| 3.32.1 | Motor type | | |  |  |  |  |
| 3.32.2 | Motor | | |  | V |  |  |
| 3.33 | Rated voltage | | |  | W |  |  |
| 3.34 | Power demand | | |  | A |  |  |
| 3.34.1 | Full load current | | |  | rpm |  |  |
| 3.34.2 | Speed | | |  |  |  |  |
| 3.35 | Type of motor protection | | |  |  |  |  |
| 3.36 | Total time from initiation of opening operation in fully open position | | |  | sec | ≤15 |  |
| 3.37 | Breaking and closing of: | | |  |  |  |  |
| 3.37.1 | Magnetizing current of power transformers | | |  | Yes / No | Yes |  |
| 3.37.2 | Mutual inductive/capacitive current of parallel circuit in double circuit line | | |  | Yes / No | Yes |  |
| 3.37.3 | Charging current of unloaded lines and/or cables | | |  | Yes / No | Yes |  |
| 3.38 | Minimum guaranteed no. of operations for grounding switches before maintenance | | |  | N |  |  |
| 3.39 | Maximum required force for hand operation with supplied handle | | |  |  |  |  |
| 3.40 | Thickness of steel control cabinet | | |  | mm | Min (2) |  |
| 3.41 | Degree of protection (IP) of mechanism housing | | |  |  | IP55 |  |
| 3.42 | Cubicle space heaters (thermostat Controlled) | | |  | Yes / No | Yes |  |
| 3.43 | Cabinet heater | | |  |  |  |  |
| 3.43.1 | Power | | |  | W |  |  |
| 3.43.2 | Nominal Voltage | | |  | V | 240 AC |  |
| 3.44 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | | |  | Yes / No |  |  |
| 3.45 | Whether open/neutral /close control switch is provided? ( Yes / No) | | |  | Yes / No |  |  |
| 3.46 | Whether under voltage relay is provided for motor supply? | | |  | Yes / No | Yes |  |
| 3.47 | Whether all of the heaters are equipped with a M.C.B ? | | |  | Yes / No | Yes |  |
| 3.48 | Rated power of operation coil | | |  | W |  |  |
| 3.49 | Total load of heaters | | |  | W |  |  |
|  | **Insulators** | | |  |  |  |  |
| 3.50 | Manufacturer | | |  |  |  |  |
| 3.51 | Place of manufacturing | | |  |  |  |  |
| 3.52 | Type (porcelain /composite) | | |  |  | porcelain |  |
| 3.53 | Color | | |  |  |  |  |
| 3.54 | Creepage distance | | |  | mm | 4495 |  |
| 3.55 | Protected creepage distance | | |  | mm |  |  |
| 3.56 | Permissible cantilever working load | | |  | N | C8 |  |
| 3.57 | Operating handle or lever mounting height above ground | | |  | m | 1.2 |  |
| 3.58 | Permissible tensional strength | | |  | N.m |  |  |
| 3.59 | Minimum clearance | | |  | mm |  |  |
| 3.59.1 | Between poles when earth switch is closed | | |  |  |  |  |
| 3.59.2 | Between poles when earth switch is open | | |  |  |  |  |
| 3.59.3 | Between phase and ground | | |  |  |  |  |
| 3.59.4 | Between one pole terminals at open condition | | |  |  |  |  |
|  | **Interlocks** | | |  |  |  |  |
| 3.60 | Type of interlocking | | |  |  | Electrical and Mechanical |  |
| 3.61 | Locking arrangement in on/off position | | |  | Yes / No | Yes |  |
| 3.62 | Automatic isolation of control supplies when lock off | | |  | Yes / No | Yes |  |
|  | **Miscellaneous** | | |  |  |  |  |
| 3.63 | Type of main contacts | | |  |  |  |  |
| 3.64 | For grounding switch | | |  |  |  |  |
| 6.65 | Material of main contacts | | |  |  |  |  |
| 3.65.1 | For grounding switch | | |  |  |  |  |
| 3.66 | Material of blades | | |  |  |  |  |
| 3.66.1 | For grounding switch | | |  |  | Copper |  |
| 3.67 | Whether main contacts are silver plated | | |  |  |  |  |
| 3.67.1 | For grounding switches | | |  |  | Yes |  |
| 3.68 | Quantity and type of free auxiliary contacts | | |  |  |  |  |
| 3.67.1 | For grounding switches | | |  |  | >10NO+ >10NC |  |
| 3.69 | Permissible force on HV terminals | | |  |  |  |  |
| 3.69.1 | Static in any direction | | |  | N |  |  |
| 3.69.2 | Dynamic in any direction | | |  | N |  |  |
| 3.70 | Weight of maximum package ready for shipment | | |  | kg |  |  |
| 3.71 | Weight of complete earth switch | | |  | kg |  |  |
| 3.72 | Cubicle Light (Compact LED) | | |  | Yes / No | Yes |  |
|  | 132kV CURRENT TRANSFOMERS | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 4.1 | Manufacturer | | |  |  |  |  |
| 4.2 | Place of manufacturing | | |  |  |  |  |
| 4.3 | Type designation | | |  |  | Post |  |
| 4.4 | Number of phases | | |  |  | 3 phase |  |
| 4.5 | Type of neutral grounding | | |  |  | Non-Effective |  |
| 4.6 | Applicable standard | | |  |  | IEC 61869-1/-2 |  |
| 4.7 | Class (indoor / outdoor) | | |  |  | Outdoor |  |
| 4.8 | Type (Oil-immersed / dry) | | |  |  | Oil-immersed Oil impregnated paper |  |
| 4.9 | Construction (tank / inverted) | | |  |  | Tank |  |
| 4.10 | Rated voltage | | |  | kV rms | 145 |  |
| 4.11 | System Voltage | | |  | kV | 132 |  |
| 4.12 | Rated current at max. site temperature : | | |  | A |  |  |
| 4.12.1 | For line feeders | | |  |  | Acc. to PSLD |  |
| 4.12.2 | For transformer feeders | | |  |  | Acc. to PSLD |  |
| 4.12.3 | For bus coupler feeders | | |  |  | Acc. to PSLD |  |
| 4.12.4 | For bus coupler feeders | | |  |  | Acc. to PSLD |  |
| 4.12.5 | Power transformer neutral | | |  |  | N.A |  |
| 4.12.6 | For Reactor feeder | | |  |  | N.A |  |
| 4.13 | Rated frequency | | |  | Hz | 50 |  |
| 4.14 | Max. and min. ambient temperatures used for design | | |  | °C | Acc. to section 1 |  |
| 4.15 | Rated short time withstand current | | |  | kA rms | 31.5/1sec |  |
| 4.16 | Rated short time dynamic current | | |  | kA peak | 2.5\*31.5 |  |
| 4.17 | Whether withstanding in load combinations of earthquake, wind, short circuit? (Yes / No) | | |  | (Yes / No) | Yes |  |
| 4.18 | Altitude above sea level | | |  | m | Acc. to section 1 |  |
| 4.19 | Manufacturer quality system in accordance with ISO 9000 | | |  | Yes/No | Yes |  |
| 4.19.1 | Date of issue | | |  |  | Latest |  |
| 4.19.2 | Validity | | |  |  |  |  |
| 4.19.3 | Certificate attached to the offer | | |  | Yes/No | Yes |  |
| 4.20 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | | |  | Yes/No | Yes |  |
| 4.20.1 | Certificate to be attached to the offer | | |  | Yes/No | Yes |  |
| 4.20.2 | Report to be attached to the offer | | |  | Yes/No | Yes |  |
|  | **Insulation** | | |  |  |  |  |
| 4.21 | Maximum continuous line to line operating voltage | | |  | kV rms | 145 |  |
| 4.22 | Basic Insulation level (at site condition) | | |  | kV peak | 650 |  |
| 4.23 | Switching impulse withstand level (at site condition ) | | |  | kV peak | - |  |
| 4.24 | One minute power frequency withstand voltage (at site condition) | | |  | kV rms |  |  |
| 4.24.1 | Dry | | |  |  | 275 |  |
| 4.24.2 | Wet | | |  |  |  |  |
| 4.25 | One minute power frequency withstand voltage for secondary winding | | |  | kV rms |  |  |
| 4.26 | Highest value of partial discharge when tested acc. to IEC | | |  | pc | 5 |  |
| 4.27 | Voltage at secondary winding terminals with normal primary load current , and secondary open circuit | | |  | kV |  |  |
| 4.28 | Time permitted with open circuit secondary | | |  | sec |  |  |
| 4.29 | Dielectric dissipation factor | | |  |  |  |  |
|  | **Ratings and Accuracies** | | |  |  |  |  |
| 4.30 | Rated primary current | | |  | A | Acc. to SLD |  |
| 4.31 | Rated extended primary current | | |  |  | 120% |  |
| 4.32 | Rated secondary current | | |  | A | 1 |  |
| 4.33 | Change of CT ratio shall be possible at the secondary circuit only | | |  | Yes/No | Yes |  |
| 4.34 | specification of CTs on: Line feeders, Transformer feeders,Bus couple, Tie coupler, Auxiliary transformer, Power transformer neutral, Core balance | | |  |  |  |  |
| 4.34.1 | Number of cores | | |  |  | Acc. to PSLD |  |
| 4.34.2 | Ratio (TR – turns ratio) | | |  | A | Acc. to PSLD |  |
| 4.34.3 | Class | | |  |  | Acc. to PSLD |  |
| 4.34.4 | Knee point voltage (Ek) | | |  | V | Acc. to PSLD |  |
| 4.34.5 | Exciting current (IE) at Ek | | |  | mA | Acc. to PSLD |  |
| 4.34.6 | Rated output (burden to be 25-100% rated burden) | | |  | VA | Acc. to PSLD |  |
|  | **External Insulation** | | |  |  |  |  |
| 4.35 | Material | | |  |  |  |  |
| 4.36 | Manufacturer | | |  |  |  |  |
| 4.37 | Place of manufacturing | | |  |  |  |  |
| 4.38 | Type designation | | |  |  |  |  |
| 4.39 | Minimum creepage distance | | |  | mm | 4495 |  |
| 4.40 | Color | | |  |  | Brown |  |
| 4.41 | Protected creepage distance (90 shadow) | | |  | mm |  |  |
| 4.42 | Shortest flash-over distance | | |  | mm |  |  |
| 4.43 | Whether washable in service ? (Yes / No) | | |  | (Yes / No) | Yes |  |
|  | **Miscellaneous** | | |  |  |  |  |
| 4.44 | Maximum R.I.V. level at 1.2 max. rated voltage at 1 MHz according to NEMA 107 | | |  | μv | 2500 |  |
| 4.45 | Whether oil level indicator/oil sampling valve/oil filling valve are provided ? (Yes / No) | | |  |  | Yes |  |
| 4.46 | Means for compensation of oil expansion | | |  |  |  |  |
| 4.47 | Temperature rise at rated continuous thermal current | | |  | °C |  |  |
| 4.48 | Rated continuous thermal current (% of rated primary current ) | | |  |  | Rated extended primary current |  |
| 4.49 | Electrostatic capacity of complete current transformer. PF | | |  |  |  |  |
| 4.50 | Loss angle at rated voltage | | |  |  |  |  |
| 4.51 | Permissible force at HV terminals | | |  |  |  |  |
| 4.51.1 | Static at any direction | | |  | N |  |  |
| 4.51.2 | Dynamic at any direction | | |  | N |  |  |
| 4.52 | Type , grade and manufacturer of oil | | |  |  |  |  |
| 4.53 | Weight of oil | | |  | kg |  |  |
| 4.54 | Primary conductor material | | |  |  |  |  |
| 4.55 | Secondary conductor material | | |  |  |  |  |
| 4.56 | Overall height | | |  | mm |  |  |
| 4.57 | Overall width | | |  | mm |  |  |
| 4.58 | Overall length | | |  | mm |  |  |
| 4.59 | Total weight of complete current transformer | | |  | Kg |  |  |
| 4.60 | Max. package weight ready for shipment | | |  | Kg |  |  |
| 4.61 | ting up of CT are provided? (Yes / No) | | |  |  | Yes |  |
| 4.62 | Permitted inclination refer to vertical axis during transport or storage | | |  | Degree |  |  |
| 4.63 | Degree protection of Terminal box | | |  |  | IP55 |  |
|  | 132kV CAPACITIVE VOLTAGE TRANSFORMERS | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 5.1 | Manufacturer | | |  |  |  |  |
| 5.2 | Place of manufacturing | | |  |  |  |  |
| 5.3 | Type of CVT | | |  |  | Single-phase/self-Cooled |  |
| 5.4 | Applicable standard | | |  |  | IEC 61869-1/-5 |  |
| 5.5 | Rated voltage | | |  | kV rms | 145 |  |
| 5.6 | System Voltage | | |  | kV | 132 |  |
| 5.7 | Rated frequency | | |  | Hz | 50 |  |
| 5.8 | Max. and min. ambient temperatures used for design | | |  | °C | Acc. to Section1 |  |
| 5.9 | Class (indoor/ outdoor ) | | |  |  | Outdoor |  |
| 5.8 | Type (Oil-immersed / dry) | | |  |  | Oil-immensed/ Oil-impregnated paper |  |
| 5.9 | Maximum permissible partial discharge level at Um | | |  | pC | 10 |  |
| 5.10 | Maximum permissible partial discharge level at 1.2Um /Ö3 | | |  | pC | 5 |  |
| 5.11 | Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No) | | |  | (Yes / No) | Yes |  |
| 5.12 | Altitude above sea level | | |  | m | Acc. to Section1 |  |
| 5.13 | Manufacturer quality system in accordance with ISO 9000 | | |  | Yes/No | Yes |  |
| 5.13.1 | Date of issue | | |  |  | Latest |  |
| 5.13.2 | Validity | | |  |  |  |  |
| 5.13.3 | Certificate attached to the offer | | |  | Yes/No | Yes |  |
|  | **Insulation ratings** | | |  |  |  |  |
| 5.14 | Basic insulation level (at site condition) | | |  | kV peak | 650 |  |
| 5.15 | Switching impulse withstand voltage (at site condition ) | | |  | kV peak | - |  |
| 5.16 | One minute power frequency withstand voltage (at site condition ) | | |  | kV rms | 275 |  |
| 5.17 | Power frequency withstand voltage between secondaries and secondary to earth | | |  | kV rms |  |  |
| 5.18 | Rated voltage factor | | |  |  |  |  |
| 5.18.1 | Continuous | | |  |  | 1.2 |  |
| 5.18.2 | 30 seconds | | |  |  | 1.5 |  |
| 5.19 | Minimum HV terminal withstand | | |  |  |  |  |
| 5.19.1 | Static terminal load | | |  |  | 1000 |  |
| 5.19.2 | Dynamic terminal load | | |  |  | 2000 |  |
| 5.20 | Max. RIV measured at 1.2 highest system voltage , 1 Mega-Hz acc. to CISPR | | |  | μV |  |  |
|  | **Burdens and accuracies** | | |  |  |  |  |
|  | * **3-Winding CVT** | | |  |  | 3 |  |
| 5.21 | Number of secondary windings | | |  |  |  |  |
| 5.22 | Accuracy class for | | |  |  | Acc. to PSLD |  |
| 5.22.1 | Winding 1 | | |  |  | Acc. to PSLD |  |
| 5.22.2 | Winding 2 | | |  |  | Acc. to PSLD |  |
| 5.22.3 | Winding 3 | | |  |  | Acc. to PSLD |  |
| 5.23 | Rated primary voltage | | |  | KVrms | 132/√3 |  |
| 5.24 | Rated secondary voltage | | |  | KVrms | 0.11/√3 |  |
| 5.25 | Rated burden for | | |  |  |  |  |
| 5.25.1 | Winding 1 | | |  | VA | Acc. to PSLD |  |
| 5.25.2 | Winding 2 | | |  | VA | Acc. to PSLD |  |
| 5.25.3 | Winding 3 | | |  | VA | Acc. to PSLD |  |
| 5.26 | Continuous thermal burden of | | |  |  |  |  |
| 5.26.1 | Winding 1 alone | | |  | VA |  |  |
| 5.26.2 | Winding 2 alone | | |  | VA | 2 |  |
|  | * **2-Winding CVT** | | |  |  |  |  |
| 5.27 | Number of secondary windings | | |  |  | Acc. to PSLD |  |
| 5.28 | Accuracy class for | | |  |  |  |  |
| 5.28.1 | Winding 1 | | |  |  | Acc. to PSLD |  |
| 5.28.2 | Winding 2 | | |  |  | Acc. to PSLD |  |
| 5.29 | Rated primary voltage | | |  | KVrms | 132/√3 |  |
| 5.2.30 | Rated secondary voltage | | |  | KVrms | 0.11/√3 |  |
| 5.31 | Rated burden for | | |  |  |  |  |
| 5.31.1 | Winding 1 | | |  | VA | Acc. to PSLD |  |
| 5.31.2 | Winding 2 | | |  | VA | Acc. to PSLD |  |
| 5.32 | Continuous thermal burden of | | |  |  |  |  |
| 5.32.1 | Winding 1 alone | | |  | VA | Effective |  |
| 5.32.2 | Winding 2 alone | | |  | VA | phase to ground |  |
| 5.33 | Type of system grounding | | |  |  |  |  |
| 5.34 | Type of connection | | |  |  | Terminal |  |
| 5.35 | Connections | | |  |  | Standard terminal block (screw and bolt) |  |
| 5.35.1 | Primary | | |  |  | MCB with auxiliary contact |  |
| 5.35.2 | Secondary | | |  |  | MCB with auxiliary contact |  |
| 5.36 | Type of protection device in secondary side | | |  |  | Stud type |  |
| 5.37 | Total continuous thermal burden of secondary windings | | |  | VA | Standard terminal block (screw and bolt) |  |
| 5.37.1 | Primary | | |  |  |  |  |
| 5.37.2 | Secondary | | |  |  | 60K Wind. 50K Oil |  |
|  | **Other Characteristics** | | |  |  | 1 |  |
| 5.38 | Temperature rise at rated burden and at 1.2 times rated primary voltage and ambient temperature | | |  | K | Max(0.25) |  |
| 5.39 | Permissible secondary short circuit time with rated primary voltage | | |  | sec | RLC Dumping |  |
| 5.40 | Short circuit impedance | | |  | Ohm |  |  |
| 5.41 | Method of suppressing for ferro-resonance | | |  |  | Max (10000) |  |
| 5.42 | Available ranges of high voltage capacitor | | |  | pF | 35\*10-4 |  |
| 5.43 | Coupling capacitor \* | | |  | pF |  |  |
| 5.44 | Loss angle at rated voltage | | |  |  | Max(40) |  |
| 5.45 | Frequency range for PLC use | | |  | KHz |  |  |
| 5.46 | Equipment series resistance for 35-450 KHz | | |  | Ohm |  |  |
| 5.47 | Natural frequency | | |  | MHz |  |  |
| 5.48 | Intermediate stage voltage | | |  | kV |  |  |
| 5.49 | Attenuation of intermediate voltage transformer within 35-450 KHz | | |  | dB |  |  |
| 5.50 | Max. insertion loss when used for PLC | | |  | dB |  |  |
| 5.51 | Whether intermediate tap is brought out? (Yes / No) | | |  |  |  |  |
|  | | \* Min. coupling capacitance of CVT could be changed by manufacture | | | | | |
|  | **Insulator columns** | | |  |  |  |  |
| 5.52 | Manufacturer | | |  |  |  |  |
| 5.53 | Place of manufacturing | | |  |  |  |  |
| 5.54 | Type designation | | |  |  |  |  |
| 5.55 | Material | | |  |  |  |  |
| 5.56 | Min. creepage distance | | |  | mm | 4495 |  |
| 5.57 | Protected creepage distance | | |  | mm |  |  |
| 5.58 | Color | | |  |  | Brown |  |
|  | **Miscellaneous** | | |  |  |  |  |
| 5.59 | Type and manufacturer of oil for capacitor section | | |  |  |  |  |
| 5.60 | Type and manufacturer of oil for intermediate section | | |  |  |  |  |
| 5.61 | Whether oil level indicator is provided? (Yes / No) | | |  | (Yes / No) | Yes |  |
| 5.62 | Class and grade of insulation material used in capacitors | | |  |  |  |  |
| 5.63 | Permitted inclination during transport/ storage | | |  | Degree |  |  |
| 5.64 | Material of windings | | |  |  |  |  |
| 5.65 | Whether CVT is designed to mount line trap on top? (Yes / No) | | |  |  |  |  |
| 5.66 | Permissible force at HV terminals | | |  |  |  |  |
| 5.66.1 | Static at any direction | | |  | N |  |  |
| 5.66.2 | Dynamic at any direction | | |  | N |  |  |
| 5.67 | Total weight | | |  | kg |  |  |
| 5.68 | Total oil weight | | |  | kg |  |  |
| 5.69 | Overall height | | |  | mm |  |  |
| 5.70 | Overall width | | |  | mm |  |  |
| 5.71 | Max. package dimensions ready for shipment | | |  | m3 |  |  |
| 5.72 | Washable in service? (Yes / No) | | |  |  |  |  |
|  | **132KV Conductors** | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 6.1 | Rated current | | |  | A |  |  |
| 6.1.1 | Line feeders | | |  |  | Acc. to SLD |  |
| 6.1.2 | Trans feeders | | |  |  | Acc. to SLD |  |
| 6.1.3 | Busbars | | |  |  | Acc. to SLD |  |
| 6.1.4 | Busbar coupler | | |  |  | Acc. to SLD |  |
| 6.2 | Rated frequency | | |  | Hz | 50 |  |
| 6.3 | Rated voltage | | |  | kV | 145 |  |
| 6.3.1 | Basic insulation level of equipment at site condition | | |  | kV peak | 650 |  |
| 6.3.2 | Rated one minute power frequency withstand voltage at site condition | | |  | kV rms | 275 |  |
| 6.3.3 | Rated short circuit withstand current and its duration | | |  | kA/sec | 31.5/3 |  |
| 6.4 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No) | | |  | (Yes / No) | Yes |  |
| 6.5 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | | |  | °C | 80 Max |  |
| 6.6 | Minimum assumed tension for each stranded conductor at E.D.S condition | | |  | % of UTS | 3 |  |
| 6.7 | Minimum assumed tension for each stranded conductor of incoming and outgoing overhead lines (per phase ) | | |  | % of UTS | 20 |  |
| 6.8 | Minimum tension of incoming and outgoing shield wires | | |  | % of UTS | 10 |  |
| 6.9 | Maximum permissible surface gradient | | |  | kV/cm | 16 |  |
| 6.10 | Maximum permissible angle for incoming and outgoing overhead lines | | |  |  | ±30 |  |
| 6.11 | Ambient condition | | |  |  |  |  |
| 6.11.1 | Minimum ambient temperature | | |  |  | Acc. to section 1 |  |
| 6.11.2 | Maximum ambient temperature | | |  |  | Acc. to section 1 |  |
| 6.11.3 | Solar radiation | | |  |  | Acc. to section 1 |  |
| 6.11.4 | Seismic acceleration | | |  |  | Acc. to section 1 |  |
| 6.11.5 | Wind speed | | |  |  | Acc. to section 1 |  |
| 6.10.6 | Ice thickness | | |  |  | Acc. to section 1 |  |
| 6.12 | Solar radiation absorption coefficient (ϒ) | | |  |  | Acc. to section 1 |  |
| 6.13 | Emissivity coefficient in respect to black body (Ke) | | |  |  | 0.5 |  |
| 6.14 | Altitude above sea level | | |  | m | Acc. to section 1 |  |
|  | **Stranded Conductors** | | |  |  |  |  |
| 6.15 | Manufacturer | | |  |  |  |  |
| 6.16 | Place of manufacturing | | |  |  |  |  |
| 6.17 | Material and alloy type | | |  |  | AAAC/AAC |  |
| 6.18 | Nominal cross section | | |  | mm² |  |  |
| 6.19 | Number of strands | | |  |  |  |  |
| 6.20 | Overall diameter of conductor | | |  | mm |  |  |
| 6.21 | Ultimate strength of conductor | | |  | kN |  |  |
| 6.22 | Continuous current rating of conductor at max. ambient temperature and 80° conductor Temperature | | |  | A |  |  |
|  | **Note:** The stranded conductor size adequacy shall be determined by calculation. | | |  |  |  |  |
|  | **Tubular Conductors** | | |  |  |  |  |
| 6.23 | Manufacturer | | |  |  |  |  |
| 6.24 | Place of manufacturing | | |  |  |  |  |
| 6.25 | Material and alloy type | | |  |  | Aluminum alloy |  |
| 6.26 | Outside diameter | | |  | mm |  |  |
| 6.27 | Thickness | | |  | mm |  |  |
| 6.28 | Weight | | |  | kg/m |  |  |
| 6.29 | Max. deflection after installation | | |  | mm |  |  |
| 6.30 | Continuous current rating of conductor at max. ambient temperature at and tube Temperature 80 °C | | |  | A |  |  |
| 6.31 | Moment of inertia | | |  | cm |  |  |
| 6.32 | Minimum yield strength | | |  | kg/cm² |  |  |
|  | **Note:** The tubular conductor size adequacy shall be determined by calculation. | | |  |  |  |  |
|  | **Shield wires** | | |  |  |  |  |
| 6.33 | Manufacturer | | |  |  |  |  |
| 6.34 | Place of manufacturing | | |  |  |  |  |
| 6.35 | Material | | |  |  | Al clad steel |  |
| 6.36 | Cross section | | |  | mm² | 58.56 |  |
| 6.37 | Diameter | | |  | mm | 9.78 |  |
| 6.38 | Number of strands | | |  |  | 7 no.8 |  |
| 6.39 | Resistance (at 20 °C) | | |  | ohm/km | 1.463 |  |
| 6.40 | Ultimate strength | | |  | kN | 70.76 |  |
| 6.41 | Modulus of elasticity | | |  | kg/mm2 | 16000 |  |
| 6.42 | Coefficient of linier expansion | | |  | 1/°C | 13\* 10^(−6) |  |
| 6.43 | Aluminium coating thickness | | |  | μm |  |  |
|  | **Connectors and Hardware** | | |  |  |  |  |
| 6.44 | Manufacturer | | |  |  |  |  |
| 6.45 | Place of manufacturing | | |  |  |  |  |
| 6.46 | Material of connectors | | |  |  |  |  |
| 6.47 | Material of bolts and nuts | | |  |  |  |  |
| 6.48 | Material of washers | | |  |  |  |  |
| 6.49 | Applicable standard for connectors | | |  |  |  |  |
| 6.50 | Type of contact paste | | |  |  |  |  |
|  | **Minimum Clearances** (Not applicable for equipment subject to impulse voltage tests ) | | |  |  |  |  |
| 6.51 | Clearance between live parts and ground (Basic value ) | | |  | mm | 1500 |  |
| 6.52 | Clearance between different phases in bays | | |  | mm | 2500 |  |
| 6.53 | Minimum Spacing between phases of rigid buses | | |  | mm | 2500 |  |
| 6.54 | Minimum height of energized parts above ground | | |  | mm | 4000 |  |
| 6.55 | Height of energized parts above access roads | | |  | mm | 9000 |  |
| 6.56 | Minimum Distance between over-span phases | | |  | mm | 3500 |  |
| 6.57 | Shield wire clearance over bus conductors | | |  | mm | 3000 |  |
|  | **132KV Insulators** | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 7.1 | Rated current | | |  | A |  |  |
| 7.1.1 | Line feeders | | |  |  | Acc. to SLD |  |
| 7.1.2 | Trans feeders | | |  |  | Acc. to SLD |  |
| 7.1.3 | Busbars | | |  |  | Acc. to SLD |  |
| 7.1.4 | Coupler | | |  |  | Acc. to SLD |  |
| 7.1.5 | Reactor feeders | | |  |  | N.A |  |
| 7.2 | Rated frequency | | |  | Hz | 50 |  |
| 7.3 | Rated voltage | | |  | kV | 145 |  |
| 7.2.1 | Basic insulation level of equipment at site condition | | |  | kV peak | 650 |  |
| 7.2.2 | Rated one minute power frequency withstand voltage at site condition | | |  | kV rms | 275 |  |
| 7.2.3 | Rated short circuit withstand current and its duration | | |  | kA/sec | 31.5/3 |  |
| 7.4 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? ( Yes / No) | | |  | ( Yes / No) | Yes |  |
| 7.5 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | | |  | °C | 80 |  |
| 7.6 | Maximum permissible surface gradient | | |  | kV/cm | 16 |  |
| 7.7 | Maximum permissible angle for incoming and outgoing overhead lines | | |  |  | ±30 |  |
| 7.8 | Ambient condition | | |  |  |  |  |
| 7.8.1 | Minimum ambient temperature | | |  |  | Acc. to section 1 |  |
| 7.8.2 | Maximum ambient temperature | | |  |  | Acc. to section 1 |  |
| 7.8.3 | Solar radiation | | |  |  | Acc. to section 1 |  |
| 7.8.4 | Seismic acceleration | | |  |  | Acc. to section 1 |  |
| 7.8.5 | Wind speed | | |  |  | Acc. to section 1 |  |
| 7.8.6 | Ice thickness | | |  |  | Acc. to section 1 |  |
| 7.8.7 | Solar radiation absorption coefficient (ϒ) | | |  |  | Acc. to section 1 |  |
| 7.8.8 | Emissivity coefficient in respect to black body (Ke) | | |  |  | 0.5 |  |
| 7.9 | Altitude above sea level | | |  | m | Acc. to section 1 |  |
| 7.10 | Manufacturer quality system in accordance with ISO 9000 | | |  | Yes / No | Yes |  |
| 7.10.1 | Date of issue | | |  |  | Latest |  |
| 7.10.2 | Validity | | |  |  |  |  |
| 7.10.3 | Certificate attached to the offer | | |  | Yes / No | Yes |  |
| 7.11 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | | |  | Yes / No | Yes |  |
| 7.11.1 | Certificate to be attached to the offer | | |  |  | Yes |  |
|  | **String Insulators** | | |  |  |  |  |
| 7.12 | Manufacturer | | |  |  |  |  |
| 7.13 | Place of manufacturing | | |  |  |  |  |
| 7.14 | Type designation | | |  |  | ball & socket |  |
| 7.15 | Applicable standard | | |  |  |  |  |
| 7.16 | Insulator material | | |  |  | Glazed porcelain |  |
| 7.17 | Color | | |  |  |  |  |
| 7.18 | Wet power frequency withstand voltage of each unit | | |  | kV | 47 |  |
| 7.19 | Lightning impulse withstand voltage of each unit | | |  | kV | 110 |  |
| 7.20 | Electromechanical failing load of each unit | | |  | kN | 120 |  |
| 7.21 | Puncture voltage of each unit | | |  | kV | 130 |  |
| 7.22 | Minimum creepage distance of each unit | | |  | mm | 295 |  |
| 7.23 | Total creepage distance of string | | |  | mm | 4459 |  |
| 7.24 | Nominal spacing | | |  | mm | 146 |  |
| 7.25 | Protected ( 90 ) creepage distance | | |  | mm |  |  |
| 7.26 | Size of ball and socket | | |  | mm |  |  |
| 7.27 | IEC coupling ball | | |  |  |  |  |
| 7.28 | Material of fittings | | |  |  |  |  |
| 7.29 | Minimum quantity of disks per string | | |  |  | 16 |  |
| 7.30 | Power frequency withstand voltage of complete String | | |  | kV rms |  |  |
| 7.30.1 | Dry | | |  |  | 275 |  |
| 7.30.2 | Wet | | |  |  |  |  |
| 7.31 | Basic Insulation level of complete string | | |  | KV peak |  |  |
| 7.31.1 | Positive | | |  |  | 650 |  |
| 7.31.2 | Negative | | |  |  |  |  |
| 7.32 | Max. R.I.V. at 1MHz as per CISPR no.1 | | |  | μ V |  |  |
| 7.33 | Overall length of string with accessories | | |  | mm |  |  |
| 7.34 | Ultimate tensile strength of string | | |  | kN |  |  |
| 7.35 | Total weight of string | | |  | kg |  |  |
| 7.36 | Whether arcing ring at ground side Provided? (Yes / No) | | |  | (Yes / No) | Yes |  |
| 7.37 | Whether corona ring at live side Provided? (Yes / No) | | |  | (Yes / No) | Yes |  |
| 7.38 | Arcing distance | | |  | mm |  |  |
| 7.39 | Whether washable in service? (Yes / No) | | |  | (Yes / No) | Yes |  |
|  | **Note:** The string insulator and each insulator size adequacy shall be determined by calculation. | | |  |  |  |  |
|  | **String Insulator Accessories** | | |  |  |  |  |
| 7.40 | Manufacturer | | |  |  |  |  |
| 7.41 | Place of manufacturing | | |  |  |  |  |
| 7.42 | Material | | |  |  |  |  |
| 7.43 | Applicable standard | | |  |  |  |  |
| 7.44 | Rated ultimate tensile strength | | |  | kN |  |  |
|  | **Post Insulators** | | |  |  |  |  |
| 7.45 | Manufacturer | | |  |  |  |  |
| 7.46 | Place of manufacturing | | |  |  |  |  |
| 7.47 | Type designation | | |  |  | Post type |  |
| 7.48 | Applicable standard | | |  |  |  |  |
| 7.49 | One minute power frequency withstand Voltage (at IEC condition ) | | |  | kV rms |  |  |
| 7.49.1 | Dry | | |  |  | 275 |  |
| 7.49.2 | Wet | | |  |  |  |  |
| 7.48 | Basic Insulation level (at IEC condition) | | |  | kV peak | 650 |  |
| 7.49 | Basic Insulation level (at site condition) | | |  | kV peak |  |  |
| 7.50 | Switching impulse withstand voltage | | |  | kV peak | - |  |
| 7.51 | Color | | |  |  |  |  |
| 7.52 | Insulator material | | |  |  | Ceramic |  |
| 7.53 | Top metal fitting material | | |  |  |  |  |
| 7.54 | Bottom metal fitting material | | |  |  |  |  |
| 7.55 | Bonding material | | |  |  |  |  |
| 7.56 | Minimum creepage distance | | |  | mm | 4495 |  |
| 7.57 | Protected (90) creepage distance | | |  | mm |  |  |
| 7.58 | Maximum cantilever working load (complete post insulator) | | |  | kN |  |  |
| 7.59 | Minimum cantilever breaking load, upright (complete post insulator) | | |  | kN |  |  |
| 7.60 | Minimum torsion strength | | |  | kNm |  |  |
| 7.61 | Minimum compression strength | | |  | kN |  |  |
| 7.62 | Total height | | |  | mm |  |  |
| 7.63 | Arcing distance | | |  | mm |  |  |
| 7.64 | Fixing bolts | | |  |  |  |  |
| 7.64.1 | Quantity per post insulator | | |  |  |  |  |
| 7.64.2 | Diameter | | |  |  |  |  |
| 7.65 | Bolt circle diameter (Top / Bottom ) | | |  | mm |  |  |
| 7.66 | Total weight | | |  | kg |  |  |
| 7.67 | Maximum R.I.V. at 100 KHz | | |  | µv | 500 |  |
| 7.68 | Whether washable in service? ( Yes / No) | | |  |  |  |  |
| 7.69 | Maximum weight of one package ready for Shipment | | |  | kg |  |  |
| 7.70 | Whether corona ring at live side Provided? (Yes / No) | | |  |  | Yes |  |
| 7.71 | Number of units in complete post insulator | | |  |  |  |  |
| 7.72 | Length of each unit | | |  | mm |  |  |
|  | **Note:** The post insulator size adequacy shall be determined by calculation. | | |  |  |  |  |
|  | **Connectors and Hardware** | | |  |  |  |  |
| 7.73 | Manufacturer | | |  |  |  |  |
| 7.74 | Place of manufacturing | | |  |  |  |  |
| 7.75 | Material of connectors | | |  |  |  |  |
| 7.76 | Material of bolts and nuts | | |  |  |  |  |
| 7.77 | Material of washers | | |  |  |  |  |
| 7.78 | Applicable standard for connectors | | |  |  |  |  |
| 7.79 | Type of contact paste | | |  |  |  |  |
|  | **Minimum Clearances** (Not applicable for equipment subject to impulse voltage tests ) | | |  |  |  |  |
| 7.80 | Height of base of post insulator from ground | | |  | mm | 2500 |  |
| 7.81 | Clearance between live parts and ground (Basic value ) | | |  | mm | 1500 |  |
| 7.82 | Minimum height of energized parts above ground | | |  | mm | 4000 |  |
| 7.83 | Height of energized parts above access roads | | |  | mm | 9000 |  |
|  | 132kV SURGE ARRESTERS | | |  |  |  |  |
|  | **General** | | |  |  |  |  |
| 8.1 | Manufacturer of surge arrester: | | |  |  |  |  |
| 8.1.1 | Name | | |  |  |  |  |
| 8.1.2 | Country | | |  |  |  |  |
| 8.2 | Manufacturer of surge counter: | | |  |  |  |  |
| 8.2.1 | Name | | |  |  |  |  |
| 8.2.2 | Country | | |  |  |  |  |
| 8.3 | Type designation for surge arresters | | |  |  |  |  |
| 8.4 | Type designation for surge counter (equipped with leakage current measuring device ) | | |  |  |  |  |
| 8.5 | Applicable standard | | |  |  | IEC 60099-4 |  |
| 8.6 | Rated frequency | | |  | Hz | 50 |  |
| 8.7 | Nominal line to line voltage rating | | |  | kV | 145 |  |
| 8.8 | Type | | |  |  | MOA |  |
| 8.9 | Class of surge arrester | | |  |  | Very Heavy |  |
| 8.10 | Maximum and Minimum ambient temperature for design | | |  | °C | Acc. to section 1 |  |
| 8.11 | Altitude above sea level | | |  | m | Acc. to section 1 |  |
| 8.12 | Design seismic acceleration | | |  | g | Acc. to section 1 |  |
| 8.13 | Ice thickness | | |  | mm | Acc. to section 1 |  |
| 8.14 | Wind velocity | | |  | m/s | Acc. to section 1 |  |
| 8.15 | Maximum overvoltage factor on the system due to any switching duty | | |  | pu | 2.3 |  |
| 8.16 | Whether withstanding in load combinations of earthquake , wind , short circuit, as mentioned In Technical Specification? | | |  | (Yes / No ) | Yes |  |
|  | **Surge Arresters** | | |  |  |  |  |
| 8.17 | Rated voltage | | |  | kV rms | 120 |  |
| 8.18 | Continuous operating voltage | | |  | kV rms | 96 |  |
| 8.19 | Long duration discharge class as per IEC 99-1 | | |  | Class | 3 |  |
| 8.20 | Number of phases | | |  |  | 3 |  |
| 8.21 | Type of system earthing | | |  |  | Solid |  |
| 8.22 | Nominal discharge current with 8/20 us wave | | |  | kA peak | 10 |  |
| 823 | Arrester designation | | |  |  | SM |  |
| 8.24 | Type of housing in the case of utilizing porcelain and its classification acc to Std. 60672 | | |  |  | Brown glazed Aluminum porcelain class C130 |  |
| 8.25 | Type of housing in the case of utilizing composite polymer and its resistance classification acc to IEC 60587 | | |  |  | Silicon rubber (LSR,HCR or RTV type) class 3.4 |  |
| 8.26 | Earth fault factor | | |  |  | 1.4 |  |
| 8.27 | Place of installation | | |  |  | Line/Transformer/GIS Feeders |  |
| 8.28 | Pressure relief class | | |  |  |  |  |
| 8.28.1 | High current 0.2 sec | | |  | kA | 50 |  |
| 8.28.2 | Low current 1 sec | | |  |  | 600±200 |  |
| 8.29 | Thermal energy rating (Wth) | | |  | (kJ / kV) of  U rated | > 10 |  |
| 8.30 | Repetitive charge transfer rating (Qrs) | | |  | C | > 2.4 |  |
| 8.31 | Reference voltage | | |  | kV rms |  |  |
| 8.32 | Reference current | | |  | mA |  |  |
| 8.33 | TOV capability for | | |  |  |  |  |
| 8.33.1 | 1 sec | | |  | kV | Acc. to IEC 60099-4 |  |
| 8.33.2 | 10 sec | | |  | kV | Acc. to IEC 60099-4 |  |
| 8.34 | Continuous current under ambient temperature | | |  | mA |  |  |
| 8.35 | Maximum residual voltage for lightning impulse current with 8/20 microsecond wave for following impulse peaks | | |  |  |  |  |
| 8.35.1 | Switching surges-1kA/2kA | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.35.2 | 5 KA | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.35.3 | 10 KA | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.35.4 | 20 KA | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.36 | Maximum residual voltage for switching impulse current with 30/60 microsecond wave for following impulse peaks | | |  |  |  |  |
| 8.36.1 | 500 A | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.36.2 | 1 KA | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.36.3 | 2 KA | | |  | kV peak | Acc. to IEC 60099-4 |  |
| 8.37 | Maximum residual voltage for steep current impulse with 1/20 microsecond wave and 10 KA peak | | |  | kV peak |  |  |
| 8.38 | High current 4/10 microsecond impulse withstand level | | |  | kA peak | Acc. to IEC 60099-4 |  |
| 8.39 | Low current 2000 microsecond withstand level | | |  | kA peak | Acc. to IEC 60099-4 |  |
| 8.40 | Number of arrester units | | |  |  |  |  |
| 8.41 | Rated voltage of each arrester unit | | |  | kV rms |  |  |
| 8.42 | Number of parallel non linear MO resistance block | | |  |  | 1 |  |
| 8.43 | Power frequency voltage versustime characteristics included? | | |  | (Yes/No) |  |  |
| 8.44 | Maximum internal partial discharge | | |  | pC | Acc. to IEC 60099 |  |
| 8.45 | Manufacturer quality system in accordance with ISO 9000 | | |  | Yes/No | Yes |  |
| 8.45.1 | Date of issue | | |  |  | Latest |  |
| 8.45.2 | Validity | | |  |  |  |  |
| 8.45.3 | Certificate attached to the offer | | |  | Yes/No | Yes |  |
| 8.46 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | | |  | Yes/No | Yes |  |
| 8.46.1 | Certificate to be attached to the offer | | |  | Yes/No | Yes |  |
| 8.46.2 | Report to be attached to the offer | | |  | Yes/No | Yes |  |
|  | **Miscellaneous** | | |  |  |  |  |
| 8.47 | Insulator | | |  |  |  |  |
| 8.47.1 | Manufacturer | | |  |  |  |  |
| 8.47.2 | Country | | |  |  |  |  |
| 8.47.3 | Type | | |  |  |  |  |
| 8.47.4 | Material | | |  |  |  |  |
| 8.48 | Creepage distance of insulator | | |  | mm | 4495 |  |
| 8.49 | Basic insulation level of insulator at site condition | | |  | kV peak | 1.3\*LIPL |  |
| 8.50 | One minute power frequency withstand voltage of insulator at site condition | | |  | kV rms | 1.06\*SIWL/ √2 |  |
| 8.51 | Switching Impulse withstand voltage of insulator at site condition | | |  | kV peak | 1.25\*SIWL |  |
| 8.52 | Filling medium | | |  |  |  |  |
| 8.53 | Method used for sealing test | | |  |  |  |  |
| 8.54 | Whether washable in service (Yes/ No) | | |  | (Yes/ No) | Yes |  |
| 8.55 | Permissible force at HV terminals | | |  |  |  |  |
| 8.55.1 | Static Horizontal | | |  | N |  |  |
| 8.55.2 | Static Vertical | | |  | N |  |  |
| 8.55.3 | Dynamic Horizontal | | |  | N |  |  |
| 8.55.4 | Dynamic vertical | | |  | N |  |  |
| 8.56 | Whether isolating pads for surge arresters with surge counter provided? (Yes/No) | | |  | (Yes/ No) | Yes, separated |  |
| 8.57 | Non Linear MO resistor | | |  |  |  |  |
| 8.57.1 | Manufacturer | | |  |  |  |  |
| 8.57.2 | Country | | |  |  |  |  |
| 8.57.3 | Type | | |  |  |  |  |
| 8.58 | Dimension of each non-linear MO resistance block | | |  |  |  |  |
| 8.58.1 | Diameter | | |  | mm |  |  |
| 8.58.2 | Height | | |  | mm |  |  |
| 8.59 | Total weight of single unit | | |  | kg |  |  |
| 8.60 | Total weight of complete surge arrester | | |  | kg |  |  |
| 8.61 | Total height of surge arrester | | |  | mm |  |  |
| 8.62 | Total width of surge arrester | | |  | mm |  |  |
| 8.63 | Whether grading ring for high voltage terminal required? | | |  | (Yes/ No) | Yes |  |
| 8.64 | Maximum Package weight ready for shipment | | |  | kg |  |  |

c) 33 kV OPEN TERMINAL SWITCHGEAR

| 1. 33 kV OPEN TERMINAL SWITCHGEAR | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
|  | **33KV Circuit Breaker** |  |  |  |
|  | **General** |  |  |  |
| 1.1 | Manufacturer |  |  |  |
| 1.2 | Place of manufacturing |  |  |  |
| 1.3 | Type designation for breaker |  |  |  |
| 1.4 | Type designation for operating mechanism |  |  |  |
| 1.5 | Type of operation mechanism |  | Spring Charge  motor operated |  |
| 1.6 | Type of interrupting chamber |  |  |  |
| 1.7 | Applicable standard |  | IEC 62271-200, 62271-102, 62271-1, 62155, 61869-1, 61869-5, 60383, 60815 |  |
| 1.8 | Rated voltage | kV | 36 |  |
| 1.9 | System Voltage | kV | 33 |  |
| 1.10 | Rated current at maximum site temperature | A |  |  |
| 1.10.1 | For line feeder |  | 2000 |  |
| 1.10.2 | For Transformer feeder |  | 2000 |  |
| 1.10.3 | For Diameter |  | N.A. |  |
| 1.10.4 | For Bus Coupler feeder |  | N.A. |  |
| 1.10.5 | For Bus Section |  | 2000 |  |
| 1.10.6 | For reactor feeder |  | N.A. |  |
| 1.11 | Rated frequency | Hz | 50 |  |
| 1.12 | Media of breaking chamber |  | Vacuum |  |
| 1.13 | Single pressure, low pressure or others |  |  |  |
| 1.14 | Quantity of poles per breaker |  | 3 Poles |  |
| 1.15 | Rated operating sequence |  | O -0.3 sec- CO - 3 min - CO |  |
| 1.16 | Single pole or three pole operation |  |  |  |
| 1.16.1 | For line feeder |  | 3 pole operated |  |
| 1.16.2 | For Transformer feeder |  | 3 pole operated |  |
| 1.16.3 | For Diameter |  | N.A |  |
| 1.16.4 | For Bus Coupler feeder |  | N.A |  |
| 1.16.5 | For Bus Section |  | 3 pole operated |  |
| 1.16.6 | For reactor feeder |  | N.A |  |
| 1.17 | Number of interrupting chambers per pole |  |  |  |
| 1.18 | Class (indoor / outdoor) |  | Outdoor |  |
| 1.19 | Circuit breaker type (live tank / dead tank) |  | Live tank |  |
| 1.20 | Type of system earthing |  | Solid |  |
| 1.21 | Withstanding in load combinations of earthquake, wind , short circuit , etc as mentioned in Technical Specification | (Yes/ No) | Yes |  |
| 1.22 | Maximum and Minimum ambient temperature for design | °C | Acc. to section 1 |  |
| 1.23 | Design altitude above sea level | m | Acc. to section 1 |  |
| 1.24 | Pollution level | mm/kV | Acc. to section 1 |  |
| 1.25 | Design seismic acceleration | g | Acc. to section 1 |  |
|  | **Insulation Rating** |  |  |  |
| 1.26 | Type of Insulator (porcelain/silicon rubber) |  | porcelain |  |
| 1.27 | Basic Insulation level (at site condition) | kV peak |  |  |
| 1.27.1 | Common value (Phase-phase, Phase-ground) |  | 170 |  |
| 1.27.2 | Across the isolating distance |  | 200 |  |
| 1.28 | One minute power frequency withstand voltage (at IEC condition) | kV rms |  |  |
| 1.28.1 | Common value (Phase-phase, Phase-ground) |  | 70 |  |
| 1.28.2 | Across isolating distance |  | 70 |  |
| 1.29 | Switching Impulse Withstand Voltage at IEC conditions | kV peak |  |  |
| 1.29.1 | Phase to ground and across open switching device |  | N.A. |  |
| 1.29.2 | Phase to phase |  | N.A. |  |
| 1.29.3 | Across isolating distance |  | N.A. |  |
| 1.30 | Rated transient recovery voltage for terminal faults | kV peak | 62 |  |
| 1.31 | Rated transient recovery voltage | kV peak |  |  |
| 1.31.1 | Amplitude factor |  |  |  |
| 1.31.2 | Rate of rise | kV/µs |  |  |
| 1.32 | Rate of rise of restriking voltage |  |  |  |
| 1.32.1 | For 30% breaking capacity | kV/µs |  |  |
| 1.32.2 | For 60% breaking capacity | kV/µs |  |  |
| 1.32.3 | For 100% breaking capacity | kV/µs |  |  |
| 1.33 | Maximum recovery voltage on breaking a synchronous system | kV |  |  |
| 1.34 | Rated characteristics for short line faults | kV rms |  |  |
| 1.35 | First pole to clear factor |  | 1.5 |  |
| 1.36 | Whether circuit breaker is restrike free? |  | Yes |  |
| 1.37 | Maximum overvoltage factor on any switching duty | pu | 2.3 |  |
| 1.38 | Maximum overvoltage factor when interrupting rated line/cable/capacitor bank charging currents | pu | 2.3 |  |
| 1.39 | Maximum overvoltage factor when switching small inductive/reactor currents | pu | 2.3 |  |
| 1.40 | Maximum total break time (trip initiation to final arc extinction) | ms |  |  |
|  | **Current Ratings** |  |  |  |
| 1.41 | Rated short time withstand current & duration | kA rms/sec | 25/1 |  |
| 1.42 | Rated short circuit making current | kA peak | 2.5\*25 |  |
| 1.43 | Rated out of phase breaking current | kA rms | 10 |  |
| 1.44 | Rated small inductive breaking current | A rms | Acc. To IEC |  |
| 1.45 | Rated capacitive breaking current |  |  |  |
| 1.45.1 | Rated line-charging breaking current | A rms | Acc. To IEC |  |
| 1.45.2 | Rated cable charging breaking current | A rms | Acc. To IEC |  |
| 1.45.3 | Rated Single/Back to Back Capacitor bank breaking current | A rms | Acc. To IEC |  |
| 1.46 | Rated short circuit breaking current |  |  |  |
| 1.46.1 | AC component | kA rms | 25 |  |
| 1.46.2 | DC component | % | Acc. To IEC |  |
| 1.47 | Maximum current on breaking asynchronous system | kA peak |  |  |
| 1.48 | 180° out of phase switching duty as a percentage of rated  breaking current | % |  |  |
|  | **Other Characteristics** |  |  |  |
| 1.49 | Voltage drop across MV terminals of one pole at 100 A dc | mV |  |  |
| 1.50 | Maximum temperature rise at normal current over maximum  ambient temperature | °C |  |  |
| 1.51 | Opening time (from trip contact closing to the primary contacts separation in all poles) |  |  |  |
| 1.51.1 | Without current | ms |  |  |
| 1.51.2 | With 100% rated breaking current | ms |  |  |
| 1.52 | Opening time from trip contact closing to primary contact separation | µs |  |  |
| 1.53 | Closing time (from energization of close coil to latching of circuit breaker in fully closed position) | µs |  |  |
| 1.54 | Rated break or interrupting time (opening time plus arcing time) | µs |  |  |
| 1.55 | Making time (energization of close coil to contact touch) |  |  |  |
| 1.55.1 | Without current | ms |  |  |
| 1.55.2 | 100% making current | ms |  |  |
| 1.56 | Maximum break time | ms |  |  |
| 1.57 | Maximum close time | ms |  |  |
| 1.58 | Dead time (during auto-reclosing) | ms |  |  |
| 1.59 | Reclosing | ms |  |  |
| 1.60 | Arcing time | ms |  |  |
| 1.61 | Maximum time interval between opening of first and last phase of three phase circuit breakers | ms |  |  |
| 1.62 | Maximum time interval between opening of interrupters of one phase | µs |  |  |
| 1.63 | Maximum time interval between closure of interrupters of one phase | µs |  |  |
| 1.64 | Minimum time from extinction of main arc to contact make during auto-reclosing duty | ms |  |  |
| 1.65 | Closing time from energisation of close coil to latching of circuit breaker in fully closed position | ms |  |  |
| 1.66 | Making time (energisation of close coil to contact touch) |  |  |  |
| 1.66.1 | Without current | ms |  |  |
| 1.66.2 | 100% making current | ms |  |  |
|  | **Operating Mechanism** |  |  |  |
| 1.67 | Type of spring |  | spring operated |  |
| 1.68 | Motor type |  | DC Motor charged, |  |
| 1.69 | Motor |  |  |  |
| 1.69.1 | Rated voltage | V | 110 VDC |  |
| 1.69.2 | Power demand | W |  |  |
| 1.69.3 | Full-load current | A |  |  |
| 1.69.4 | Maximum starting current | A |  |  |
| 1.69.5 | Speed | rpm |  |  |
| 1.69.6 | Required time by motor to charge the spring completely | s |  |  |
| 1.69.7 | Type of protection of motor |  |  |  |
| 1.70 | Hand operating facility | Yes/No | Yes |  |
| 1.70.1 | Manual spring charging facility to be accessible from ground respectively platform to be provided | Yes/No | Yes |  |
| 1.70.2 | Manual spring release (suitably positioned to avoid accidental operation) | Yes/No | Yes |  |
| 1.70.3 | Manual mechanism charging torque | Nm |  |  |
| 1.71 | Mechanical on/off indicator | Yes/No | Yes |  |
| 1.72 | Mechanical spring charge/discharge indication | Yes/No | Yes |  |
| 1.73 | Charging time | S | ≤12 |  |
| 1.74 | Number of trip coils per breaker |  | 2 |  |
| 1.75 | Number of close coils per breaker |  | 1 |  |
| 1.76 | Reclosing suitable for 1 pole and/or 3 pole |  | As protection diagram |  |
| 1.77 | Whether circuit breaker is trip free or others? |  | Yes |  |
| 1.78 | Number and type of spare auxiliary reversible contacts |  | 6NO+6NC (min.) |  |
| 1.79 | Opening and closing nominal control voltage | V dc |  |  |
| 1.80 | Control cabinet |  |  |  |
| 1.80.1 | Power Socket in Control cabinet |  | British Standard |  |
| 1.80.2 | cabinet Light (Compact LED) | Yes/No | Yes |  |
| 1.80.3 | Number, type & power of cabinet heater |  |  |  |
| 1.80.4 | cabinet space heaters (thermostat Controlled) | Yes/No | Yes |  |
| 1.80.5 | Degree of protection (IP) of control cabinet |  | IP55 |  |
| 1.80.6 | Minimum thickness of steel control cabinet | mm | 2 |  |
| 1.81 | Tripping and closing coils |  |  |  |
| 1.81.1 | Number of closing coils |  | 1 |  |
| 1.81.2 | Number of tripping coils |  | 2 |  |
| 1.81.3 | Tripping coil current | A, DC |  |  |
| 1.81.4 | Closing coil current | A, DC |  |  |
| 1.81.5 | Rated power of trip coil | W |  |  |
| 1.81.6 | Rated power of close coil | W |  |  |
| 1.81.7 | Tripping and closing coils' nominal control voltage | V, DC | 110 |  |
| 1.81.8 | Variation of closing / opening coils' operating voltage | % | 85-110 / 70-110 |  |
| 1.81.9 | Minimum voltage for proper operation of trip & close coils | % | 40 |  |
| 1.81.10 | - Pick up range of control voltage |  |  |  |
| 1.82 | Whether antipumping device is provided? | Yes/No | Yes |  |
| 1.83 | Whether operating counter is provided? | Yes/No | Yes |  |
| 1.84 | Whether emergency trip is provided? | Yes/No | Yes |  |
| 1.85 | Whether circuit breaker is equipped with Local/ remote/ maintenance change over switch? | Yes/No | Yes |  |
| 1.86 | Whether circuit breaker is equipped with manually spring charge facilities? | Yes/No | Yes |  |
| 1.87 | Whether Pre-insertion resistor is provided? | Yes/No | No |  |
| 1.87.1 | Closing resistor value | Ω |  |  |
| 1.87.2 | Insertion time | ms |  |  |
| 1.88 | Whether Switching Control Relay is provided? | Yes/No | No |  |
| 1.89 | Pole discrepancy feature | Yes/No | Yes |  |
|  | **Insulating Medium** |  |  |  |
| 1.90 | Insulating medium |  | Vacuum |  |
| 1.91 | Rated pressure SF6 at 20°C | Absolute  bar |  |  |
| 1.92 | Limits of gas pressure for correct operation of breaker | Absolute  bar |  |  |
| 1.93 | Signal loss of SF6 at 20°C | Absolute  bar |  |  |
| 1.94 | General lockout at 20°C | Absolute  bar |  |  |
| 1.95 | Leakage rate of SF6 at rated pressure per annum | % | < 0.1 |  |
| 1.96 | Type and material of gasket used to gas tightening the joints |  |  |  |
| 1.96.1 | Metal to metal joints |  |  |  |
| 1.96.2 | Metal to porcelain joints |  |  |  |
| 1.97 | Supplier of SF6 gas |  |  |  |
| 1.98 | Supplier of Density meter |  |  |  |
| 1.99 | Toxicological test |  |  |  |
| 1.100 | Storage capacity of each gas cylinder | m³ |  |  |
| 1.101 | Whether sufficient gas plus 20% supplied for first filling? | Yes / No |  |  |
| 1.102 | Mass of gas stored cylinder | kg |  |  |
| 1.103 | Time required to fill the circuit breaker with SF6 gas ready  for operation | hour |  |  |
| 1.104 | Time required to empty gas of the circuit breaker | hour |  |  |
| 1.105 | Total mass of transportable gas handling equipment | kg |  |  |
| 1.106 | Whether SF6 is stored as gas or liquid? |  |  |  |
|  | **Insulator Columns** |  |  |  |
| 1.107 | Manufacturer |  |  |  |
| 1.108 | Type |  |  |  |
| 1.109 | Color |  |  |  |
| 1.110 | Creepage distance phase to ground | mm | 1256 |  |
| 1.111 | Creepage distance between terminals of one pole | mm |  |  |
| 1.112 | Protected creepage distance (90° shadow) | mm |  |  |
| 1.113 | Clearance (phase to phase ) | mm |  |  |
| 1.114 | External striking distance |  |  |  |
| 1.114.1 | Phase to ground | mm |  |  |
| 1.114.2 | Phase to phase | mm |  |  |
| 1.115 | Ultimate strength of columns |  |  |  |
| 1.115.1 | Cantilever | N |  |  |
| 1.115.2 | Tension | N |  |  |
| 1.115.3 | Torsion | N.m |  |  |
| 1.115.4 | Compression | N |  |  |
| 1.116 | Permissible force at MV terminals |  |  |  |
| 1.116.1 | Static at any direction | N |  |  |
| 1.116.2 | Dynamic at any direction | N |  |  |
| 1.117 | Washable in service | Yes / No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 1.118 | Mechanical life of CB and mechanism in No. of operations | time | 10000 |  |
| 1.119 | Electrical contact life in number of operations at: |  |  |  |
| 1.119.1 | Rated current | time | 10000 |  |
| 1.119.2 | Breaking current | time | ≥ 30 |  |
| 1.119.3 | Cumulative ampere rating | time |  |  |
| 1.120 | Whether a lock out device for preventing circuit breaker to close is provided? | Yes / No |  |  |
| 1.121 | Whether Switching Control Relay is provided? | Yes/No |  |  |
| 1.122 | Number and type of free auxiliary contacts for main contact monitoring |  | >10NO+ >10NC |  |
| 1.123 | Number and type of free auxiliary contacts for SF6 gas pressure monitoring |  | >10NO+ >10NC |  |
| 1.124 | Number and type of free auxiliary contacts for local/remote selector switch monitoring |  | >10NO+ >10NC |  |
| 1.125 | Whether circuit breaker is equipped with rings? | Yes/No |  |  |
| 1.126 | Whether circuit breaker is equipped with grading capacitors? | (Yes/ No) | Yes |  |
| 1.127 | Mechanical on/off indicator | Yes/No | Yes |  |
| 1.128 | Gas supervision | Yes/No | Yes |  |
| 1.129 | Circuit breaker Operating platform (from ground level) | Yes/No | Yes |  |
| 1.130 | Type and material for main contacts |  |  |  |
| 1.131 | Material of MV conductor |  | Aluminum |  |
| 1.132 | Whether contacts are silver plated? | Yes / No | Yes |  |
| 1.133 | Un-galvanized metal parts shall primed, undercoated and finished with outdoor corrosion-resistant painting | Yes/No | Yes |  |
| 1.134 | Galvanizing parts accordance with ISO 1461 standards |  | As per ISO-1461 |  |
| 1.135 | CB weight |  |  |  |
| 1.135.1 | Weight of single pole breaker | kg |  |  |
| 1.135.2 | Total weight of complete circuit breaker | kg |  |  |
| 1.135.3 | Maximum weight of pakage ready for shipment | kg |  |  |
| 1.136 | CB main dimensions |  |  |  |
| 1.136.1 | Overall height of assembled circuit breaker | mm |  |  |
| 1.136.2 | Phase spacing | mm |  |  |
| 1.136.3 | Minimum vertical distance between upper and lower terminal of the circuit breaker | mm |  |  |
| 1.136.4 | Minimum vertical distance between lower side of the circuit breaker and metallic support | mm |  |  |
| 1.137 | Mechanical endurance class |  | M2 |  |
| 1.138 | Electrical endurance class |  | E2 |  |
| 1.139 | Restrike probability class due to capacitive current breaking |  | C2 |  |
|  | **33kV ISOLATOR** |  |  |  |
|  | **General** |  |  |  |
| 2.1 | Manufacturer |  |  |  |
| 2.2 | Place of manufacturing |  |  |  |
| 2.3 | Type designation for Isolator |  |  |  |
| 2.4 | Type designation for grounding switch |  |  |  |
| 2.5 | Type of Isolator |  | Horizontal Double Break/Centre break |  |
| 2.6 | Applicable standard |  | IEC 62271-102 |  |
| 2.7 | Quantity of poles |  | 3 pole operated |  |
| 2.8 | Rated voltage | kV | 36 |  |
| 2.9 | System Voltage | kV | 33 |  |
| 2.10 | Rated current at maximum site temperature | A |  |  |
| 2.9.1 | At maximum site temperature |  |  |  |
| 2.9.1.1 | For line feeder |  | 1250 |  |
| 2.9.1.2 | For Transformer feeder |  | 1250 |  |
| 2.9.1.3 | At IEC condition |  |  |  |
| 2.9.1.4 | For Transformer feeder |  | 1250 |  |
| 2.9.1.5 | For Bus Section |  | 1250 |  |
| 2.9.1.6 | For reactor feeder |  | N.A. |  |
| 2.9.2 | At IEC condition |  |  |  |
| 2.9.2.1 | For line feeder |  | Acc. to SLD |  |
| 2.9.2.2 | For Transformer feeder |  | Acc. to SLD |  |
| 2.9.2.3 | For Diameter |  | N.A. |  |
| 2.9.2.4 | For Bus Coupler feeder |  | N.A. |  |
| 2.9.2.5 | For Bus Section |  | 1250 |  |
| 2.9.2.6 | For reactor feeder |  | N.A. |  |
| 2.10 | Rated frequency | Hz | 50 |  |
| 2.11 | Class (outdoor / indoor) |  | Outdoor |  |
| 2.12 | Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No) | Yes / No | Yes |  |
| 2.13 | Hand operating facility is provided? ( Yes / No) | Yes / No | Yes |  |
| 2.14 | Accessibility to operating mechanism from ground level | Yes / No | Yes |  |
| 2.15 | Mechanical Endurance Class |  | M2 |  |
| 2.16.1 | Electrical Endurance Class |  | E2 |  |
| 2.16.2 | Capacitive switching at maximum temporary  overvoltage |  | C2 |  |
| 2.17 | Manufacturer quality system in accordance with ISO 9000 | Yes / No | Yes |  |
| 2.17.1 | Date of issue |  | Latest |  |
| 2.17.2 | Validity |  |  |  |
| 2.17.3 | Certificate attached to the offer | Yes / No | Yes |  |
| 2.18 | Type test certificate to be issued by independent laboratory or independently witnessed type test | Yes / No | Yes |  |
| 2.18.1 | Certificate to be attached to the offer |  | Yes |  |
| 2.18.2 | Report to be attached to the offer |  | Yes |  |
|  | **Insulation Rating** |  |  |  |
| 2.19 | Basic Insulation level (at site condition) |  |  |  |
| 2.19.1 | Common value | kV peak | 170 |  |
| 2.19.2 | Across the isolating distance | kV peak | 200 |  |
| 2.20 | One minute power frequency withstand voltage (at site condition) |  |  |  |
| 2.20.1 | Common value | kV rms | 70 |  |
| 2.20.2 | Across the isolating distance | kV rms | 70 |  |
| 2.21 | Switching impulse withstand voltage (at site condition) |  |  |  |
| 2.21.1 | Common value | kV peak | N.A. |  |
| 2.21.2 | Across the isolating distance | kV peak | N.A. |  |
| 2.22 | Type of Insulation(porcelain/silicon rubber) |  | porcelain |  |
|  | **Current Rating** |  |  |  |
| 2.23 | Rated short time withstand current |  |  |  |
| 2.23.1 | For Isolator | kA rms/sec | 25/1 |  |
| 2.23.2 | For grounding switch | kA rms/sec | 25/1 |  |
| 2.24 | Rated short circuit making current for grounding switches | kA rms | 2.5\*25 |  |
| 2.25 | Rated peak short circuit withstand current | kA peak |  |  |
| 2.26 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | kVA |  |  |
| 2.27 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | kVA |  |  |
|  | **Other Characteristic** |  |  |  |
| 2.28 | Rated Supply Voltage |  |  |  |
| 2.28.1 | For motor, control and interlock | Vdc | 110 |  |
| 2.28.2 | For AC auxiliaries | Vac | 240 |  |
| 2.29 | Voltage drop across terminals of one pole at 100 A.dc for Isolator and ground switches | mV |  |  |
| 2.30 | Maximum temperature rise at normal current over Maximum ambient temperature | °C |  |  |
| 2.31 | Maximum and minimum ambient temperature for design | °C | Acc. to section 1 |  |
| 2.32 | Altitude above sea level | m | Acc. to section 1 |  |
|  | **Operating Mechanism** |  |  |  |
| 2.33 | Type of operating mechanism |  |  |  |
| 2.33.1 | For Isolator |  | DC Motor |  |
| 2.33.2 | For grounding switch |  | DC Motor |  |
| 2.34 | Motor type |  |  |  |
| 2.35 | Motor | V | 110 VDC |  |
| 2.35.1 | Rated voltage | W |  |  |
| 2.35.2 | Power demand | A |  |  |
| 2.35.3 | Full load current | rpm |  |  |
| 2.35.4 | Speed |  |  |  |
| 2.36 | Type of motor protection |  |  |  |
| 2.37 | Total time from initiation of opening operation to Isolator in fully open position | sec |  |  |
| 2.38 | Time from contact separation to extinct of capacitive arc | sec |  |  |
| 2.39 | Total time from initiation of opening operation to time when Isolator gap can withstand phase voltage |  |  |  |
| 2.40 | Breaking and closing of: |  |  |  |
| 2.40.1 | Magnetizing current of power transformers | Yes / No | Yes |  |
| 2.40.2 | Mutual inductive/capacitive current of parallel circuit in double circuit line | Yes / No | Yes |  |
| 2.40.3 | Charging current of unloaded lines and/or cables | Yes / No | Yes |  |
| 2.41 | Minimum guaranteed no. of operations for Isolators or grounding switches before maintenance | N |  |  |
| 2.42 | Maximum required force for hand operation with supplied handle |  |  |  |
| 2.43 | Thickness of steel control cabinet | mm | Min (2) |  |
| 2.44 | Degree of protection (IP) of mechanism housing |  | IP55 |  |
| 2.45 | Cubicle space heaters (thermostat Controlled) | Yes / No | Yes |  |
| 2.46 | Cabinet heater |  |  |  |
| 2.46.1 | Power | W |  |  |
| 2.46.2 | Nominal Voltage | V | 240VAC |  |
| 2.47 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | Yes / No |  |  |
| 2.48 | Whether open/neutral /close control switch is provided? ( Yes / No) | Yes / No |  |  |
| 2.49 | Whether under voltage relay is provided for motor supply? | Yes / No | Yes |  |
| 2.50 | Whether all of the heaters are equipped with a M.C.B ? | Yes / No | Yes |  |
| 2.51 | Rated power of operation coil | W |  |  |
| 2.52 | Total load of heaters for Isolator | W |  |  |
|  | **Insulators** |  |  |  |
| 2.53 | Manufacturer |  |  |  |
| 2.54 | Place of manufacturing |  |  |  |
| 2.55 | Type (porcelain /composite) |  | porcelain |  |
| 2.56 | Colour |  |  |  |
| 2.57 | Creepage distance | mm | 1256 |  |
| 2.58 | Protected creepage distance | mm |  |  |
| 2.59 | Permissible cantilever working load | N | C8 |  |
| 2.60 | Operating handle or lever mounting height above ground | m | 1.2 |  |
| 2.61 | Permissible tensional strength | N.m |  |  |
|  | Minimum clearance | mm |  |  |
| 2.61.1 | Between poles when Isolator is closed |  |  |  |
| 2.61.2 | Between poles when Isolator is open |  |  |  |
| 2.61.3 | Between phase and ground |  |  |  |
| 2.61.4 | Between one pole terminals at open condition |  |  |  |
|  | **Interlocks** |  |  |  |
| 2.62 | Type of interlock between Isolator and associated ground switch |  | Electrical and Mechanical |  |
| 2.63 | Type of interlock between ground switch and related circuit breakers |  | Electrical |  |
| 2.64 | Type of interlock between Isolator and related circuit breaker |  | Electrical |  |
| 2.65 | Locking arrangement in on/off position | Yes / No | Yes |  |
| 2.66 | Automatic isolation of control supplies when lock off | Yes / No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 2.67 | Type of main contacts |  |  |  |
| 2.67.1 | For Isolator |  |  |  |
| 2.67.2 | For grounding switch |  |  |  |
| 2.68 | Material of main contacts |  |  |  |
| 2.68.1 | For Isolator |  | Copper |  |
| 2.68.2 | For grounding switch |  | Copper |  |
| 2.69 | Material of blades |  |  |  |
| 2.69.1 | For Isolator |  | Copper |  |
| 2.69.2 | For grounding switch |  | Copper |  |
| 2.70 | Whether main contacts are silver plated |  |  |  |
| 2.70.1 | For Isolators |  | Yes |  |
| 2.70.2 | For grounding switches |  | Yes |  |
| 2.71 | Quantity and type of free auxiliary contacts |  |  |  |
| 2.71.1 | For Isolators |  | >10NO+ >10NC |  |
| 2.71.2 | For grounding switches |  | >10NO+ >10NC |  |
| 2.72 | Permissible force on MV terminals |  |  |  |
| 2.72.1 | Static in any direction | N |  |  |
| 2.72.2 | Dynamic in any direction | N |  |  |
| 2.73 | Weight of maximum package ready for shipment | kg |  |  |
| 2.74 | Weight of complete |  |  |  |
| 2.74.1 | Isolator | kg |  |  |
| 2.74.2 | Isolator with associated grounding switch | kg |  |  |
| 2.74.3 | Single phase | kg |  |  |
| 2.75 | Cubicle Light (Compact LED) | Yes / No | Yes |  |
| 2.76 | Number of grounding switch |  | 1 |  |
| **Note:** The table should be filled and submitted for each of the following equipment separately:  1. Isolator without Ground Switches  2. Isolator with 1 Ground Switches | | | | |
|  | **33kV EARTHING SWITCH** |  |  |  |
|  | **General** |  |  |  |
| 3.1 | Manufacturer |  |  |  |
| 3.2 | Place of manufacturing |  |  |  |
| 3.3 | Type designation |  |  |  |
| 3.4 | Type of operating mechanism |  | DC Motor |  |
| 3.5 | Applicable standard |  | IEC 62271-102 |  |
| 3.6 | Rated voltage | kV | 36 |  |
| 3.7 | System Voltage | kV | 33 |  |
| 3.8 | Rated current | A |  |  |
| 3.8.1 | At maximum site temperature |  | Acc. to SLD |  |
| 3.8.2 | At IEC condition |  | Acc. to SLD |  |
| 3.9 | Rated frequency | Hz | 50 |  |
| 3.10 | Class (outdoor / indoor) |  | Outdoor |  |
| 3.11 | Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No) | Yes / No | Yes |  |
| 3.12 | Hand operating facility is provided? ( Yes / No) | Yes / No | Yes |  |
| 3.13 | Accessibility to operating mechanism from ground level | Yes / No | Yes |  |
| 3.14 | Manufacturer quality system in accordance with ISO 9000 | Yes / No | Yes |  |
| 3.15 | Date of issue |  | Latest |  |
| 3.16 | Validity |  |  |  |
| 3.17 | Certificate attached to the offer | Yes / No | Yes |  |
| 3.18 | Type test certificate to be issued by independent laboratory or independently witnessed type test | Yes / No | Yes |  |
| 3.18.1 | Certificate to be attached to the offer |  | Yes |  |
| 3.18.2 | Report to be attached to the offer |  | Yes |  |
|  | **Insulation Rating** |  |  |  |
| 3.19 | Basic Insulation level (at site condition) |  |  |  |
| 3.19.1 | Common value | kV peak | 170 |  |
| 3.19.2 | Across the isolating distance | kV peak | 200 |  |
| 3.20 | One minute power frequency withstand voltage (at site condition) |  |  |  |
| 3.20.1 | Common value | kV rms | 70 |  |
| 3.20.2 | Across the isolating distance | kV rms | 70 |  |
| 3.21 | Switching impulse withstand voltage (at site condition) |  |  |  |
| 3.21.1 | Common value | kV peak | N.A. |  |
| 3.21.2 | Across the isolating distance | kV peak | N.A. |  |
| 3.22 | Type of Insulation(porcelain/silicon rubber) |  | porcelain |  |
|  | **Current Rating** |  |  |  |
| 3.23 | Rated short time withstand current |  |  |  |
| 3.23.1 | For grounding switch | kA rms/sec | 25/1 |  |
| 3.23.2 | Rated short circuit making current for grounding switches | kA rms | 2.5\*25 |  |
| 3.24 | Rated peak short circuit withstand current | kA peak |  |  |
| 3.25 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | kVA |  |  |
| 3.26 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | kVA |  |  |
|  | **Other Characteristic** |  |  |  |
| 3.27 | Rated Supply Voltage |  |  |  |
| 3.27.1 | For motor, control and interlock | Vdc | 110 |  |
| 3.27.2 | For AC auxiliaries | Vac | 240 |  |
| 3.28 | Voltage drop across terminals of one pole at 100 A.dc for ground switches | mV |  |  |
| 3.29 | Maximum temperature rise at normal current over Maximum ambient temperature | °C |  |  |
| 3.30 | Maximum and minimum ambient temperature for design | °C | Acc. to section 1 |  |
|  | Altitude above sea level | m | Acc. to section 1 |  |
| 3.31 | **Operating Mechanism** |  |  |  |
| 3.32 | Type of operating mechanism |  | DC Motor |  |
| 3.32.1 | Motor type |  |  |  |
| 3.32.2 | Motor | V |  |  |
| 3.33 | Rated voltage | W |  |  |
| 3.34 | Power demand | A |  |  |
| 3.34.1 | Full load current | rpm |  |  |
| 3.34.2 | Speed |  |  |  |
| 3.35 | Type of motor protection |  |  |  |
| 3.36 | Total time from initiation of opening operation in fully open position | sec | ≤15 |  |
| 3.37 | Breaking and closing of: |  |  |  |
| 3.37.1 | Magnetizing current of power transformers | Yes / No | Yes |  |
| 3.37.2 | Mutual inductive/capacitive current of parallel circuit in double circuit line | Yes / No | Yes |  |
| 3.37.3 | Charging current of unloaded lines and/or cables | Yes / No | Yes |  |
| 3.38 | Minimum guaranteed no. of operations for grounding switches before maintenance | N |  |  |
| 3.39 | Maximum required force for hand operation with supplied handle |  |  |  |
| 3.40 | Thickness of steel control cabinet | mm | Min (2) |  |
| 3.41 | Degree of protection (IP) of mechanism housing |  | IP55 |  |
| 3.42 | Cubicle space heaters (thermostat Controlled) | Yes / No | Yes |  |
| 3.43 | Cabinet heater |  |  |  |
| 3.43.1 | Power | W |  |  |
| 3.43.2 | Nominal Voltage | V | 240 VAC |  |
| 3.44 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | Yes / No |  |  |
| 3.45 | Whether open/neutral /close control switch is provided? ( Yes / No) | Yes / No |  |  |
| 3.46 | Whether under voltage relay is provided for motor supply? | Yes / No | Yes |  |
| 3.47 | Whether all of the heaters are equipped with a M.C.B ? | Yes / No | Yes |  |
| 3.48 | Rated power of operation coil | W |  |  |
| 3.49 | Total load of heaters | W |  |  |
|  | **Insulators** |  |  |  |
| 3.50 | Manufacturer |  |  |  |
| 3.51 | Place of manufacturing |  |  |  |
| 3.52 | Type (porcelain /composite) |  | porcelain |  |
| 3.53 | Color |  |  |  |
| 3.54 | Creepage distance | mm | 1256 |  |
| 3.55 | Protected creepage distance | mm |  |  |
| 3.56 | Permissible cantilever working load | N | C8 |  |
| 3.57 | Operating handle or lever mounting height above ground | m | 1.2 |  |
| 3.58 | Permissible tensional strength | N.m |  |  |
| 3.59 | Minimum clearance | mm |  |  |
| 3.59.1 | Between poles when earth switch is closed |  |  |  |
| 3.59.2 | Between poles when earth switch is open |  |  |  |
| 3.59.3 | Between phase and ground |  |  |  |
| 3.59.4 | Between one pole terminals at open condition |  |  |  |
|  | **Interlocks** |  |  |  |
| 3.60 | Type of interlocking |  | Electrical and Mechanical |  |
| 3.61 | Locking arrangement in on/off position | Yes / No | Yes |  |
| 3.62 | Automatic isolation of control supplies when lock off | Yes / No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 3.63 | Type of main contacts |  |  |  |
| 3.64 | For grounding switch |  |  |  |
| 6.65 | Material of main contacts |  |  |  |
| 3.65.1 | For grounding switch |  |  |  |
| 3.66 | Material of blades |  |  |  |
| 3.66.1 | For grounding switch |  | Copper |  |
| 3.67 | Whether main contacts are silver plated |  |  |  |
| 3.67.1 | For grounding switches |  | Yes |  |
| 3.68 | Quantity and type of free auxiliary contacts |  |  |  |
| 3.67.1 | For grounding switches |  | >10NO+ >10NC |  |
| 3.69 | Permissible force on MV terminals |  |  |  |
| 3.69.1 | Static in any direction | N |  |  |
| 3.69.2 | Dynamic in any direction | N |  |  |
| 3.70 | Weight of maximum package ready for shipment | kg |  |  |
| 3.71 | Weight of complete earth switch | kg |  |  |
| 3.72 | Cubicle Light (Compact LED) | Yes / No | Yes |  |
|  | 33kV CURRENT TRANSFOMERS |  |  |  |
|  | **General** |  |  |  |
| 4.1 | Manufacturer |  |  |  |
| 4.2 | Place of manufacturing |  |  |  |
| 4.3 | Type designation |  | Post |  |
| 4.4 | Number of phases |  | 3 phase |  |
| 4.5 | Type of neutral grounding |  | Effective |  |
| 4.6 | Applicable standard |  | IEC 61869-1/-2 |  |
| 4.7 | Class (indoor / outdoor) |  | Outdoor |  |
| 4.8 | Type (Oil-immersed / dry) |  | Oil-immersed Oil impregnated paper |  |
| 4.9 | Construction (tank / inverted) |  | Tank |  |
| 4.10 | Rated voltage | kV rms | 36 |  |
| 4.11 | System Voltage | kV | 33 |  |
| 4.12 | Rated current at max. site temperature : | A |  |  |
| 4.12.1 | For line feeders |  | Acc. to PSLD |  |
| 4.12.2 | For transformer feeders |  | Acc. to PSLD |  |
| 4.12.3 | Power transformer neutral |  | Acc. to PSLD |  |
| 4.12.4 | For bus section feeders |  | Acc. to PSLD |  |
| 4.12.5 | Power transformer neutral |  | Acc. to PSLD |  |
| 4.12.6 | For Reactor feeder |  | N.A |  |
| 4.13 | Rated frequency | Hz | 50 |  |
| 4.14 | Max. and min. ambient temperatures used for design | °C | Acc. to section 1 |  |
| 4.15 | Rated short time withstand current | kA rms | 25/1sec |  |
| 4.16 | Rated short time dynamic current | kA peak | 2.5\*25 |  |
| 4.17 | Whether withstanding in load combinations of earthquake, wind, short circuit? (Yes / No) | (Yes / No) | Yes |  |
| 4.18 | Altitude above sea level | m | Acc. to section 1 |  |
| 4.19 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 4.19.1 | Date of issue |  | Latest |  |
| 4.19.2 | Validity |  |  |  |
| 4.19.3 | Certificate attached to the offer | Yes/No | Yes |  |
| 4.20 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | Yes/No | Yes |  |
| 4.20.1 | Certificate to be attached to the offer | Yes/No | Yes |  |
| 4.20.2 | Report to be attached to the offer | Yes/No | Yes |  |
|  | **Insulation** |  |  |  |
| 4.21 | Maximum continuous line to line operating voltage | kV rms | 36 |  |
| 4.22 | Basic Insulation level (at site condition) | kV peak | 170 |  |
| 4.23 | Switching impulse withstand level (at site condition ) | kV peak | - |  |
| 4.24 | One minute power frequency withstand voltage (at site condition) | kV rms |  |  |
| 4.24.1 | Dry |  | 70 |  |
| 4.24.2 | Wet |  |  |  |
| 4.25 | One minute power frequency withstand voltage for secondary winding | kV rms |  |  |
| 4.26 | Highest value of partial discharge when tested acc. to IEC | pc | 5 |  |
| 4.27 | Voltage at secondary winding terminals with normal primary load current , and secondary open circuit | kV |  |  |
| 4.28 | Time permitted with open circuit secondary | sec |  |  |
| 4.29 | Dielectric dissipation factor |  |  |  |
|  | **Ratings and Accuracies** |  |  |  |
| 4.30 | Rated primary current | A | Acc. to PSLD |  |
| 4.31 | Rated extended primary current |  | 120% |  |
| 4.32 | Rated secondary current | A | 1 |  |
| 4.33 | Change of CT ratio shall be possible at the secondary circuit only | Yes/No | Yes |  |
| 4.34 | specification of CTs on: Line feeders, Transformer feeders,Bus couple, Tie coupler, Auxiliary transformer, Power transformer neutral, Core balance |  |  |  |
| 4.34.1 | Number of cores |  | Acc. to PSLD |  |
| 4.34.2 | Ratio (TR – turns ratio) | A | Acc. to PSLD |  |
| 4.34.3 | Class |  | Acc. to PSLD |  |
| 4.34.4 | Knee point voltage (Ek) | V | Acc. to PSLD |  |
| 4.34.5 | Exciting current (IE) at Ek | mA | Acc. to PSLD |  |
| 4.34.6 | Rated output (burden to be 25-100% rated burden) | VA | Acc. to PSLD |  |
|  | **External Insulation** |  |  |  |
| 4.35 | Material |  |  |  |
| 4.36 | Manufacturer |  |  |  |
| 4.37 | Place of manufacturing |  |  |  |
| 4.38 | Type designation |  |  |  |
| 4.39 | Minimum creepage distance | mm | 1256 |  |
| 4.40 | Color |  | Brown |  |
| 4.41 | Protected creepage distance (90 shadow) | mm |  |  |
| 4.42 | Shortest flash-over distance | mm |  |  |
| 4.43 | Whether washable in service ? (Yes / No) | (Yes / No) | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 4.44 | Maximum R.I.V. level at 1.2 max. rated voltage at 1 MHz according to NEMA 107 | μv | 500 |  |
| 4.45 | Whether oil level indicator/oil sampling valve/oil filling valve are provided ? (Yes / No) |  | Yes |  |
| 4.46 | Means for compensation of oil expansion |  |  |  |
| 4.47 | Temperature rise at rated continuous thermal current | °C |  |  |
| 4.48 | Rated continuous thermal current (% of rated primary current ) |  | Rated extended primary current |  |
| 4.49 | Electrostatic capacity of complete current transformer. PF |  |  |  |
| 4.50 | Loss angle at rated voltage |  |  |  |
| 4.51 | Permissible force at MV terminals |  |  |  |
| 4.51.1 | Static at any direction | N |  |  |
| 4.51.2 | Dynamic at any direction | N |  |  |
| 4.52 | Type , grade and manufacturer of oil |  |  |  |
| 4.53 | Weight of oil | kg |  |  |
| 4.54 | Primary conductor material |  |  |  |
| 4.55 | Secondary conductor material |  |  |  |
| 4.56 | Overall height | mm |  |  |
| 4.57 | Overall width | mm |  |  |
| 4.58 | Overall length | mm |  |  |
| 4.59 | Total weight of complete current transformer | Kg |  |  |
| 4.60 | Max. package weight ready for shipment | Kg |  |  |
| 4.61 | ting up of CT are provided? (Yes / No) |  | Yes |  |
| 4.62 | Permitted inclination refer to vertical axis during transport or storage | Degree |  |  |
| 4.63 | Degree protection of Terminal box |  | IP55 |  |
|  | 33kV VOLTAGE TRANSFORMERS |  |  |  |
|  | **General** |  |  |  |
| 5.1 | Manufacturer |  |  |  |
| 5.2 | Place of manufacturing |  |  |  |
| 5.3 | Type of VT |  | Single-phase/self-Cooled |  |
| 5.4 | Applicable standard |  | IEC 61869-1/-5 |  |
| 5.5 | Rated voltage | kV rms | 36 |  |
| 5.6 | System Voltage | kV | 33 |  |
| 5.7 | Rated frequency | Hz | 50 |  |
| 5.8 | Max. and min. ambient temperatures used for design | °C | Acc. to Section 1 |  |
| 5.9 | Class (indoor/ outdoor ) |  | Outdoor |  |
| 5.8 | Type (Oil-immersed / dry) |  | Oil-immersed/ Oil-impregnated paper |  |
| 5.9 | Maximum permissible partial discharge level at Um | pC | 10 |  |
| 5.10 | Maximum permissible partial discharge level at 1.2Um /Ö3 | pC | 5 |  |
| 5.11 | Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No) | (Yes / No) | Yes |  |
| 5.12 | Altitude above sea level | m | Acc. to Section 1 |  |
| 5.13 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 5.13.1 | Date of issue |  | Latest |  |
| 5.13.2 | Validity |  |  |  |
| 5.13.3 | Certificate attached to the offer | Yes/No | Yes |  |
|  | **Insulation ratings** |  |  |  |
| 5.14 | Basic insulation level (at site condition) | kV peak | 170 |  |
| 5.15 | Switching impulse withstand voltage (at site condition ) | kV peak | - |  |
| 5.16 | One minute power frequency withstand voltage (at site condition ) | kV rms | 70 |  |
| 5.17 | Power frequency withstand voltage between secondaries and secondary to earth | kV rms |  |  |
| 5.18 | Rated voltage factor |  |  |  |
| 5.18.1 | Continuous |  | 1.2 |  |
| 5.18.2 | 30 seconds |  | 1.5 |  |
| 5.19 | Minimum MV terminal withstand |  |  |  |
| 5.19.1 | Static terminal load |  |  |  |
| 5.19.2 | Dynamic terminal load |  |  |  |
| 5.20 | Max. RIV measured at 1.2 highest system voltage , 1 Mega-Hz acc. to CISPR | μV |  |  |
|  | **Burdens and accuracies** |  |  |  |
|  | * **3-Winding VT** |  | 3 |  |
| 5.21 | Number of secondary windings |  |  |  |
| 5.22 | Accuracy class for |  |  |  |
| 5.22.1 | Winding 1 |  | Acc. to PSLD |  |
| 5.22.2 | Winding 2 |  | Acc. to PSLD |  |
| 5.22.3 | Winding 3 |  | Acc. to PSLD |  |
| 5.23 | Rated primary voltage | KVrms | 33/√3 |  |
| 5.24 | Rated secondary voltage | KVrms | 0.11/√3 |  |
| 5.25 | Rated burden for |  |  |  |
| 5.25.1 | Winding 1 | VA | Acc. to PSLD |  |
| 5.25.2 | Winding 2 | VA | Acc. to PSLD |  |
| 5.25.3 | Winding 3 | VA | Acc. to PSLD |  |
| 5.26 | Continuous thermal burden of |  |  |  |
| 5.26.1 | Winding 1 alone | VA |  |  |
| 5.26.2 | Winding 2 alone | VA | 2 |  |
|  | * **2-Winding VT** |  |  |  |
| 5.27 | Number of secondary windings |  | Acc. to PSLD |  |
| 5.28 | Accuracy class for |  |  |  |
| 5.28.1 | Winding 1 |  | Acc. to PSLD |  |
| 5.28.2 | Winding 2 |  | Acc. to PSLD |  |
| 5.29 | Rated primary voltage | KVrms | 33/√3 |  |
| 5.2.30 | Rated secondary voltage | KVrms | 0.11/√3 |  |
| 5.31 | Rated burden for |  |  |  |
| 5.31.1 | Winding 1 | VA | Acc. to PSLD |  |
| 5.31.2 | Winding 2 | VA | Acc. to PSLD |  |
| 5.32 | Continuous thermal burden of |  |  |  |
| 5.32.1 | Winding 1 alone | VA | Solid |  |
| 5.32.2 | Winding 2 alone | VA | phase to ground |  |
| 5.33 | Type of system grounding |  |  |  |
| 5.34 | Type of connection |  | Terminal |  |
| 5.35 | Connections |  | Standard terminal block (screw and bolt) |  |
| 5.35.1 | Primary |  | MCB with auxiliary contact |  |
| 5.35.2 | Secondary |  | MCB with auxiliary contact |  |
| 5.36 | Type of protection device in secondary side |  | Stud type |  |
| 5.37 | Total continuous thermal burden of secondary windings | VA | Standard terminal block (screw and bolt) |  |
| 5.37.1 | Primary |  |  |  |
| 5.37.2 | Secondary |  |  |  |
|  | **Other Characteristics** |  | 1 |  |
| 5.38 | Temperature rise at rated burden and at 1.2 times rated primary voltage and ambient temperature | K | Max(0.25) |  |
| 5.39 | Permissible secondary short circuit time with rated primary voltage | sec | RLC Dumping |  |
| 5.40 | Short circuit impedance | Ohm |  |  |
| 5.41 | Method of suppressing for ferro-resonance |  | Max (10000) |  |
| 5.42 | Available ranges of high voltage capacitor | pF | 35\*10-4 |  |
| 5.43 | Coupling capacitor \* | pF |  |  |
| 5.44 | Loss angle at rated voltage |  | Max(40) |  |
| 5.45 | Frequency range for PLC use | KHz |  |  |
| 5.46 | Equipment series resistance for 35-450 KHz | Ohm |  |  |
| 5.47 | Natural frequency | MHz |  |  |
| 5.48 | Intermediate stage voltage | kV |  |  |
| 5.49 | Attenuation of intermediate voltage transformer within 35-450 KHz | dB |  |  |
| 5.50 | Max. insertion loss when used for PLC | dB |  |  |
| 5.51 | Whether intermediate tap is brought out? (Yes / No) |  |  |  |
|  | **Insulator columns** |  |  |  |
| 5.52 | Manufacturer |  |  |  |
| 5.53 | Place of manufacturing |  |  |  |
| 5.54 | Type designation |  |  |  |
| 5.55 | Material |  |  |  |
| 5.56 | Min. creepage distance | mm | 1256 |  |
| 5.57 | Protected creepage distance | mm |  |  |
| 5.58 | Color |  | Brown |  |
|  | **Miscellaneous** |  |  |  |
| 5.59 | Type and manufacturer of oil for capacitor section |  |  |  |
| 5.60 | Type and manufacturer of oil for intermediate section |  |  |  |
| 5.61 | Whether oil level indicator is provided? (Yes / No) | (Yes / No) | Yes |  |
| 5.62 | Class and grade of insulation material used in capacitors |  |  |  |
| 5.63 | Permitted inclination during transport/ storage | Degree |  |  |
| 5.64 | Material of windings |  |  |  |
| 5.66 | Permissible force at MV terminals |  |  |  |
| 5.66.1 | Static at any direction | N |  |  |
| 5.66.2 | Dynamic at any direction | N |  |  |
| 5.67 | Total weight | kg |  |  |
| 5.68 | Total oil weight | kg |  |  |
| 5.69 | Overall height | mm |  |  |
| 5.70 | Overall width | mm |  |  |
| 5.71 | Max. package dimensions ready for shipment | m3 |  |  |
| 5.72 | Washable in service? (Yes / No) |  |  |  |
|  | **33kV Conductors** |  |  |  |
|  | **General** |  |  |  |
| 6.1 | Rated current | A |  |  |
| 6.1.1 | Trans feeders |  | Acc. to SLD |  |
| 6.1.2 | Busbars |  | Acc. to SLD |  |
| 6.1.3 | Busbar Section |  | Acc. to SLD |  |
| 6.1.4 | Busbar Section |  | Acc. to SLD |  |
| 6.2 | Rated frequency | Hz | 50 |  |
| 6.3 | Rated voltage | kV | 36 |  |
| 6.3.1 | Basic insulation level of equipment at site condition | kV peak | 170 |  |
| 6.3.2 | Rated one minute power frequency withstand voltage at site condition | kV rms | 70 |  |
| 6.3.3 | Rated short circuit withstand current and its duration | kA/sec | 25/1 |  |
| 6.4 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No) | (Yes / No) | Yes |  |
| 6.5 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | °C | 80 Max |  |
| 6.6 | Minimum assumed tension for each stranded conductor at E.D.S condition | % of UTS | 3 |  |
| 6.7 | Minimum assumed tension for each stranded conductor of incoming and outgoing overhead lines (per phase ) | % of UTS | 20 |  |
| 6.8 | Minimum tension of incoming and outgoing shield wires | % of UTS | 10 |  |
| 6.9 | Maximum permissible surface gradient | kV/cm | 16 |  |
| 6.10 | Maximum permissible angle for incoming and outgoing overhead lines |  | ±30 |  |
| 6.11 | Ambient condition |  |  |  |
| 6.11.1 | Minimum ambient temperature |  | Acc. to section 1 |  |
| 6.11.2 | Maximum ambient temperature |  | Acc. to section 1 |  |
| 6.11.3 | Solar radiation |  | Acc. to section 1 |  |
| 6.11.4 | Seismic acceleration |  | Acc. to section 1 |  |
| 6.11.5 | Wind speed |  | Acc. to section 1 |  |
| 6.10.6 | Ice thickness |  | Acc. to section 1 |  |
| 6.12 | Solar radiation absorption coefficient (ϒ) |  | Acc. to section 1 |  |
| 6.13 | Emissivity coefficient in respect to black body (Ke) |  | 0.5 |  |
| 6.14 | Altitude above sea level | m | Acc. to section 1 |  |
|  | **Stranded Conductors** |  |  |  |
| 6.15 | Manufacturer |  |  |  |
| 6.16 | Place of manufacturing |  |  |  |
| 6.17 | Material and alloy type |  | AAAC/AAC |  |
| 6.18 | Nominal cross section | mm² |  |  |
| 6.19 | Number of strands |  |  |  |
| 6.20 | Overall diameter of conductor | mm |  |  |
| 6.21 | Ultimate strength of conductor | kN |  |  |
| 6.22 | Continuous current rating of conductor at max. ambient temperature and 80° conductor Temperature | A |  |  |
|  | **Note:** The stranded conductor size adequacy shall be determined by calculation. |  |  |  |
|  | **Tubular Conductors** |  |  |  |
| 6.23 | Manufacturer |  |  |  |
| 6.24 | Place of manufacturing |  |  |  |
| 6.25 | Material and alloy type |  | Aluminum alloy |  |
| 6.26 | Outside diameter | mm |  |  |
| 6.27 | Thickness | mm |  |  |
| 6.28 | Weight | kg/m |  |  |
| 6.29 | Max. deflection after installation | mm |  |  |
| 6.30 | Continuous current rating of conductor at max. ambient temperature at and tube Temperature 80 °C | A |  |  |
| 6.31 | Moment of inertia | cm |  |  |
| 6.32 | Minimum yield strength | kg/cm² |  |  |
|  | **Note:** The tubular conductor size adequacy shall be determined by calculation. |  |  |  |
|  | **Shield wires** |  |  |  |
| 6.33 | Manufacturer |  |  |  |
| 6.34 | Place of manufacturing |  |  |  |
| 6.35 | Material |  | Al clad steel |  |
| 6.36 | Cross section | mm² | 58.56 |  |
| 6.37 | Diameter | mm | 9.78 |  |
| 6.38 | Number of strands |  | 7 no.8 |  |
| 6.39 | Resistance (at 20 °C) | ohm/km | 1.463 |  |
| 6.40 | Ultimate strength | kN | 70.76 |  |
| 6.41 | Modulus of elasticity | kg/mm2 | 16000 |  |
| 6.42 | Coefficient of linier expansion | 1/°C | 13\* 10^(−6) |  |
| 6.43 | Aluminium coating thickness | μm |  |  |
|  | **Connectors and Hardware** |  |  |  |
| 6.44 | Manufacturer |  |  |  |
| 6.45 | Place of manufacturing |  |  |  |
| 6.46 | Material of connectors |  |  |  |
| 6.47 | Material of bolts and nuts |  |  |  |
| 6.48 | Material of washers |  |  |  |
| 6.49 | Applicable standard for connectors |  |  |  |
| 6.50 | Type of contact paste |  |  |  |
|  | **Minimum Clearances** (Not applicable for equipment subject to impulse voltage tests ) |  |  |  |
| 6.51 | Clearance between live parts and ground (Basic value ) | mm | 350 |  |
| 6.52 | Clearance between different phases in bays | mm | 1000 |  |
| 6.53 | Minimum Spacing between phases of rigid buses | mm | 1000 |  |
| 6.54 | Minimum height of energized parts above ground | mm | 2850 |  |
| 6.55 | Height of energized parts above access roads | mm | 7500 |  |
| 6.56 | Minimum Distance between over-span phases | mm | 1000 |  |
| 6.57 | Shield wire clearance over bus conductors | mm | 2000 |  |
|  | **33kV Insulators** |  |  |  |
|  | **General** |  |  |  |
| 7.1 | Rated current | A |  |  |
| 7.1.1 | Trans feeders |  | Acc. to SLD |  |
| 7.1.2 | Busbars |  | Acc. to SLD |  |
| 7.1.3 | Diameter |  | N.A |  |
| 7.1.4 | Busbars |  | Acc. to SLD |  |
| 7.1.5 | Reactor feeders |  |  |  |
| 7.2 | Rated frequency | Hz | 50 |  |
| 7.3 | Rated voltage | kV | 36 |  |
| 7.2.1 | Basic insulation level of equipment at site condition | kV peak | 170 |  |
| 7.2.2 | Rated one minute power frequency withstand voltage at site condition | kV rms | 70 |  |
| 7.2.3 | Rated short circuit withstand current and its duration | kA/sec | 25/1 |  |
| 7.4 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? ( Yes / No) | ( Yes / No) | Yes |  |
| 7.5 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | °C | 80 |  |
| 7.6 | Maximum permissible surface gradient | kV/cm | 16 |  |
| 7.7 | Maximum permissible angle for incoming and outgoing overhead lines |  | ±30 |  |
| 7.8 | Ambient condition |  |  |  |
| 7.8.1 | Minimum ambient temperature |  | Acc. to section 1 |  |
| 7.8.2 | Maximum ambient temperature |  | Acc. to section 1 |  |
| 7.8.3 | Solar radiation |  | Acc. to section 1 |  |
| 7.8.4 | Seismic acceleration |  | Acc. to section 1 |  |
| 7.8.5 | Wind speed |  | Acc. to section 1 |  |
| 7.8.6 | Ice thickness |  | Acc. to section 1 |  |
| 7.8.7 | Solar radiation absorption coefficient (ϒ) |  | Acc. to section 1 |  |
| 7.8.8 | Emissivity coefficient in respect to black body (Ke) |  | 0.5 |  |
| 7.9 | Altitude above sea level | m | Acc. to section 1 |  |
| 7.10 | Manufacturer quality system in accordance with ISO 9000 | Yes / No | Yes |  |
| 7.10.1 | Date of issue |  | Latest |  |
| 7.10.2 | Validity |  |  |  |
| 7.10.3 | Certificate attached to the offer | Yes / No | Yes |  |
| 7.11 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | Yes / No | Yes |  |
| 7.11.1 | Certificate to be attached to the offer |  | Yes |  |
|  | **String Insulators** |  |  |  |
| 7.12 | Manufacturer |  |  |  |
| 7.13 | Place of manufacturing |  |  |  |
| 7.14 | Type designation |  | ball & socket |  |
| 7.15 | Applicable standard |  |  |  |
| 7.16 | Insulator material |  | Glazed porcelain |  |
| 7.17 | Color |  |  |  |
| 7.18 | Wet power frequency withstand voltage of each unit | kV | 70 |  |
| 7.19 | Lightning impulse withstand voltage of each unit | kV | 170 |  |
| 7.20 | Electromechanical failing load of each unit | kN | 120 |  |
| 7.21 | Puncture voltage of each unit | kV | 130 |  |
| 7.22 | Minimum creepage distance of each unit | mm | 295 |  |
| 7.23 | Total creepage distance of string | mm | 1256 |  |
| 7.24 | Nominal spacing | mm | 146 |  |
| 7.25 | Protected ( 90 ) creepage distance | mm |  |  |
| 7.26 | Size of ball and socket | mm |  |  |
| 7.27 | IEC coupling ball |  |  |  |
| 7.28 | Material of fittings |  |  |  |
| 7.29 | Minimum quantity of disks per string |  | 5 |  |
| 7.30 | Power frequency withstand voltage of complete String | kV rms |  |  |
| 7.30.1 | Dry |  | 70 |  |
| 7.30.2 | Wet |  |  |  |
| 7.31 | Basic Insulation level of complete string | KV peak |  |  |
| 7.31.1 | Positive |  | 170 |  |
| 7.31.2 | Negative |  |  |  |
| 7.32 | Max. R.I.V. at 1MHz as per CISPR no.1 | μ V |  |  |
| 7.33 | Overall length of string with accessories | mm |  |  |
| 7.34 | Ultimate tensile strength of string | kN |  |  |
| 7.35 | Total weight of string | kg |  |  |
| 7.36 | Whether arcing ring at ground side Provided? (Yes / No) | (Yes / No) | Yes |  |
| 7.37 | Whether corona ring at live side Provided? (Yes / No) | (Yes / No) | Yes |  |
| 7.38 | Arcing distance | mm |  |  |
| 7.39 | Whether washable in service? (Yes / No) | (Yes / No) | Yes |  |
|  | **Note:** The string insulator and each insulator size adequacy shall be determined by calculation. |  |  |  |
|  | **String Insulator Accessories** |  |  |  |
| 7.40 | Manufacturer |  |  |  |
| 7.41 | Place of manufacturing |  |  |  |
| 7.42 | Material |  |  |  |
| 7.43 | Applicable standard |  |  |  |
| 7.44 | Rated ultimate tensile strength | kN |  |  |
|  | **Post Insulators** |  |  |  |
| 7.45 | Manufacturer |  |  |  |
| 7.46 | Place of manufacturing |  |  |  |
| 7.47 | Type designation |  | Post type |  |
| 7.48 | Applicable standard |  |  |  |
| 7.49 | One minute power frequency withstand Voltage (at IEC condition ) | kV rms |  |  |
| 7.49.1 | Dry |  | 70 |  |
| 7.49.2 | Wet |  |  |  |
| 7.48 | Basic Insulation level (at IEC condition) | kV peak | 170 |  |
| 7.49 | Basic Insulation level (at site condition) | kV peak |  |  |
| 7.50 | Switching impulse withstand voltage | kV peak | - |  |
| 7.51 | Color |  |  |  |
| 7.52 | Insulator material |  | Ceramic |  |
| 7.53 | Top metal fitting material |  |  |  |
| 7.54 | Bottom metal fitting material |  |  |  |
| 7.55 | Bonding material |  |  |  |
| 7.56 | Minimum creepage distance | mm | 1256 |  |
| 7.57 | Protected (90) creepage distance | mm |  |  |
| 7.58 | Maximum cantilever working load (complete post insulator) | kN |  |  |
| 7.59 | Minimum cantilever breaking load, upright (complete post insulator) | kN |  |  |
| 7.60 | Minimum torsion strength | kNm |  |  |
| 7.61 | Minimum compression strength | kN |  |  |
| 7.62 | Total height | mm |  |  |
| 7.63 | Arcing distance | mm |  |  |
| 7.64 | Fixing bolts |  |  |  |
| 7.64.1 | Quantity per post insulator |  |  |  |
| 7.64.2 | Diameter |  |  |  |
| 7.65 | Bolt circle diameter (Top / Bottom ) | mm |  |  |
| 7.66 | Total weight | kg |  |  |
| 7.67 | Maximum R.I.V. at 100 KHz | µv | 500 |  |
| 7.68 | Whether washable in service? ( Yes / No) |  |  |  |
| 7.69 | Maximum weight of one package ready for Shipment | kg |  |  |
| 7.70 | Whether corona ring at live side Provided? (Yes / No) |  | Yes |  |
| 7.71 | Number of units in complete post insulator |  |  |  |
| 7.72 | Length of each unit | mm |  |  |
|  | **Note:** The post insulator size adequacy shall be determined by calculation. |  |  |  |
|  | **Connectors and Hardware** |  |  |  |
| 7.73 | Manufacturer |  |  |  |
| 7.74 | Place of manufacturing |  |  |  |
| 7.75 | Material of connectors |  |  |  |
| 7.76 | Material of bolts and nuts |  |  |  |
| 7.77 | Material of washers |  |  |  |
| 7.78 | Applicable standard for connectors |  |  |  |
| 7.79 | Type of contact paste |  |  |  |
|  | **Minimum Clearances** (Not applicable for equipment subject to impulse voltage tests ) |  |  |  |
| 7.80 | Height of base of post insulator from ground | mm | 2500 |  |
| 7.81 | Clearance between live parts and ground (Basic value ) | mm | 350 |  |
| 7.82 | Minimum height of energized parts above ground | mm | 2850 |  |
| 7.83 | Height of energized parts above access roads | mm | 7500 |  |
|  | 33kV SURGE ARRESTERS |  |  |  |
|  | **General** |  |  |  |
| 8.1 | Manufacturer of surge arrester: |  |  |  |
| 8.1.1 | Name |  |  |  |
| 8.1.2 | Country |  |  |  |
| 8.2 | Manufacturer of surge counter: |  |  |  |
| 8.2.1 | Name |  |  |  |
| 8.2.2 | Country |  |  |  |
| 8.3 | Type designation for surge arresters |  |  |  |
| 8.4 | Type designation for surge counter (equipped with leakage current measuring device ) |  |  |  |
| 8.5 | Applicable standard |  | IEC 60099-4 |  |
| 8.6 | Rated frequency | Hz | 50 |  |
| 8.7 | Nominal line to line voltage rating | kV | 36 |  |
| 8.8 | Type |  | MOA |  |
| 8.9 | Class of surge arrester |  | Very Heavy |  |
| 8.10 | Maximum and Minimum ambient temperature for design | °C | Acc. to section 1 |  |
| 8.11 | Altitude above sea level | m | Acc. to section 1 |  |
| 8.12 | Design seismic acceleration | g | Acc. to section 1 |  |
| 8.13 | Ice thickness | mm | Acc. to section 1 |  |
| 8.14 | Wind velocity | m/s | Acc. to section 1 |  |
| 8.15 | Maximum overvoltage factor on the system due to any switching duty | pu | 2.3 |  |
| 8.16 | Whether withstanding in load combinations of earthquake , wind , short circuit, as mentioned In Technical Specification? | (Yes / No ) | Yes |  |
|  | **Surge Arresters** |  |  |  |
| 8.17 | Rated voltage | kV rms | 30 |  |
| 8.18 | Continuous operating voltage | kV rms | 24 |  |
| 8.19 | Long duration discharge class as per IEC 99-1 | Class | 2 |  |
| 8.20 | Number of phases |  | 3 |  |
| 8.21 | Type of system earthing |  | Solid |  |
| 8.22 | Nominal discharge current with 8/20 us wave | kA peak | 10 |  |
| 823 | Arrester designation |  | SL |  |
| 8.24 | Type of housing in the case of utilizing porcelain and its classification acc to Std. 60672 |  | Brown glazed Aluminum porcelain class C130 |  |
| 8.25 | Type of housing in the case of utilizing composite polymer and its resistance classification acc to IEC 60587 |  | Silicon rubber (LSR,HCR or RTV type) class 3.4 |  |
| 8.26 | Earth fault factor |  | 1.4 |  |
| 8.27 | Place of installation |  | Line/Transformer/GIS Feeders |  |
| 8.28 | Pressure relief class |  |  |  |
| 8.28.1 | High current 0.2 sec | kA | 50 |  |
| 8.28.2 | Low current 1 sec |  | 600±200 |  |
| 8.29 | Thermal energy rating (Wth) | (kJ / kV) of  U rated | > 10 |  |
| 8.30 | Repetitive charge transfer rating (Qrs) | C | > 2.4 |  |
| 8.31 | Reference voltage | kV rms |  |  |
| 8.32 | Reference current | mA |  |  |
| 8.33 | TOV capability for |  |  |  |
| 8.33.1 | 1 sec | kV | Acc. to IEC 60099-3 |  |
| 8.33.2 | 10 sec | kV | Acc. to IEC 60099-3 |  |
| 8.34 | Continuous current under ambient temperature | mA |  |  |
| 8.35 | Maximum residual voltage for lightning impulse current with 8/20 microsecond wave for following impulse peaks |  |  |  |
| 8.35.1 | Switching surges-1kA/2kA | kV peak | Acc. to IEC 60099-3 |  |
| 8.35.2 | 5 KA | kV peak | Acc. to IEC 60099-3 |  |
| 8.35.3 | 10 KA | kV peak | Acc. to IEC 60099-3 |  |
| 8.35.4 | 20 KA | kV peak | Acc. to IEC 60099-3 |  |
| 8.36 | Maximum residual voltage for switching impulse current with 30/60 microsecond wave for following impulse peaks |  |  |  |
| 8.36.1 | 500 A | kV peak | Acc. to IEC 60099-3 |  |
| 8.36.2 | 1 KA | kV peak | Acc. to IEC 60099-3 |  |
| 8.36.3 | 2 KA | kV peak | Acc. to IEC 60099-3 |  |
| 8.37 | Maximum residual voltage for steep current impulse with 1/20 microsecond wave and 10 KA peak | kV peak |  |  |
| 8.38 | High current 4/10 microsecond impulse withstand level | kA peak | Acc. to IEC 60099-3 |  |
| 8.39 | Low current 2000 microsecond withstand level | kA peak | Acc. to IEC 60099-3 |  |
| 8.40 | Number of arrester units |  |  |  |
| 8.41 | Rated voltage of each arrester unit | kV rms |  |  |
| 8.42 | Number of parallel non linear MO resistance block |  | 1 |  |
| 8.43 | Power frequency voltage versustime characteristics included? | (Yes/No) |  |  |
| 8.44 | Maximum internal partial discharge | pC | Acc. to IEC 60099 |  |
| 8.45 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 8.45.1 | Date of issue |  | Latest |  |
| 8.45.2 | Validity |  |  |  |
| 8.45.3 | Certificate attached to the offer | Yes/No | Yes |  |
| 8.46 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | Yes/No | Yes |  |
| 8.46.1 | Certificate to be attached to the offer | Yes/No | Yes |  |
| 8.46.2 | Report to be attached to the offer | Yes/No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 8.47 | Insulator |  |  |  |
| 8.47.1 | Manufacturer |  |  |  |
| 8.47.2 | Country |  |  |  |
| 8.47.3 | Type |  |  |  |
| 8.47.4 | Material |  |  |  |
| 8.48 | Creepage distance of insulator | mm | 1256 |  |
| 8.49 | Basic insulation level of insulator at site condition | kV peak | 1.3\*LIPL |  |
| 8.50 | One minute power frequency withstand voltage of insulator at site condition | kV rms | 1.06\*SIWL/ √2 |  |
| 8.51 | Switching Impulse withstand voltage of insulator at site condition | kV peak | 1.25\*SIWL |  |
| 8.52 | Filling medium |  |  |  |
| 8.53 | Method used for sealing test |  |  |  |
| 8.54 | Whether washable in service (Yes/ No) | (Yes/ No) | Yes |  |
| 8.55 | Permissible force at MV terminals |  |  |  |
| 8.55.1 | Static Horizontal | N |  |  |
| 8.55.2 | Static Vertical | N |  |  |
| 8.55.3 | Dynamic Horizontal | N |  |  |
| 8.55.4 | Dynamic vertical | N |  |  |
| 8.56 | Whether isolating pads for surge arresters with surge counter provided? (Yes/No) | (Yes/ No) | Yes, separated |  |
| 8.57 | Non Linear MO resistor |  |  |  |
| 8.57.1 | Manufacturer |  |  |  |
| 8.57.2 | Country |  |  |  |
| 8.57.3 | Type |  |  |  |
| 8.58 | Dimension of each non-linear MO resistance block |  |  |  |
| 8.58.1 | Diameter | mm |  |  |
| 8.58.2 | Height | mm |  |  |
| 8.59 | Total weight of single unit | kg |  |  |
| 8.60 | Total weight of complete surge arrester | kg |  |  |
| 8.61 | Total height of surge arrester | mm |  |  |
| 8.62 | Total width of surge arrester | mm |  |  |
| 8.63 | Whether grading ring for high voltage terminal required? | (Yes/ No) | Yes |  |
| 8.64 | Maximum Package weight ready for shipment | kg |  |  |

d) 132/33KV POWER TRANSFORMERS (AIS-AIS)

| 1. 132/33KV POWER TRANSFORMERS (AIS-AIS) | | **UNIT** | **Data** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **REQUIRED** | | | | **OFFERED** | | | | |
| **1** | **Substation name** |  | NAROK  SUBSTATION | | | |  | | | | |
| **2** | **Manufacture name & country** |  | Should be Proposed By Tenderer | | | |  | | | | |
| **3** | **Type designation** |  | Should be Proposed By Tenderer | | | |  | | | | |
| **4** | **Type of transformers** |  | Two Windings | | | |  | | | | |
| 4.1 | Auto or separate windings |  | Separate | | | |  | | | | |
| 4.2 | Shell or core |  | Core | | | |  | | | | |
| 4.3 | Indoor or outdoor |  | Outdoor | | | |  | | | | |
| 4.4 | Three phases or single phases units |  | Three phase | | | |  | | | | |
| **5** | **Type of cooling acc. to IEC** |  |  | | | |  | | | | |
| 5.1 | First stage |  | ONAN | | | |  | | | | |
| 5.2 | Second stage |  | ONAF | | | |  | | | | |
| 5.3 | Third stage |  | - | | | |  | | | | |
| **6** | **Rated frequency** | Hz | 50 | | | |  | | | | |
| **7** | **Rated voltage** |  |  | | | |  | | | | |
| 7.1 | HV | kVrms | 132 | | | |  | | | | |
| 7.2 | LV | kVrms | 33 | | | |  | | | | |
| **8** | **Continuous power rating at principle tap** |  |  | | | |  | | | | |
| 8.1 | Type |  | ONAN/ONAF | | | |  | | | | |
| 8.2 | Nominal power rating at site conditions | MVA | 23 | | | |  | | | | |
| 8.3 | At first stage of cooling: |  |  | | | |  | | | | |
| 8.3.1 | HV winding | MVA | 18 | | | |  | | | | |
| 8.3.2 | LV winding | MVA | 18 | | | |  | | | | |
| 8.4 | At second stage of cooling: |  |  | | | |  | | | | |
| 8.4.1 | HV winding | MVA | 23 | | | |  | | | | |
| 8.4.2 | LV winding | MVA | 23 | | | |  | | | | |
| **9** | **Maximum temperature rise at rated power outputs corrected for altitude & ambient temperature of site** |  |  | | | |  | | | | |
| 9.1 | Top oil | °C | 56 | | | |  | | | | |
| 9.2 | Winding | °C | 61 | | | |  | | | | |
| 9.3 | Hottest spot | °C | 74 | | | |  | | | | |
| **10** | **Off load tap changer** |  | N.A | | | |  | | | | |
| 10.1 | Type |  | ----- | | | |  | | | | |
| 10.2 | Manufacture |  | ----- | | | |  | | | | |
| 10.3 | Rated current | Arms | ----- | | | |  | | | | |
| 10.4 | Total range | % | ----- | | | |  | | | | |
| 10.5 | Total number of steps |  | ----- | | | |  | | | | |
| 10.6 | Variation per step | % | ----- | | | |  | | | | |
| 10.7 | Position to tapings (winding) |  | ----- | | | |  | | | | |
| **11** | **On load tap changer** |  |  | | | |  | | | | |
| 11.1 | Type |  | On-load | | | |  | | | | |
| 11.1.1 | Resistor/reactor |  | Resistor | | | |  | | | | |
| 11.1.2 | In tank/ out of tank |  | In Tank | | | |  | | | | |
| 11.1.3 | Vacuum or oil |  | Vacuum | | | |  | | | | |
| 11.2 | Manufacturer |  | MR | | | |  | | | | |
| 11.3 | Country of manufacturer |  | Should be Proposed By Tenderer | | | |  | | | | |
| 11.4 | Standards |  | IEC 60214 | | | |  | | | | |
| 11.5 | Number of phases |  | 3 | | | |  | | | | |
| 11.6 | Arrangement of tapping (linear, coarse/fine, reversing) |  | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.7 | Rated current | Arms | Min (140) | | | |  | | | | |
| 11.8 | Rated step voltage | Vrms | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.9 | Rated switching capacity | kVA | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.10. | Rated short circuit withstand current | kArms | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.11 | Rated short circuit duration | sec | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.12 | Total range | % | ±13.36 | | | |  | | | | |
| 11.13 | Total number of steps |  | ±8(1.67%)  steps | | | |  | | | | |
| 11.14 | Variation per step | V | 2200 | | | |  | | | | |
| 11.15 | Principle Tap Position |  | 9 | | | |  | | | | |
| 11.16 | Insulation level |  | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.16.1 | Voltage class | kVrms | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.16.2 | Highest voltage for equipment | kVrms | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.16.3 | BIL to ground | kVpeak | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.16.4 | BIL between diverter switch contacts | kVpeak | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.16.5 | BIL across regulating winding | kVpeak | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.17 | OLTC protection system |  | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.17.1 | Is oil flow relay required? If so, type and manufacturer |  | Required | | | |  | | | | |
| 11.17.2 | Is pressure relief device required? If so, type and manufacturer |  | Required | | | |  | | | | |
| 11.17.3 | Over pressure relay type and manufacturer |  | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.17.4 | Other protection device type & manufacturer |  | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.18 | Rated voltage of drive system | V | 415/240 | | | |  | | | | |
| 11.19 | Rated voltage of control circuit | V | 110 | | | |  | | | | |
| 11.20. | All features, controls, alarms and interlocks as called for provide | Yes/No | Yes | | | |  | | | | |
| 11.21 | Whether remote control cubicle included in scope of work | Yes/No | Yes | | | |  | | | | |
| 11.22 | Whether AVR required? | Yes/No | Yes | | | |  | | | | |
| 11.23 | Type of AVR |  | Should be Proposed By Manufacturer | | | |  | | | | |
| 11.24 | Full description of remote OLTC control included | Yes/No | Yes | | | |  | | | | |
| 11.25 | Parallel operation control required for number of transformers |  | 2 | | | |  | | | | |
| 11.26 | Method of parallel control |  | Acc. to Specifications | | | |  | | | | |
| 11.26.1 | Master /follower |  |  | | | |  | | | | |
| 11.26.2 | Min circulating current |  |  | | | |  | | | | |
| 11.26.3 | Reverse reactance method |  |  | | | |  | | | | |
| 11.27 | Is line drop compensation required? | Yes/No | Yes | | | |  | | | | |
| 11.28 | Tap position output type |  | BCD/mA/Ohm/Contact | | | |  | | | | |
| **12** | **Vector group** |  | Dyn1 | | | |  | | | | |
| **13** | **Impedance** |  |  | | | |  | | | | |
|  | On the base of rated power of main windings | MVA | 23 | | | |  | | | | |
| 13.1 | Positive sequence impedance at 75 ̊C, on principal tapping and on: |  |  | | | |  | | | | |
| 13.1.1 | Between HV & LV winding | % | 9.57 | | | |  | | | | |
| 13.1.2 | Between HV & TV winding (if applicable) | % | Should be Filled By Manufacturer | | | |  | | | | |
| 13.1.3 | Between LV & TV winding (if applicable) | % | Should be Filled By Manufacturer | | | |  | | | | |
| 13.2 | Positive sequence impedance at 75 ̊C, on max. raise voltage and on: |  |  | | | |  | | | | |
| 13.2.1 | Between HV & LV windings | % | 10.16 | | | |  | | | | |
| 13.2.2 | Between HV & TV winding (if applicable) | % | Should be Filled By Manufacturer | | | |  | | | | |
| 13.2.3 | Between LV & TV winding (if applicable) | % | Should be Filled By Manufacturer | | | |  | | | | |
| 13.3 | Positive sequence impedance at 75 ̊C, on max. lower voltage and on: |  |  | | | |  | | | | |
| 13.3.1 | Between HV & LV windings | % | 9.81 | | | |  | | | | |
| 13.3.2 | Between HV & TV winding (if applicable) | % | Should be Filled By Manufacturer | | | |  | | | | |
| 13.3.3 | Between LV & TV winding (if applicable) | % | Should be Filled By Manufacturer | | | |  | | | | |
| 13.4 | Zero sequence impedance at 75 ̊C: |  |  | | | |  | | | | |
| 13.4.1 | Between HV & LV windings (LV open) | Ohm/ph. | Should be Filled By Manufacturer | | | |  | | | | |
| 13.4.2 | Between HV & LV windings (LV short) | Ohm/ph. | Should be Filled By Manufacturer | | | |  | | | | |
| 13.4.3 | Between LV & HV windings (HV open) | Ohm/ph. | Should be Filled By Manufacturer | | | |  | | | | |
| 13.4.4 | Between LV & HV windings (HV short) | Ohm/ph. | Should be Filled By Manufacturer | | | |  | | | | |
| 13.5 | Resistance of windings at 75 ̊C on principal tapping: |  |  | | | |  | | | | |
| 13.5.1 | HV | Ohm/ph. | Should be Filled By Manufacturer | | | |  | | | | |
| 13.5.2 | LV | Ohm/ph. | Should be Filled By Manufacturer | | | |  | | | | |
| 13.6 | Estimated winding capacitance's with: |  | Should be Filled By Manufacturer | | | |  | | | | |
| 13.6.1 | Series capacitance of HV phase winding | PF |  | | | |  | | | | |
| 13.6.2 | Series capacitance of LV phase winding | PF |  | | | |  | | | | |
| 13.6.3 | Shunt capacitance to earth of each HV phase winding with LV unearthed | PF |  | | | |  | | | | |
| 13.6.4 | Shunt capacitance to earth of each LV phase winding with HV unearthed | PF |  | | | |  | | | | |
| 13.6.5 | Capacitance of HV-LV phase winding with LV unearthed | PF |  | | | |  | | | | |
| **14** | **Rated short circuit strength of windings (symmetrical values)** |  | Should be Filled By Manufacturer | | | |  | | | | |
| 14.1 | HV system Indicate 1 and 3 phase | kA/kA | 31.5 | | | |  | | | | |
| 14.2 | LV system Indicate 1 and 3 phase | kA/kA | 25 | | | |  | | | | |
| 14.3 | Short circuit duration | sec | 2 | | | |  | | | | |
| 14.4 | Short circuit calculation will be submitted after award of contract | Yes/No | Yes | | | |  | | | | |
| **15** | **Insulation levels** |  |  | | | |  | | | | |
| 15.1 | Lightning impulse withstand voltages: |  |  | | | |  | | | | |
| 15.1.1 | HV winding/bushing | kVpeak / kVpeak | 650 | | | |  | | | | |
| 15.1.2 | LV winding/bushing | kVpeak / kVpeak | 200 | | | |  | | | | |
| 15.1.3 | Neutral end winding/bushing | kVpeak / kVpeak | 145 | | | |  | | | | |
| 15.2 | Switching impulse withstand voltages: |  |  | | | |  | | | | |
| 15.2.1 | HV winding/bushing | kVpeak / kVpeak | N.A | | | |  | | | | |
| 15.2.2 | LV winding/bushing | kVpeak / kVpeak | N.A | | | |  | | | | |
| 15.2.3 | Neutral end winding/bushing | kVpeak / kVpeak | N.A | | | |  | | | | |
| 15.3 | One minute power frequency withstand voltages: |  |  | | | |  | | | | |
| 15.3.1 | HV winding/bushing | kVrms / kVrms | 275 | | | |  | | | | |
| 15.3.2 | LV winding/bushing | kVrms / kVrms | 70 | | | |  | | | | |
| 15.3.3 | Neutral end winding/bushing | kVrms / kVrms | 50 | | | |  | | | | |
| 15.4 | Partial discharge measurement: |  |  | | | |  | | | | |
| 15.4.1 | Standard |  | IEC 60270 | | | |  | | | | |
| 15.4.2 | Test method |  | IVPD | | | |  | | | | |
| 15.4.3 | Long duration induced voltage | kVrms | Acc. to IEC 60076-3 | | | |  | | | | |
| 15.4.4 | Enhancement voltage level | kVrms | Acc. to IEC 60076-3 | | | |  | | | | |
| 15.4.5 | Maximum allowable partial discharge | pC | Acc. to IEC 60076-3 | | | |  | | | | |
| **16** | **Bushing data** |  | HV | LV | TV | N | HV | | LV | TV | N |
| 16.1 | Manufacturer & country |  |  |  |  |  |  | |  |  |  |
| 16.2 | Type (OIP/RIP/RBP/...) |  | OIP | OIP | - | OIP |  | |  |  |  |
| 16.3 | Rated service voltage | kV | 132 | 33 | - | 24 |  | |  |  |  |
| 16.4 | Nominal current rating | A | 140 | 560 | - | 2000 |  | |  |  |  |
| 16.5 | Rated short circuit current | kA | 31.5 | 25 | - | 25 |  | |  |  |  |
| 16.6 | Rated thermal short time current duration | sec | 2 | 2 | - | 2 |  | |  |  |  |
| 16.7 | Power frequency withstand voltage (complete with all fittings) | kV | 275 | 70 | - | 50 |  | |  |  |  |
| 16.8 | Radio influence voltage level measured at 1.1 rated system voltage at 1MHz | microV | 2500 | | | |  | |  |  |  |
| 16.9 | Is test tap required? | Yes/No | Yes | No | - | No |  | |  |  |  |
| 16.10. | Quantity of oil per bushing | liters | Acc. to Manufacturer Data | Acc. to Manufacturer Data | - | Acc. to Manufacturer Data |  | |  |  |  |
| 16.11 | Type of internal insulation (oil impregnated/resin type) |  | Oil Impregnated | Oil Impregnated | - | Acc. to Manufacturer Data |  | |  |  |  |
| 16.12 | Equipped with magnetic oil indicator (in case of oil type) | Yes/No | Yes | No | - | No |  | |  |  |  |
| 16.13 | Creepage distance | mm | 4495 | 1116 | - | >900 |  | |  |  |  |
| 16.14 | Protected creepage distance | mm | Acc. to Manufacturer Data | Acc. to Manufacturer Data | - | Acc. to Manufacturer Data |  | |  |  |  |
| 16.15 | Loss angle (insulation power factor) at working Voltage |  | Acc. to Manufacturer Data | Acc. to Manufacturer Data | - | Acc. to Manufacturer Data |  | |  |  |  |
| 16.16 | Electrostatic capacity of complete bushing | PF | Acc. to Manufacturer Data | Acc. to Manufacturer Data | - | Acc. to Manufacturer Data |  | |  |  |  |
| 16.17 | Cantilever load class (Acc to IEC 60137) |  | Level II | Level II | - | Level II |  | |  |  |  |
| 16.18 | Max. mechanical forces |  | Acc. to Buswork Calc. | Acc. to Buswork Calc. | - | Acc. to Buswork Calc. |  | |  |  |  |
|  | Static, horizontal | N |  |  |  |  |  | |  |  |  |
| Static, vertical | N |  |  |  |  |  | |  |  |  |
| Dynamic, horizontal | N |  |  |  |  |  | |  |  |  |
| Dynamic, vertical | N |  |  |  |  |  | |  |  |  |
| 16.19 | Min. corona inception voltage | kV |  |  |  |  |  | |  |  |  |
| 16.20. | Washable in service | Yes/No | Yes | Yes | - | Yes |  | |  |  |  |
| 16.21 | Terminal leads full insulated at factory | Yes/No | Yes | Yes | - | Yes |  | |  |  |  |
| 16.22 | Bushing can be removed/ installed | Yes/No | Yes | Yes | - | Yes |  | |  |  |  |
| 16.23 | Bushing can be interchanged with spares | Yes/No | Yes | Yes | - | Yes |  | |  |  |  |
| 16.24 | Maximum external diameter of ring type current transformer which can be accommodated | mm | Acc. to Manufacturer Data | Acc. to Manufacturer Data | - | Acc. to Manufacturer Data |  | |  |  |  |
| 16.25 | Minimum external diameter of ring type current transformer which can be accommodated | mm | Acc. to Manufacturer Data | Acc. to Manufacturer Data | - | Acc. to Manufacturer Data |  | |  |  |  |
| **17** | **Bushing type current transformer** |  |  | | | | |  | | | |
| 17.1 | Fully complies with requirement | Yes/No | Yes | | | | |  | | | |
| 17.2 | Number of cores (HV,LV,HV-N,LV-N,TV) |  | Acc to PSLD | | | | |  | | | |
| 17.3 | Specification |  | Acc to PSLD | | | | |  | | | |
| 17.4 | Ratio accuracy class and burdens will be selected acc to owner request during design review | Yes/No | Yes | | | | |  | | | |
| 17.5 | Test conductor (winding) will be provided | Yes/No | Yes | | | | |  | | | |
| **18** | **Losses** |  |  | | | | |  | | | |
| 18.1 | No load losses at 75 ºC, rated frequency and rated voltage on principal tapping | kW | Max. 12 | | | | |  | | | |
| 18.2 | Load losses at rated frequency, 75 ºC And rated current on principal tapping: | kW | Max 100 | | | | |  | | | |
| 18.2.1 | At first stage of cooling |  | Should be Filled By Tenderer | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.2.2 | At second stage of cooling |  | Should be Filled By Tenderer | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.2.3 | At third stage of cooling |  |  | | | | |  | | | |
| a | HV/LV | kW | Max. 60 kW (RI2 Losses: 50 kW, Stray Losses: 10 kW) | | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | | |  | | | |
| 18.3 | Load losses at 75ْ C and max. raise Voltage tapping: |  | Should be Filled By Tenderer | | | | |  | | | |
| 18.3.1 | At first stage of cooling |  |  | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.3.2 | At second stage of cooling |  | Should be Filled By Tenderer | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.3.3 | At third stage of cooling |  | Should be Filled By Tenderer | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.4 | Load losses at 75ْ C and max. lower voltage tapping: |  | Should be Filled By Tenderer | | | | |  | | | |
| 18.4.1 | At first stage of cooling |  |  | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.4.2 | At second stage of cooling |  |  | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.4.3 | At third stage of cooling |  |  | | | | |  | | | |
| a | HV/LV | kW |  | | | | |  | | | |
| b | HV/TV (if applicable) | kW |  | | | | |  | | | |
| c | LV/TV (if applicable) | kW |  | | | | |  | | | |
| 18.5 | Cooling plant losses at ONAF/OFAF rating | kW | Max. 2 | | | | |  | | | |
| **19** | **Efficiency at winding temperature of 75ْ C & PF=1** |  |  | | | | |  | | | |
| 19.1 | At ONAN rating, full load, ¾ full load, ½ full load | % | 9000 | | | | |  | | | |
| 19.2 | At ONAF rating, full load, ¾ full load, ½ full load (ONAF1) | % | 4000 | | | | |  | | | |
| 19.3 | At OFAF rating, full load, ¾ full load, ½ full load (ONAF2) | % | Should be Filled By Tenderer | | | | |  | | | |
| **20** | **Cooling system data** |  |  | | | | |  | | | |
| 20.1 | ONAF system |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.1 | Number of coolers or cooler banks |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.2 | Number of radiator units in each bank |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.3 | Manufacturer and type of radiators |  | painted | | | | |  | | | |
| 20.1.4 | Number of fans |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.5 | Make and type of fans |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.6 | Capacity of each fan | kW | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.7 | Rated operating voltage | Vrms | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.8 | Three phase or single phase |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.9 | Starting current of each | Arms | Should be Filled By Tenderer | | | | |  | | | |
| 20.1.10 | Efficiency of each fan | % | Should be Filled By Tenderer | | | | |  | | | |
| 20.2 | OFAF system |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.1 | Number of pumps |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.2 | Manufacturer and type of pumps |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.3 | Capacity of each pumps | HP | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.4 | Rated operating voltage of pumps | Vrms | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.5 | Three phase or single phase |  | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.6 | Starting current of each | Arms | Should be Filled By Tenderer | | | | |  | | | |
| 20.2.7 | Efficiency of each pump | % | Should be Filled By Tenderer | | | | |  | | | |
| **21** | **Capability of transformer to remain in operation from hot condition without Injurious heating at rated full load in case of failure of:** |  | Should be Filled By Tenderer | | | | |  | | | |
| 21.1 | 50% of air forced cooling | Minute |  | | | | |  | | | |
| 21.2 | 100% of air forced cooling | Minute |  | | | | |  | | | |
| 21.3 | All of air and oil forced cooling | Minute |  | | | | |  | | | |
| 21.4 | Condition of injurious heating (hot spot temp.) | °C |  | | | | |  | | | |
| **22** | **Exciting current** |  | Should be Filled By Tenderer | | | | |  | | | |
| 22.1 | At rated voltage when excited from HV side | Arms |  | | | | |  | | | |
| 22.2 | At 110% rated voltage when excited from HV side | Arms |  | | | | |  | | | |
| **23** | **Core and winding data** |  | Should be Filled By Tenderer | | | | |  | | | |
| 23.1 | Three limb/ five limb |  |  | | | | |  | | | |
| 23.2 | Type of core stacking |  | Step Lap | | | | |  | | | |
| 23.3 | Type of steel core lamination |  | Should be Filled By Tenderer | | | | |  | | | |
| 23.4 | Manufactures of steel core material |  |  | | | | |  | | | |
| 23.5 | Thickness of steel core lamination | mm | <0.3 | | | | |  | | | |
| 23.6 | Flux density of core on principal tap |  |  | | | | |  | | | |
| 23.6.1 | At rated HV voltage | Wb/m2 |  | | | | |  | | | |
| 23.6.2 | At 110% rated HV voltage | Wb/m2 |  | | | | |  | | | |
| 23.7 | Main limb/yoke cross section | cm2/cm2 |  | | | | |  | | | |
| 23.8. | Types and arrangement of winding |  |  | | | | |  | | | |
| 23.8.1 | HV winding |  |  | | | | |  | | | |
| 23.8.2 | LV winding |  |  | | | | |  | | | |
| 23.8.3 | TV winding |  |  | | | | |  | | | |
| 23.9 | Winding arrangement |  |  | | | | |  | | | |
| 23.10 | Current density at rated power and voltage |  |  | | | | |  | | | |
| 23.10.1 | HV winding | A/mm2 |  | | | | |  | | | |
| 23.10.2 | LV winding | A/mm2 |  | | | | |  | | | |
| 23.10.3 | TV winding | A/mm2 |  | | | | |  | | | |
| 23.10.4 | Tap winding | A/mm2 |  | | | | |  | | | |
| 23.11 | Insulation of core |  |  | | | | |  | | | |
| 23.11.1 | Lamination |  |  | | | | |  | | | |
| 23.11.2 | Core bolts |  |  | | | | |  | | | |
| 23.11.3 | Strapping |  |  | | | | |  | | | |
| 23.12 | Type of Insulation of winding (uniform/graded) |  |  | | | | |  | | | |
| 23.12.1 | HV |  | Graded | | | | |  | | | |
| 23.12.2 | LV |  | Uniform | | | | |  | | | |
| 23.12.3 | TV |  | Uniform | | | | |  | | | |
| 23.13 | Insulation material |  |  | | | | |  | | | |
| 23.13.1 | Turn insulation HV/LV |  |  | | | | |  | | | |
| 23.13.2 | Between windings HV/LV |  |  | | | | |  | | | |
| 23.13.3 | Between core and LV side |  |  | | | | |  | | | |
| 23.13.4 | Between laminations |  |  | | | | |  | | | |
| 23.13.5 | Core bolts |  |  | | | | |  | | | |
| 23.13.6 | Core bolts washers |  |  | | | | |  | | | |
| 23.13.7 | Side plates |  |  | | | | |  | | | |
| 23.13.8 | Core lamination |  |  | | | | |  | | | |
| 23.13.9 | Tapping |  |  | | | | |  | | | |
| 23.13.10 | Tapping connections |  |  | | | | |  | | | |
| **24** | **Calculated thermal time constant** |  | Should be Filled By Tenderer | | | | |  | | | |
| 24.1 | Natural cooling | sec |  | | | | |  | | | |
| 24.2 | Forced cooling | sec |  | | | | |  | | | |
| **25** | **Tank** |  | Should be Filled By Tenderer | | | | |  | | | |
| 25.1 | Tank design conventional/bell shaped |  | Conventional | | | | |  | | | |
| 25.2 | Thickness of transformer plates: |  |  | | | | |  | | | |
| 25.2.1 | Cover of tank | mm |  | | | | |  | | | |
| 25.2.2 | Sides | mm |  | | | | |  | | | |
| 25.2.3 | Bottom | mm |  | | | | |  | | | |
| 25.2.4 | Conservator | mm |  | | | | |  | | | |
| 25.2.5 | Radiator plates | mm |  | | | | |  | | | |
| **26** | **Vacuum withstand capability** |  | Should be Filled By Tenderer | | | | |  | | | |
| 26.1 | Tank | mm Hg |  | | | | |  | | | |
| 26.2 | Radiators | mm Hg |  | | | | |  | | | |
| 26.3 | Conservator | mm Hg |  | | | | |  | | | |
| 26.4 | Positive pressure withstand capability for complete Transformer | mm Hg |  | | | | |  | | | |
| **27** | **Oil** |  |  | | | | |  | | | |
| 27.1 | Manufacture |  | Shell | | | | |  | | | |
| 27.2 | Type designation |  | Diala S4 ZX-I | | | | |  | | | |
| 27.3 | Oil preservation system |  | Air-bag | | | | |  | | | |
| 27.4 | Country of manufacture |  |  | | | | |  | | | |
| 27.5 | Naphthenic or Paraphenic based oil |  | Naphthenic | | | | |  | | | |
| 27.6 | Type – inhibited/ trace inhibited/ non-inhibited |  | non-inhibited | | | | |  | | | |
| 27.7 | Details of inhibitor |  | By manufacturer | | | | |  | | | |
| 27.8 | Details of passivators |  | By manufacturer | | | | |  | | | |
| 27.9 | Viscosity at 40 °C (Acc. to ISO 3104) | mm2/s | Max. 12 | | | | |  | | | |
| 27.10 | Viscosity at –30 °C (Acc. to ISO 3104) | mm2/s | Max. 1800 | | | | |  | | | |
| 27.11 | Pour point (Acc. To ISO 3016) | °C | Max. -40 | | | | |  | | | |
| 27.12 | Water content (Acc. To IEC 60814) | mg/kg | Max. 40 for delivery in drums (IBC) | | | | |  | | | |
| 27.13 | Breakdown voltage (Acc. To IEC 60156) |  |  | | | | |  | | | |
| 27.13.1 | As delivered | kV | Min. 30 | | | | |  | | | |
| 27.13.2 | After laboratory treatment | kV | Min. 70 | | | | |  | | | |
| 27.14 | Density at 20 °C (Acc. To ISO3675 or ISO12185) | g/ml | Max. 0.895 | | | | |  | | | |
| 27.15 | DDF at 90 °C (Acc. To IEC 60247 / IEC 61620) |  | Max. 0.005 | | | | |  | | | |
| 27.16 | Appearance |  | Clear, free from sediment and suspended matter | | | | |  | | | |
| 27.17 | Acidity (Acc. To IEC 62021-1 / IEC 62021-2) | mg KOH/g | Max. 0.01 | | | | |  | | | |
| 27.18 | Interfacial tension  (Acc. To EN 14210/ASTM D971) | mN/m | Min. 40 | | | | |  | | | |
| 27.19 | Total Sulphur content  (Acc. To IP 373 / ISO 14596) | % | Max. 0.05 | | | | |  | | | |
| 27.20 | Corrosive Sulphur (Acc. To DIN 51353) |  | Not corrosive | | | | |  | | | |
| 27.21 | Copper Corrosion (Acc. To IEC 62535) |  | Not corrosive | | | | |  | | | |
| 27.22 | Potentially corrosive Sulphur  (Acc. To IEC 62535) |  | Not corrosive | | | | |  | | | |
| 27.23 | DBDS (Acc. To IEC 62697-1) | mg/kg | Not detectable ( <5 ) | | | | |  | | | |
| 27.24 | Inhibitors of IEC 60666  (Acc. To IEC 60666) | % | (U) uninhibited oil  (Max. 0.01) | | | | |  | | | |
| 27.25 | Metal passivator additivesof IEC 60666 | mg/kg | Max. 5 | | | | |  | | | |
| 27.26 | 2-Furfural and related compounds content (Acc. To IEC 61198) | mg/kg | Max. 0.05 (for each individual compound) | | | | |  | | | |
| 27.27 | Oxidation stability (Acc. To IEC 61125:1992 (Method C)) |  |  | | | | |  | | | |
| 27.27.1 | Test duration (for uninhibited oil) | h | 164 | | | | |  | | | |
| 27.27.2 | Total acidity  (Acc. To 1.9.4 of IEC 61125:1992) | mg KOH/g | Max. 1.2 | | | | |  | | | |
| 27.27.3 | Sludge (Acc. To 1.9.1 of IEC 61125:1992) | % | Max. 0.80 | | | | |  | | | |
| 27.27.4 | DDF at 90 °C  (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247) |  | Max. 0.50 | | | | |  | | | |
| 27.28 | Flash point (Acc. To ISO 2719) | °C | Min. 135 | | | | |  | | | |
| 27.29 | PCA content (Acc. To IP 346) | % | Max. 3 | | | | |  | | | |
| 27.30 | PCB content (Acc. To IEC 61619) | mg/kg | Not detectable (Max. 2) | | | | |  | | | |
| 27.31 | Quantity of oil |  |  | | | | |  | | | |
| 27.31.1 | Main tank | Liters | By manufacturer | | | | |  | | | |
| 27.31.2 | Conservator | Liters | By manufacturer | | | | |  | | | |
| 27.31.3 | Radiator | Liters | By manufacturer | | | | |  | | | |
| 27.32 | Total oil required for commissioning | Liters | By manufacturer | | | | |  | | | |
| 27.33 | Total oil provided (including 5% extra) | Liters | By manufacturer | | | | |  | | | |
| 27.34 | Way of shipping |  | By drums | | | | |  | | | |
| 27.35 | Total number of drums provided |  | By manufacturer | | | | |  | | | |
| **28** | **Maximum sound pressure level (NEMA TR1 – 5dB(A))** | dB(A) | 74 | | | | |  | | | |
| **29** | **Max. RIV at 1 MHz for complete transformer acc. to NEMA 107** | Micro V | 500 | | | | |  | | | |
| **30** | **Applicable standard for overload capacity of transformer with cooling system in operation** |  | IEC 60076-3 | | | | |  | | | |
| **31** | **Vibration at rated frequency, voltage and 75ْ C** | Micron | <=100 | | | | |  | | | |
| **32** | **Physical data** |  | Should be Filled By Tenderer | | | | |  | | | |
| 32.1 | Overall height, including bushings | mm |  | | | | |  | | | |
| 32.2 | Overall width, including mounted accessories | mm |  | | | | |  | | | |
| 32.3 | Overall length, including mounted accessories | mm |  | | | | |  | | | |
| 32.4 | Height over cover for lifting core and coils | mm |  | | | | |  | | | |
| 32.5 | Dimensions of transformer arranged for transport |  |  | | | | |  | | | |
| 32.6 | Length | m |  | | | | |  | | | |
| 32.7 | Height | m |  | | | | |  | | | |
| 32.8 | Width | m |  | | | | |  | | | |
| 32.9 | Weight of oil | kg |  | | | | |  | | | |
| 32.10. | Weight of on load tap changer | kg |  | | | | |  | | | |
| 32.11 | Total weight of core and coils | kg |  | | | | |  | | | |
| 32.12 | Total weight of tank/cooler and fittings | kg |  | | | | |  | | | |
| 32.13 | Total weight of windings | kg |  | | | | |  | | | |
| 32.14 | Total weight of core (steel lamination) | kg |  | | | | |  | | | |
| 32.15 | Total weight steel (tank, fittings, conservator, etc) | kg |  | | | | |  | | | |
| 32.16 | Total weight of complete transformer | kg |  | | | | |  | | | |
| 32.17 | Max. shipping weight (heaviest item) | kg |  | | | | |  | | | |
| **33** | **Provisions for tank mounting lightning arresters** |  |  | | | | |  | | | |
| 33.1 | HV | Yes/No | No | | | | |  | | | |
| 33.2 | LV | Yes/No | No | | | | |  | | | |
| 33.3 | TV | Yes/No | No | | | | |  | | | |
| 33.3.1 | Type |  |  | | | | |  | | | |
| 33.3.2 | Type designation |  |  | | | | |  | | | |
| 33.3.3 | Standard |  |  | | | | |  | | | |
| 33.3.4 | Rated/system voltage | kV |  | | | | |  | | | |
| 33.3.5 | Maximum overvoltage factor on the system due to any switching duty | pu |  | | | | |  | | | |
| 33.3.6 | Rated system frequency | Hz |  | | | | |  | | | |
| 33.3.7 | Condition of system neutral |  |  | | | | |  | | | |
| 33.3.8 | Nominal Discharge current | kAcrest |  | | | | |  | | | |
| 33.3.9 | Energy capability as per IEC 60099-4 | kJ/kV |  | | | | |  | | | |
| 33.3.10 | Rated Voltage – MOA | kV |  | | | | |  | | | |
| 33.3.11 | Long duration discharge class as per IEC 99-1 | Class |  | | | | |  | | | |
| 33.3.12 | Maximum Continuous Operating Voltage (COV) | kV |  | | | | |  | | | |
| 33.3.13 | TOV capability for |  |  | | | | |  | | | |
|  | * 1sec | kV |  | | | | |  | | | |
|  | * 10sec | kV |  | | | | |  | | | |
| 33.3.14 | Maximum residual voltage with current wave |  |  | | | | |  | | | |
|  | * Switching Surges – 1kA/2kA | kV |  | | | | |  | | | |
|  | * 8/20 μs – 5kA | kV |  | | | | |  | | | |
|  | * 8/20 μs – 20kA | kV |  | | | | |  | | | |
| 33.3.15 | Discharge current withstand strength |  |  | | | | |  | | | |
|  | * High current 4/10 μs | KAp |  | | | | |  | | | |
|  | * Low current 2000 μs | KAp |  | | | | |  | | | |
| **34** | **Anti-vibrations pads** | Yes/No | Yes | | | | |  | | | |
| **35** | **Radiators mounted separate** | Yes/No | No | | | | |  | | | |
| **36** | **Wheels** | Yes/No | Acc. to Project Requirements | | | | |  | | | |
| 36.1 | Plain/ Flanged |  | Plain | | | | |  | | | |
| 36.2 | Unidirectional/ bi-directional |  | bi-directional (If Needed) | | | | |  | | | |
| 36.3 | Gauge | mm |  | | | | |  | | | |
| **37** | **All accessories supplied as specified** | Yes/No | Yes | | | | |  | | | |
| **38** | **All drawings and documents enclosed** | Yes/No | Yes | | | | |  | | | |
| **39** | **Schedule of deviations filled** | Yes/No |  | | | | |  | | | |
| **40** | **Fire protection scheme** | Yes/No | Acc. to Project Requirements | | | | |  | | | |
| **41** | **All additional equipment specified provided** | Yes/No | Yes | | | | |  | | | |
| **42** | **Accessories make and type** |  |  | | | | |  | | | |
| 42.1 | Buchholz relay with sampling device |  |  | | | | |  | | | |
| 42.1.1 | For conservator main compartment |  | Yes | | | | |  | | | |
| 42.1.2 | For conservator OLTC |  | Yes | | | | |  | | | |
| 42.2 | Pressure relief Relay |  | Yes | | | | |  | | | |
| 42.3 | Oil level indicator: |  |  | | | | |  | | | |
| 42.3.1 | For conservator main compartment |  | Yes | | | | |  | | | |
| 42.3.2 | For conservator OLTC |  | Yes | | | | |  | | | |
| 42.4 | Temperature indicators: |  |  | | | | |  | | | |
| 42.4.1 | Oil |  | Yes | | | | |  | | | |
| 42.4.2 | HV winding |  | Yes | | | | |  | | | |
| 42.4.3 | LV winding |  | Yes | | | | |  | | | |
| 42.4.4 | TV winding |  | Yes | | | | |  | | | |
| 42.5 | Conservator type: |  |  | | | | |  | | | |
| 42.5.1 | Normal/air bag (diaphragm) |  | Air bag | | | | |  | | | |
| 42.5.2 | Air detector relay (for air bag) | Yes/No | Yes | | | | |  | | | |
| 42.6 | breather |  | Maintenance free type | | | | |  | | | |
| 42.7 | Cables |  | By Contractor | | | | |  | | | |
| 42.8 | Control cabinets |  | By Contractor | | | | |  | | | |
| 42.9 | Fire extinguishing system: |  | Acc. to Project Requirements | | | | |  | | | |
| 42.9.1 | Drainage and mixing |  |  | | | | |  | | | |
| 42.9.2 | Water sprinkler system |  |  | | | | |  | | | |
| 42.9.3 | Whether full information are attached | Yes/No | Should be confirmed by Tenderer | | | | |  | | | |
| 42.10 | Whether all catalogues of accessories are enclosed | Yes/No | Should be confirmed by Tenderer | | | | |  | | | |
| **43** | **Fault currents and mechanical forces and stresses.** |  | Should be Filled by Tenderer | | | | |  | | | |
| 43.1 | Max. fault current in windings on which mechanical stresses are based. |  |  | | | | |  | | | |
| 43.1.1 | HV winding |  |  | | | | |  | | | |
| a | Symmetrical component current | Arms |  | | | | |  | | | |
| b | Asymmetrical crest current | AmpPeak |  | | | | |  | | | |
| 43.1.2 | LV winding |  |  | | | | |  | | | |
| a | Symmetrical component current | Arms |  | | | | |  | | | |
| b | Asymmetrical crest current | AmpPeak |  | | | | |  | | | |
| 43.1.3 | Tapped winding |  |  | | | | |  | | | |
| a | Symmetrical component current | Arms |  | | | | |  | | | |
| b | Asymmetrical crest current | AmpPeak |  | | | | |  | | | |
| 43.2 | Max. fault current on which mechanical stresses are based for OLTC (main+arcing contacts): |  |  | | | | |  | | | |
| 43.2.1 | Symmetrical short circuit current | kArms |  | | | | |  | | | |
| 43.2.2 | Dynamic short circuit current value |  |  | | | | |  | | | |
| 43.2.2 | Asymmetrical crest current | Ampcrest |  | | | | |  | | | |
| 43.3 | Max. fault current on which mechanical stresses are based for leads to OLTC are: |  |  | | | | |  | | | |
| 43.3.1 | Symmetrical short circuit current | Arms |  | | | | |  | | | |
| 43.3.2 | Asymmetrical crest current | Ampcrest |  | | | | |  | | | |
| 43.4 | Max. fault current on which mechanical Stresses are based for various bushings of: |  |  | | | | |  | | | |
| 43.4.1 | HV side | kArms |  | | | | |  | | | |
| 43.4.2 | LV side | kArms |  | | | | |  | | | |
| 43.4.3 | Neutral HV/LV | kArms |  | | | | |  | | | |
| 43.5 | Current density in windings on principal tapping under the most onerous fault condition |  |  | | | | |  | | | |
| 43.5.1 | HV winding | A/mm2 |  | | | | |  | | | |
| 43.5.2 | LV winding | A/mm2 |  | | | | |  | | | |
| 43.5.3 | Tapped windings | A/mm2 |  | | | | |  | | | |
| 43.5.4 | Tapping lead connections | A/mm2 |  | | | | |  | | | |
| 43.5.5 | Neutral | A/mm2 |  | | | | |  | | | |
| 43.5.6 | HV bushings | A/mm2 |  | | | | |  | | | |
| 43.5.7 | LV bushings | A/mm2 |  | | | | |  | | | |
| 43.5.8 | Neutral bushings | A/mm2 |  | | | | |  | | | |
| 43.6 | Hoop stress in winding conductors: |  |  | | | | |  | | | |
| 43.6.1 | HV winding | N/m2 |  | | | | |  | | | |
| 43.6.2 | LV winding | N/m2 |  | | | | |  | | | |
| 43.6.3 | Tapping | N/m2 |  | | | | |  | | | |
| 43.7 | Total axial compressive force in windings: |  |  | | | | |  | | | |
| 43.7.1 | HV winding | N |  | | | | |  | | | |
| 43.7.2 | LV winding | N |  | | | | |  | | | |
| 43.7.3 | Tapped winding | N |  | | | | |  | | | |
| 43.7.4 | Tertiary winding | N |  | | | | |  | | | |
| 43.8 | Max. stress to flexion of conductor between two adjacent spacers: |  |  | | | | |  | | | |
| 43.8.1 | HV winding | N/m2 |  | | | | |  | | | |
| 43.8.2 | LV winding | N/m2 |  | | | | |  | | | |
| 43.8.3 | Tapping | N/m2 |  | | | | |  | | | |
| 43.9 | Total axial and thurst in windings: |  |  | | | | |  | | | |
| 43.9.1 | HV winding | N |  | | | | |  | | | |
| 43.9.2 | LV winding | N |  | | | | |  | | | |
| 43.9.3 | Tapping | N |  | | | | |  | | | |
| 43.10. | Max. stresses in end insulation and supports: |  |  | | | | |  | | | |
| 43.10.1 | HV winding | N/m2 |  | | | | |  | | | |
| 43.10.2 | LV winding | N/m2 |  | | | | |  | | | |
| 43.10.3 | Tapped winding | N/m2 |  | | | | |  | | | |
| 43.11 | Relative axial displacement at the windings assumed in items 43.9, 43.10 Above |  |  | | | | |  | | | |
| 43.12 | Cross sectional area of conductor for each windings: | % |  | | | | |  | | | |
| 43.12.1 | HV winding | mm2 |  | | | | |  | | | |
| 43.12.2 | LV winding | mm2 |  | | | | |  | | | |
| 43.12.3 | Tapped winding | mm2 |  | | | | |  | | | |
| 43.13 | Cross section area of insulation for: |  |  | | | | |  | | | |
| 43.13.1 | HV winding | mm2 |  | | | | |  | | | |
| 43.13.2 | LV winding | mm2 |  | | | | |  | | | |
| 43.13.3 | Tapped winding | mm2 |  | | | | |  | | | |
| 43.14 | Specific heat in watt- seconds per degree Celsius per pound of conductor Material for: |  |  | | | | |  | | | |
| 43.14.1 | HV winding | mm2 |  | | | | |  | | | |
| 43.14.2 | LV winding | mm2 |  | | | | |  | | | |
| 43.14.3 | Tapped winding | mm2 |  | | | | |  | | | |
| 43.15 | Position and magnitude of max. axial stress on inter turn insulation in: |  |  | | | | |  | | | |
| 43.15.1 | HV winding | N/m2 |  | | | | |  | | | |
| 43.15.2 | LV winding | N/m2 |  | | | | |  | | | |
| 43.15.3 | Tapped winding | N/m2 |  | | | | |  | | | |
| **44** | **On-line gas monitoring** |  | Should be Filled by Tenderer | | | | |  | | | |
| 44.1 | Manufacturer |  |  | | | | |  | | | |
| 44.2 | Country of manufacturer |  |  | | | | |  | | | |
| 44.3 | Model/Type |  |  | | | | |  | | | |
| 44.4 | Detectable key gases |  | Minimum 5 gasses | | | | |  | | | |
| 44.5 | Moisture detection | Yes/No | Yes | | | | |  | | | |
| 44.6 | Lower detection limit (LDL) | ppm | Should be confirmed by Tenderer | | | | |  | | | |
| 44.7 | Accuracy of sensor | % | Should be confirmed by Tenderer | | | | |  | | | |
| 44.8 | Response time | Minute | Should be confirmed by Tenderer | | | | |  | | | |
| 44.9 | Operating range |  |  | | | | |  | | | |
| 44.9.1 | Operating temperature | ºC |  | | | | |  | | | |
| 44.9.2 | Operating oil temperature | ºC |  | | | | |  | | | |
| 44.9.3 | Operating oil pressure | PSI |  | | | | |  | | | |
| 44.9.4 | Operating humidity | % RH |  | | | | |  | | | |
| 44.9.5 | Storage temperature | ºC |  | | | | |  | | | |
| 44.9.6 | Storage humidity | % RH |  | | | | |  | | | |
| 44.9.7 | Altitude | m |  | | | | |  | | | |
| 44.10 | Input power requirement |  |  | | | | |  | | | |
| 44.10.1 | Voltage | V AC |  | | | | |  | | | |
| 44.10.2 | Frequency | Hz |  | | | | |  | | | |
| 44.10.3 | Current or power | A or kW |  | | | | |  | | | |
| 44.11 | Communication option |  |  | | | | |  | | | |
| 44.11.1 | Display |  |  | | | | |  | | | |
| 44.11.2 | Communication protocols |  |  | | | | |  | | | |
| 44.11.3 | Communication ports and analog I/O |  |  | | | | |  | | | |
| 44.11.4 | Measurement alarms |  |  | | | | |  | | | |
| 44.11.5 | Alarm contacts |  |  | | | | |  | | | |
| 44.11.6 | Data storage | Year |  | | | | |  | | | |
| 44.12 | Software |  |  | | | | |  | | | |
| 44.13 | Dimensions |  |  | | | | |  | | | |
| 44.14 | Weight | kg |  | | | | |  | | | |
| 44.15 | Whether all catalogues and description of the system attached | Yes/No |  | | | | |  | | | |
| **45** | **Minimum Clearances (IEC 60076-3)** |  | Should be confirmed by Tenderer | | | | |  | | | |
| 45.1 | Line to earth |  |  | | | | |  | | | |
| 45.1.1 | HV side | mm | 1300 | | | | |  | | | |
| 45.1.2 | LV side | mm | 320 | | | | |  | | | |
| 45.2 | Phase to phase |  |  | | | | |  | | | |
| 45.2.1 | HV side | mm | 1500 | | | | |  | | | |
| 45.2.2 | LV side | mm | 320 | | | | |  | | | |
| **45** | **System Grounding** |  |  | | | | |  | | | |
| 45.1 | HV system |  |  | | | | |  | | | |
| 45.2 | LV system |  | Solid | | | | |  | | | |
| 45.3 | TV system |  | N.A. | | | | |  | | | |
| **45** | **Winding and oil temp. (Dial type or temp. monitoring)** |  | Dial type | | | | |  | | | |
| **46** | **Size of copper ground conductor** |  | 240 | | | | |  | | | |
| **47** | **Type of terminals** |  |  | | | | |  | | | |
|  | HV |  | Air bushing | | | | |  | | | |
|  | LV |  | Air bushing | | | | |  | | | |
|  | TV |  | N.A. | | | | |  | | | |
|  | Neutral |  | Air bushing | | | | |  | | | |
| **48** | **Pre-stressed non-return valve (PNRV)** | Yes/No | Yes | | | | |  | | | |
| **49** | **Buchholz relay test pump** | Yes/No | Yes | | | | |  | | | |
| **50** | **Color of exterior/finishing paint** |  | Will be Finalized During Detail Design | | | | |  | | | |
| **51** | **Manufacturer quality assurance** |  | Yes | | | | |  | | | |
| **52** | According to ISO 9000, 9001, 9002, 9003 and 9004 | Validity | Yes | | | | |  | | | |
| **52.1** | Certificate attached to the offer | Yes/No | Yes | | | | |  | | | |
| **52.2** | **Type test certificate to be issued by:** |  | Yes | | | | |  | | | |
| **53** | Independent laboratory or independently witnessed type test certificate | Yes/No |  | | | | |  | | | |
| **53.1** | Certificate attached to the offer | Yes/No | Yes | | | | |  | | | |
| **53.2** | **Special Tests to be performed:**  **As Type test = T**  **As Routine test = R** |  | Yes | | | | |  | | | |
| **54** | Chopped Wave Lightning Impulse Test  (\*)Type or routine test as appropriate to transformer HV Um |  | Yes (R) | | | | |  | | | |
| **54.1** | Measurement of zero-sequence impedance |  | Yes (R) | | | | |  | | | |
| **54.2** | Determination of sound levels |  | Yes (T) | | | | |  | | | |
| **54.3** | Measurement of harmonics of no-load current |  | Yes (R) | | | | |  | | | |
| **54.4** | Frequency response analysis (FRA) |  | Yes (R) | | | | |  | | | |
| **54.5** | Measurement of the power by the fan motors and oil pumps |  | Yes (T) | | | | |  | | | |
| **54.6** | Check of external coating |  | Yes (R) | | | | |  | | | |
| **54.7** | Determination of capacitance, windings to earth and between windings |  | Yes (R) | | | | |  | | | |
| **54.8** | Measurement of insulation resistance to earth and loss angle of insulation system capacitances |  | Yes (R) | | | | |  | | | |
| **54.9** | Short circuit withstand test/calculations |  | Yes (Calculations) | | | | |  | | | |
| **54.10** | **Wheel locking capability on Transformer rails** | Yes/No | Yes | | | | |  | | | |

e) 33/0.415kV AUXILIARY TRANSFORMER

| 1. 33/0.415kV AUXILIARY TRANSFORMER | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
| **ITEM** | **DESCRIPTION** | **ITEM** | **DESCRIPTION** |
| **1** | **System performance data** |  |  |  |
| 1.1 | Nominal power rating at site conditions | KVA | 250 |  |
| 1.2 | Nominal service voltage | kVrms | 33/0.415 |  |
| 1.3 | Max. system voltage | kVrms | 36 |  |
| 1.4 | System earthing |  | Solid |  |
| 1.5 | Rated frequency | Hz | 50 |  |
| 1.6 | 3-Phase short circuit |  |  |  |
| 1.6.1 | Rated value | kArms | 25 |  |
| 1.6.2 | Dynamic value | kApeak | 80 |  |
| 1.7 | Max radio interference level measured at 1.1 rated system voltage at 1 MHz | microV | By Manufacturer |  |
| 1.8 | Station service aux. AC supply |  |  |  |
| 1.8.1 | Rated voltage | V | 415/240 |  |
| 1.8.2 | Voltage variation | % | ±10% |  |
| 1.8.3 | Phase |  | 3 (4 wires) |  |
| 1.8.4 | Frequency | Hz | 50 |  |
| 1.8.5 | Neutral earthing |  | Solid |  |
| 1.9 | Station service aux. DC supply |  |  |  |
| 1.9.1 | Rated voltage | V | 110 |  |
| **2** | **Auxiliary transformer specifications** |  |  |  |
| 2.1 | Number of transformers |  | 1 |  |
| 2.2 | Manufacturer, type designation and country |  | Should be Filled By Tenderer |  |
| 2.3 | Type |  |  |  |
| 2.3.1 | Indoor/Outdoor |  | Outdoor |  |
| 2.3.2 | Stationary/Mobile |  | Stationary |  |
| 2.4 | Rated capacity of secondary winding at site conditions | kVA | 250 |  |
| 2.5 | Type of cooling |  | ONAN |  |
| 2.6 | Vector group |  | Dyn11 |  |
| 2.7 | Impedance voltage between HV and LV windings at 75 °C | % | 4.5 |  |
| 2.8 | Rated voltage of windings | kVrms | 33 |  |
| 2.9 | Highest system voltages | kVrms | 36 |  |
| 2.10 | Rated frequency | Hz | 50 |  |
| 2.11 | Insulation levels |  |  |  |
| 2.11.1 | Windings (HV/LV) |  |  |  |
| 2.11.1.1 | Rated voltage | kVrms | 33/0.415 |  |
| 2.11.1.2 | Highest voltage for equipment | kVrms | 36/1 |  |
| 2.11.1.3 | Rated one min. power frequency withstand voltage | kVrms | 70/3 |  |
| 2.11.1.4 | Rated lightning impulse withstand voltage | kVpeak | 170/N.A |  |
| 2.11.2 | Bushings (HV/LV) |  |  |  |
| 2.11.2.1 | Rated voltage | kVrms | 33/0.415 |  |
| 2.11.2.2 | Highest voltage for equipment | kVrms | 36/1 |  |
| 2.11.2.3 | Rated one min. power frequency withstand voltage | kVrms | 70/3 |  |
| 2.11.2.4 | Rated lightning impulse withstand voltage | kVpeak | 170/N.A |  |
| 2.12 | Tap changer |  |  |  |
| 2.12.1 | Whether manual off circuit tap changer is required | Yes/No | Yes |  |
| 2.12.2 | Type (Onload - Off load) |  | Off load |  |
| 2.12.3 | Manufacturer & country |  |  |  |
| 2.12.4 | Total range(number of steps) |  | ±2\*2.5% |  |
| 2.12.5 | Location |  | HV-N |  |
| 2.12.6 | Rated current | A | 5 (Min) |  |
| 2.13 | Losses |  |  |  |
| 2.13.1 | No load losses at 75 ºC, rated frequency and rated voltage on principal tapping | kW | Max. 0.65 |  |
| 2.13.2 | Load losses at rated frequency, 75ْ C And rated current on principal tapping | kW | Max. 3.0 |  |
| 2.13.3 | Evaluation rate of no load loss at Tendering stage | $/kW | 9000 |  |
| 2.13.4 | Evaluation rate of load loss & cooling loss at Tendering stage | $/kW | 4000 |  |
| 2.14 | Exciting current |  |  |  |
| 2.14.1 | At rated voltage | A | By manufacturer |  |
| 2.14.2 | At 110% rated voltage | A | By manufacturer |  |
| 2.15 | Temperature rise (corrected for altitude, ambient condition and IEC 60076-2) |  |  |  |
| 2.15.1 | Top oil | °C | 57 |  |
| 2.15.2 | Winding | °C | 62 |  |
| 2.15.3 | Hot Spot | °C | 75 |  |
| 2.16 | Max. sound level (acc. to IEC 60076-10) | dB | 50 |  |
| 2.17 | Vacuum withstand capacity of total transformer | mmHg | Acc. To Technical Specification |  |
| 2.19 | Core and winding data |  |  |  |
| 2.19.1 | Manufacturer of steel core material |  |  |  |
| 2.19.2 | Type of steel core lamination |  | By manufacturer |  |
| 2.19.3 | Flux density of core |  |  |  |
| 2.19.3.1 | At rated voltage | Wb/m2 | 1.727 |  |
| 2.19.3.2 | As above at 110% rated voltage | Wb/m2 | 1.9 |  |
| 2.19.4 | Thickness of steel core lamination | mm | ≤0.3 |  |
| 2.19.5 | Main limb/yoke cross section | cm2 | By manufacturer |  |
| 2.19.6 | Current density at rated power and voltage |  |  |  |
| 2.19.6.1 | HV winding | A/mm2 | By manufacturer |  |
| 2.19.6.2 | LV winding | A/mm2 | By manufacturer |  |
| 2.19.7 | Current density at rated short circuit current |  |  |  |
| 2.19.7.1 | HV winding | A/mm2 | By manufacturer |  |
| 2.19.7.2 | LV winding | A/mm2 | By manufacturer |  |
| 2.20 | Thickness of transformer plates |  |  |  |
| 2.20.1 | Tank | mm | By manufacturer |  |
| 2.20.2 | Sides | mm | By manufacturer |  |
| 2.20.3 | Bottom | mm | By manufacturer |  |
| 2.20.4 | Radiator plates | mm | By manufacturer |  |
| 2.21 | Bushings (HV/LV) |  |  |  |
| 2.21.1 | Manufacturer & country |  |  |  |
| 2.21.2 | External creepage distance | mm | min (1116) |  |
| 2.21.3 | Protected creepage distance | mm | By manufacturer |  |
| 2.21.4 | Rated normal | A | 5\420 |  |
| 2.21.5 | Short circuit current (HV) | kA | 25 |  |
| 2.21.6 | Test tap required | Yes/No | No |  |
| 2.21.7 | Rated normal/short circuit current for neutral | (A/kA) |  |  |
| 2.21.4 | Bushing type current transformers (Required) | Yes/No | Yes |  |
| 2.21.4.1 | No of cores (HV,HVN,LV,LVN) |  | According to SLD |  |
| 2.21.4.2 | Specifications |  | According to SLD |  |
| 2.22 | Type of terminals |  |  |  |
| 2.22.1 | HV |  | Air bushing |  |
| 2.22.2 | LV |  | Cable Box |  |
| 2.22.3 | HV-N |  | Air bushing |  |
| 2.22.4 | LV-N |  | Cable Box |  |
| 2.22.5 | Filling medium for cable box |  | Air |  |
| 2.23 | Overall Dimensions (H\*W\*L) | mm\*mm\*mm |  |  |
| 2.24 | Weights |  |  |  |
| 2.24.1 | Core and coils | kg | By manufacturer |  |
| 2.24.2 | Tank and fittings | kg | By manufacturer |  |
| 2.24.3 | Weight of oil | kg | By manufacturer |  |
| 2.24.4 | Total Weight of complete transformer | kg | By manufacturer |  |
| 2.25 | Regulation at full load and 75°C winding temperature |  |  |  |
| 2.25.1 | a) Unity Power Factor |  | By manufacturer |  |
| 2.25.2 | b) 0.8 PF lag |  | By manufacturer |  |
| 2.26 | Efficiency (at P.F.=1 ) |  |  |  |
| 2.26.1 | At full load | % | By manufacturer |  |
| 2.26.2 | At 3/4 full load | % | By manufacturer |  |
| 2.26.3 | At 1/2 full load | % | By manufacturer |  |
| 2.26.3 | Max. and the load at which it occurs | % | By manufacturer |  |
| 2.27 | Oil |  |  |  |
| 2.27.1 | Manufacture |  |  |  |
| 2.27.2 | Country of manufacture |  |  |  |
| 2.27.3 | Naphthenic or Paraphenic based oil |  | Naphthenic |  |
| 2.27.4 | Type – inhibited/ trace inhibited/ non-inhibited |  | non-inhibited |  |
| 2.27.5 | Details of inhibitor |  |  |  |
| 2.27.6 | Details of passivators |  |  |  |
| 2.27.7 | Viscosity at 40 °C (Acc. to ISO 3104) | mm2/s | Max. 12 |  |
| 2.27.8 | Viscosity at –30 °C (Acc. to ISO 3104) | mm2/s | Max. 1800 |  |
| 2.27.9 | Pour point (Acc. To ISO 3016) | °C | Max. -40 |  |
| 2.27.10 | Water content (Acc. To IEC 60814) | mg/kg | Max. 40 |  |
| 2.27.11 | Breakdown voltage (Acc. To IEC 60156) |  |  |  |
| 2.27.11.1 | As delivered | kV | Min. 30 |  |
| 2.27.11.2 | After laboratory treatment | kV | Min. 70 |  |
| 2.27.12 | Density at 20 °C (Acc. To ISO3675 or ISO12185) | g/ml | Max. 0.895 |  |
| 2.27.13 | DDF at 90 °C (Acc. To IEC 60247 / IEC 61620) |  | Max. 0.005 |  |
| 2.27.14 | Appearance |  | Clear, free from sediment and suspended matter |  |
| 2.27.15 | Acidity (Acc. To IEC 62021-1 / IEC 62021-2) | mg KOH/g | Max. 0.01 |  |
| 2.27.16 | Interfacial tension  (Acc. To EN 14210/ASTM D971) | mN/m | Min. 40 |  |
| 2.27.17 | Total Sulphur content  (Acc. To IP 373 / ISO 14596) | % | Max. 0.05 |  |
| 2.27.18 | Corrosive Sulphur (Acc. To DIN 51353) |  | Not corrosive |  |
| 2.27.19 | Copper Corrosion (Acc. To IEC 62535) |  | Not corrosive |  |
| 2.27.20 | Potentially corrosive Sulphur  (Acc. To IEC 62535) |  | Not corrosive |  |
| 2.27.21 | DBDS (Acc. To IEC 62697-1) | mg/kg | Not detectable ( <5 ) |  |
| 2.27.22 | Inhibitors of IEC 60666  (Acc. To IEC 60666) | % | (U) uninhibited oil  (Max. 0.01) |  |
| 2.27.23 | Metal passivator additives of IEC 60666 | mg/kg | Max. 5 |  |
| 2.27.24 | 2-Furfural and related compounds content (Acc. To IEC 61198) | mg/kg | Max. 0.05 (for each individual compound) |  |
| 2.27.25 | Oxidation stability (Acc. To IEC 61125:1992 (Method C)) |  |  |  |
| 2.27.25.1 | Test duration (for uninhibited oil) | h | 164 |  |
| 2.27.25.2 | Total acidity (Acc. To 1.9.4 of IEC 61125:1992) | mg KOH/g | Max. 1.2 |  |
| 2.27.25.3 | Sludge (Acc. To 1.9.1 of IEC 61125:1992) | % | Max. 0.8 |  |
| 2.27.25.4 | DDF at 90 °C  (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247) |  | Max. 0.5 |  |
| 2.27.26 | Flash point (Acc. To ISO 2719) | °C | Min. 135 |  |
| 2.27.27 | PCA content (Acc. To IP 346) | % | Max. 3 |  |
| 2.27.28 | PCB content (Acc. To IEC 61619) | mg/kg | Not detectable (Max. 2) |  |
| 2.27.29 | Quantity of oil |  |  |  |
| 2.27.29.1 | Main tank | Liters |  |  |
| 2.27.29.2 | Conservator | Liters |  |  |
| 2.27.29.3 | Radiator | Liters |  |  |
| 2.27.31 | Total oil required for commissioning | Liters |  |  |
| 2.27.32 | Total oil provided (including 5% extra) | Liters |  |  |
| 2.27.33 | Way of shipping |  | By drums |  |
| 2.27.34 | Total number of drums provided |  |  |  |
| 2.28 | Accessories make, type and country |  |  |  |
| 2.28.1 | Buchholz relay |  | Yes |  |
| 2.28.2 | Pressure relief device |  | Yes |  |
| 2.28.3 | Silicagel breather |  | Yes |  |
| 2.28.4 | Control Cabinet |  | Yes |  |
| 2.28.5 | Cables |  | Yes |  |
| 2.28.6 | Oil level gauge |  | Yes |  |
| 2.8.7 | Winding temperature indicator |  | Yes |  |
| 2.28.8 | Oil temperature indicator |  | Yes |  |
| 2.29 | Whether wheels are required | Yes/No | No |  |
| 2.30 | Whether switch-fuse unit is required | Yes/No | No |  |
| 2.31 | Type of conservator (Air bag/ Conventional ) |  | Conventional |  |
| 2.32 | Max. vibration (at rated condition) P-P | Micron | 50 |  |

f) EARTHING AND LIGHTNING PROTECTION

| 1. EARTHING AND LIGHTNING PROTECTION | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
| **1** | **EARTHING SYSTEM** |  |  |  |
| **1.1** | **General** |  |  |  |
| 1.1.1 | Manufacturers |  |  |  |
| 1.1.2. | Standard Applied  The following standards shall apply to the earthing installations and to the accessories: |  |  |  |
|  | * Guide for safety in A.C. substation grounding |  | IEEE80 & 81 |  |
|  | * Earthing system in A.C. installation for rated voltages above 1000 V |  | VDE 0141 |  |
| 1.1.3 | Design ground fault current | kA rms | 31.5 |  |
| 1.1.4 | Time duration of ground fault | sec | 3 |  |
| 1.1.5 | Fault clearing time | sec | 0.6 |  |
| 1.1.6 | Maximum Resistance of Earthing/Grounding System | Ohm | 1  1  1 |  |
| 1.1.7 | Step length | m |  |  |
| 1.1.8 | Body resistance | Ohm |  |  |
| 1.1.9 | Maximum touch voltage | V |  |  |
| 1.1.10 | Maximum step voltage | V |  |  |
| 1.1.11 | Tolerable touch voltage | V |  |  |
| 1.1.12 | Tolerable step voltage | V |  |  |
| 1.1.13 | Maximum ground potential rise | kV | 5 |  |
| 1.1.14 | Maximum allowable temperature for riser | °C | 250 |  |
| 1.1.15 | Maximum allowable temperature for mesh grid | °C | 450 |  |
| 1.1.16. | Physical Properties of Copper |  |  |  |
|  | The most important physical properties of copper used for the earthing conductors: |  |  |  |
|  | * Density | kg/dm3 | 8.89 |  |
|  | * Electrical resistivity at 20°C | Ωmm2/m | 0.0176 |  |
|  | * Melting point | °C | 1083 |  |
|  | * Current density at which the conductor temperature rises from 50°C to 300°C in a time of 1 s if all heat is retained in conductor | A/mm2 | 190 |  |
| 1.1.17. | Physical Properties of Lead-Sheathed Copper |  |  |  |
|  | The most important physical properties of lead-sheathed copper used for the earth electrodes: |  |  |  |
|  | * Thickness of lead sheath | mm | 2.0 |  |
|  | * Electrical resistivity of copper at 20°C | Ωmm2/m | 0.0176 |  |
|  | * Copper melting point | °C | 1083 |  |
|  | * Lead melting point | °C | 327 |  |
|  | * Current density at which the conductor temperature rises from 40°C to 150°C in a time of 1 s if all heat is retained in conductor | A/mm2 | 140 |  |
| **1.2** | **Ground Grid and Risers** |  |  |  |
| 1.2.1 | Ground grid conductor |  |  |  |
|  | * Type |  |  |  |
|  | * Material |  | Stranded soft drawn annealed copper |  |
|  | * Minimum cross-section area   to be confirmed by acceptance calculation | mm2 | min 120 /after acceptance of calculation |  |
|  | * Number of wires | No. |  |  |
|  | * Diameter of each wire | mm |  |  |
|  | * Conductor diameter | mm |  |  |
|  | * Density | kg/m |  |  |
| 1.2.2 | Riser conductor |  |  |  |
|  | * Type |  |  |  |
|  | * Material |  | Stranded soft drawn annealed copper |  |
|  | * Minimum cross-section area   to be confirmed by acceptance calculation | mm2 | after acceptance of calculation |  |
|  | * Number of wires | No. |  |  |
|  | * Diameter of each wire | mm |  |  |
|  | * Conductor diameter | mm |  |  |
|  | * Density | kg/m |  |  |
| 1.2.3 | Connections |  |  |  |
|  | Mode of Connection in the Earthing Systems: |  |  |  |
|  | * Between earthing conductors and earth electrodes |  | Brazed |  |
|  | * Crossing of earth electrodes |  | Compression |  |
|  | * Type of connection of risers to steel structures |  | bolt and two hole cable lug |  |
| 1.2.4 | Manufacturer of ground grid and risers conductor |  |  |  |
|  | Name |  |  |  |
|  | Country |  |  |  |
| 1.2.5 | Ground resistivity | ohm.m | will be declared later |  |
| 1.2.6 | Surface gravel resistivity | ohm.m | 3000 |  |
| 1.2.7 | Minimum surface gravel height | cm | 15 |  |
| 1.2.8 | Minimum depth of ground grid burial | cm | 50 |  |
| **1.3** | **Grounding Accessories** |  |  |  |
| 1.3.1. | Earth Electrodes |  |  |  |
| 1.3.1.1. | Lead-sheathed stranded copper conductors |  |  |  |
|  | The following lead-sheathed stranded copper conductor will be used as earth electrodes: |  |  |  |
|  | * Thickness of lead sheath | mm |  |  |
|  | * Copper cross-section area | mm2 |  |  |
|  | * Number of wires | pcs |  |  |
|  | * Diameter of each wire | mm |  |  |
|  | * Conductor diameter | mm |  |  |
|  | * Density | kg/m |  |  |
| 1.3.1.2. | Earth rod |  |  |  |
|  | * Manufacturer |  |  |  |
|  | * Length | m | min(3) |  |
|  | * Diameter | mm | min(16) |  |
|  | * Material (copper, stainless steel) |  |  |  |
| 1.3.1.3. | Stainless steel electrodes |  |  |  |
|  | The following steel flat bars will be used as earth electrodes: |  |  |  |
|  | * Cross-section area | mm2 |  |  |
|  | * Dimensions | mm x mm |  |  |
|  | * Density | kg/m |  |  |
| 1.3.2 | Equipment mat |  |  |  |
|  | Material |  |  |  |
|  | Size |  |  |  |
| 1.3.3 | Manufacturer of moulds |  |  |  |
| 3.4 | Type and size of cable connectors and cable lugs |  |  |  |
| **1.4** | **Miscellaneous** |  |  |  |
| 1.4.1 | Minimum estimated length of ground grid (without risers) | m |  |  |
| 1.4.2 | Minimum estimated quantity of rods inside substation |  |  |  |
| 1.4.3 | Minimum estimated quantity of rods located at primeters of substation |  |  |  |
| 1.4.4 | Is required one set of portable temporary earthing equipment? | Yes/No | Yes |  |
| 1.4.5 | Temporary grounding device |  |  |  |
|  | Type |  |  |  |
|  | Material |  |  |  |
|  | Short time current (3 sec ) | kA peak |  |  |
|  | Length of insulated stick |  |  |  |
|  | Type of insulated stick |  |  |  |
| **2.** | **LIGHTNING PROTECTION** |  |  |  |
| 2.1. | Manufacturers |  |  |  |
| 2.2. | Standard Applied: |  |  |  |
|  | * Protection of structures against lightning |  | IEC 62305 |  |
| 2.3. | Cross-section area | mm2 |  |  |
| 2.4. | Thickness of lead-sheath | mm |  |  |
| 2.5. | Supports |  |  |  |
|  | Conductor supports of the lightning protection system |  |  |  |
|  | * Type |  |  |  |
| 2.6. | Earth rod |  |  |  |
|  | * Manufacturer |  |  |  |
|  | * Length | m |  |  |
|  | * Diameter | mm |  |  |
|  | * Material (copper, stainless steel) |  |  |  |
| **3.** | Type test certificate (to be issued by independent laboratory or independently witnessed type test certificate available), to be attached to the offer | Yes/No | Yes |  |

g) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM

| 1. TRANSFORMER ONLINE CONDITION MONITORING SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
| **1.** | **GENERAL** |  |  |  |
| 1.1 | Manufacturer |  |  |  |
| 1.2 | Type |  |  |  |
| **2.** | **Field module** |  |  |  |
| 2.1 | Sampling rate | ms |  |  |
| 2.2 | Data resolution | ms | 1 |  |
| 2.3 | Auxiliary voltage range (Vn = 110Vdc) | Vdc | 88→150 |  |
| 2.4 | Protection degree of panel/box | IP | 55 |  |
| 2.5 | Range of operating temperature | °C |  |  |
| 2.6 | Communication |  |  |  |
| 2.6.1 | Local interface for PC/Laptop connection |  |  |  |
|  | * Communication ports (Front/rear etc.) |  |  |  |
|  | * Physical links (RS232/Ethernet etc.) |  |  |  |
| 2.6.2 | Remote Control and Monitoring |  |  |  |
|  | * Communication ports (Front/rear etc.) |  | Rear |  |
|  | * Physical links (RS485/Fibre optic etc.) |  | Fibre optic |  |
|  | * Protocol |  | IEC 61850 |  |
| 2.6.3 | Centralized HMI PC for analysis, evaluation and diagnostic |  |  |  |
|  | * Communication ports (Front/rear etc.) |  |  |  |
|  | * Physical links (RS485/Fibre optic etc.) |  | Fibre Optic |  |
|  | * Protocol |  |  |  |
| **3.** | **Centralized HMI PC for analysis, evaluation and diagnostic** |  |  |  |
| 3.1 | Manufacturer |  |  |  |
| 3.2 | Model |  |  |  |
| 3.3 | Processor |  |  |  |
|  | * Type |  |  |  |
|  | * Word length | Bits |  |  |
|  | * Clock speed (minimun) | GHz | 3 |  |
| 3.4 | Memory size | GB | 6 |  |
|  | * Supplied (minimum) | Mb |  |  |
|  | * Supportable/expandable | Gb |  |  |
| 3.5 | Hard disk size | GB |  |  |
|  | * Supplied (minimum) | Gb |  |  |
|  | * Supportable/expandable | Gb |  |  |
| 3.6 | Optical Storage | Yes/No | Yes |  |
| 3.7 | Pointer Device |  |  |  |
| 3.8 | Operating system |  |  |  |
| 3.9 | Operator interface screen | inch | 24 |  |
| 3.10 | Operating temperature range | °C |  |  |
| 3.11 | Maximum relative humidity | % |  |  |
| 3.12 | Nominal voltage | Vac |  |  |
| 3.13 | Operating frequency | Hz |  |  |
| 3.14 | Power requirement | W |  |  |
| **4.** | **Minimum quantities to be measured** |  |  |  |
|  | * Oil temperature | Yes/No | Yes |  |
|  | * Hot-spot-temperature | Yes/No | Yes |  |
|  | * Moisture-in-oil content | Yes/No | Yes |  |
|  | * Gas-in-oil content and gas consistency | Yes/No | Yes( Minimum 5 gasses) |  |
|  | * Gas quantity and rate in Buchholz relay | Yes/No | Yes |  |
|  | * Oil pressure | Yes/No | Yes |  |
|  | * Oil level | Yes/No | Yes |  |
|  | * Winding temperature | Yes/No | Yes |  |
|  | * Humidity of air in conservator | Yes/No | Yes |  |
|  | * Actual losses | Yes/No | Yes |  |
|  | * Overload capacity | Yes/No | Yes |  |
|  | * Emergency overloading time | Yes/No | Yes |  |
|  | * Partial discharge | Yes/No | Yes |  |
|  | * Ambient air temperature | Yes/No | Yes |  |
|  | * Ambient air humidity | Yes/No | Yes |  |
|  | * Ambient air pressure | Yes/No | Yes |  |
|  | * Load currents of bushings | Yes/No | Yes |  |
|  | * Overcurrents of bushings | Yes/No | Yes |  |
|  | * Operating voltages of bushings | Yes/No | Yes |  |
|  | * Overvoltages of bushings | Yes/No | Yes |  |
|  | * Bushing capacitance and capacitive displacement currents | Yes/No | Yes |  |
|  | * Tap changer position and number of switching operations | Yes/No | Yes |  |
|  | * Sum of switched load current tap changer | Yes/No | Yes |  |
|  | * Power consumption of motor-drive | Yes/No | Yes |  |
|  | * Contact wear | Yes/No | Yes |  |
|  | * Operating conditions and operating time of fans | Yes/No | Yes |  |
|  | * Cooling efficiency and power | Yes/No | Yes |  |
|  | * Intake and outlet cooling equipment temperatures | Yes/No | Yes |  |
| **5.** | **Type Tests** |  |  |  |
| 5.1 | Atmospheric Environment |  |  |  |
|  | * Operation -25°C and 55°C for 96hrs, IEC 60068-2-1 | Yes/No | Yes |  |
|  | * Transport/storage -25°C and 70°C for 96hrs, IEC 60068-2-2 | Yes/No | Yes |  |
| 5.2 | Relative Humidity |  |  |  |
|  | * Operation at 93% | Yes/No | Yes |  |
|  | * Tested to IEC 60068-2-3 with severity class 56 days | Yes/No | Yes |  |
| 5.3 | Enclosure |  |  |  |
|  | * IEC 60529 |  | IP50 |  |
| 5.4 | Mechanical Environment |  |  |  |
|  | * Vibration IEC 60255-21-1 | Yes/No | Yes |  |
|  | * Shock and bump IEC 60255-21-2 | Yes/No | Yes |  |
|  | * Seismic IEC 60255-21-3 | Yes/No | Yes |  |
| 5.5 | Insulation |  |  |  |
|  | * Rated insulation |  |  |  |
|  | 1000V high impedance protection CT inputs | Yes/No | Yes |  |
|  | 250V for other circuits | Yes/No | Yes |  |
|  | 1000V open contact withstand | Yes/No | Yes |  |
|  | * Dielectric Tests   IEC 60255-5 – Series C of table 1 | Yes/No | Yes |  |
|  | * Impulse voltage   IEC 60255-5 test voltage 5kV | Yes/No | Yes |  |
| 5.6 | Electromagnetic compatibility |  |  |  |
|  | * 1MHz Burst disturbance test,   IEC 60255-22-1 severity class III | Yes/No | Yes |  |
|  | * Electrostatic Discharge   IEC 60255-22-2 severity class III | Yes/No | Yes |  |
|  | * Radiated Electromagnetic Field Disturbance   IEC 60255-22-3 severity class III  Test method A, 27MHz through 500MHz | Yes/No | Yes |  |
|  | * Electromagnetic Emissions   IEC 60255-25 | Yes/No | Yes |  |
|  | * Fast Transient Disturbance   IEC 60255-22-4 severity level IV | Yes/No | Yes |  |
| 5.7 | Type test certificate provided | Yes/No | Yes |  |

h) PROTECTION, CONTROL AND METERING

| 1. PROTECTION, CONTROL AND METERING | | **UNIT** | **DATA** | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | | **OFFERED** | |
| **1** | **General** |  |  | |  | |
| 1.1 | Applicable standard |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Codes and Standards) | |  | |
| 1.2 | Nominal system frequency | Hz | 50 | |  | |
| 1.3 | Nominal current transformers secondary current | A | 1 | |  | |
| 1.4 | Rated voltage transformers secondary voltage | V | 110 | |  | |
| 1.5 | Auxiliary DC | V | 110 | |  | |
| 1.6 | Variation of Aux. DC | % | -15 , +10 | |  | |
| 1.7 | Auxiliary AC | V | 415 / 240 | |  | |
| 1.8 | Type of system grounding |  | 132kV: Solid | |  | |
| 33kV: Solid | |  | |
| 1.9 | Accuracy class of CTs for protection and metering equipment |  | Acc. to Attached Drawing & relay requirement | |  | |
| 1.10 | Accuracy class of CVTs for protection and metering |  | Acc. to Attached Drawing | |  | |
| **1.11** | **Control and metering system** |  |  | |  | |
| 1.11.1 | All sub-division of control and metering system such as operating system, interlocking, synchronizing, alarm annunciation, automatic and manual voltage control, metering and indication instruments, event and fault recorder, PMU (as required) and relays setting and configuration integrated control system |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Control and Metering System) | |  | |
| **1.12** | **Protection system** |  |  | |  | |
| 1.12.1 | All sub-division of protection system such as protection design criteria, protection relays requirement, common circuit breaker protection, transmission line protection, sub-transmission line protection, power transformer protection, short transmission line protection, short sub-transmission line protection, bus section protection, reactor protection, load shedding and busbar protection |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Protection system) | |  | |
| **1.13** | **Packing, transportation and storage** |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Packing, transportation and storage) | |  | |
| **1.14** | **Supervision over installation and erection procedure** |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Supervision over installation & erection procedure) | |  | |
| **1.15** | **Inspection and test** |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Inspection and test) | |  | |
| **2** | **Panel** |  |  | |  | |
| 2.1 | Manufacturer : |  |  | |  | |
| 2.1.1 | Name |  |  | |  | |
| 2.1.2 | Country |  |  | |  | |
| 2.2 | Type of panels construction |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Protection, Control and Metering Panel) | |  | |
| 2.2 | Degree of protection of panels: |  |  | |  | |
|  | Indoor | IP54 | |  | |
|  | Outdoor | IP55 | |  | |
| 2.3 | Color of Panel: |  |  | |  | |
|  | Indoor | RAL7035 | |  | |
|  | Outdoor | RAL7032 | |  | |
| 2.4 | Thickness of Panel color | Micron | Minimum 100 | |  | |
| 2.5 | Minimum thickness of steel panels | mm | 2 | |  | |
| 2.6 | Overall dimensions : |  |  | |  | |
|  | protection & Relay panels | mm\*mm\*mm | 800\*800\*2200 | |  | |
|  | Control panels | mm\*mm\*mm | 800\*800\*2200 | |  | |
|  | AVR panel | mm\*mm\*mm | 800\*800\*2200 | |  | |
| 2.7 | Size of wires : |  |  | |  | |
|  | CT & CVT circuits | mm2 | >=4 | |  | |
|  | control circuit | mm2 | >=2.5 | |  | |
| 2.8 | Voltage rating of wirings | V |  | |  | |
| 2.9 | Terminal blocks : |  |  | |  | |
|  | Manufacturer / Name / Country |  |  | |  | |
|  | Type designation |  |  | |  | |
|  | Spare | % | 10 | |  | |
| 2.1 | Earthquake protection coefficient |  |  | |  | |
| 2.11 | Lighting, door switch, heater, thermostat | yes/no | yes | |  | |
| 2.12 | DC supervision for relay and control panel | yes/no | yes | |  | |
| 2.13 | Type of mounting |  |  | |  | |
| 2.14 | Other requirement |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| (Protection, Control and Metering Panel) | |  | |
| **\*** | **Over Head Line Protection** | | | | | |
| **1** | **Distance Protection (Main I Protection)** |  | **132kV , 33kV** | |  | |
| 1.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 1.2 | Applicable standard |  |  | |  | |
| 1.3 | Type | Static/ Microprocessor based | Microprocessor based | |  | |
| 1.4 | Rated current |  |  | |  | |
| 1.5 | Rated voltage |  |  | |  | |
| 1.6 | Rated auxiliary DC |  | 110 VDC | |  | |
| 1.7 | Method of starting |  |  | |  | |
| 1.8 | Number of zones : |  | Minimum 5 zone ph-ph & ph-E | |  | |
|  | Forward reach |  |  | |  | |
|  | Reverse reach |  |  | |  | |
| 1.9 | Mounting arrangement |  |  | |  | |
| 1.10 | Maximum zone 1 operating time |  |  | |  | |
| 1.11 | Time setting range for : |  |  | |  | |
|  | Zone 2 |  |  | |  | |
|  | Zone 3 |  |  | |  | |
| 1.12 | power swing blocking provided | yes/no | yes | |  | |
| 1.13 | Dielectric test voltage |  |  | |  | |
| 1.14 | Type of relay characteristics |  |  | |  | |
| 1.15 | Type of characteristics for phase-ground and three phase faults |  |  | |  | |
| 1.16 | Number of measuring units |  |  | |  | |
| 1.17 | Type of impedance measuring characteristic for phase to ground faults /setting range / step |  | quadrilateral , mho | |  | |
|  | Zone 1 |  |  | |  | |
|  | Zone 2 |  |  | |  | |
|  | Zone 3 |  |  | |  | |
| 1.18 | Type of impedance measuring characteristic for phase to phase faults /setting range / step |  | quadrilateral , mho | |  | |
|  | Zone 1 |  |  | |  | |
|  | Zone 2 |  |  | |  | |
|  | Zone 3 |  |  | |  | |
| 1.19 | Method of ensuring correct discrimination for three phase close up faults |  |  | |  | |
| 1.20 | Fault locator feature built in | yes/no | yes | |  | |
| 1.21 | Built in directional overcurrent/ earth fault relay | yes/no | yes | |  | |
| 1.22 | Built in disturbance Recorder | yes/no | yes | |  | |
| 1.23 | Built in DTT | yes/no | yes | |  | |
| 1.24 | Built in SOTF | yes/no | yes | |  | |
| 1.25 | Mutual compensation provided | yes/no |  | |  | |
| 1.26 | internal Fuse failure blocking provided | yes/no | yes | |  | |
| 1.27 | Filtering against CVT transients provided | yes/no |  | |  | |
| 1.28 | Current carrying /making/breaking capacity for trip contacts | A |  | |  | |
| 1.29 | Weak-end in feed trip feature provided | yes/no | yes | |  | |
| 1.30 | Current reversal logic (for double lines) provided | yes/no |  | |  | |
| **2** | **Directional EF Relay (In Distance Protection)** |  | **132kV , 33kV** | |  | |
| 2.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 2.2 | Applicable standard |  |  | |  | |
| 2.3 | Rated zero sequence current | A |  | |  | |
| 2.4 | Rated zero sequence polarizing voltage | V |  | |  | |
| 2.5 | Whether the following characteristics provided : |  |  | |  | |
| 2.6 | Normal inverse /Very inverse / Extremely inverse |  |  | |  | |
| 2.7 | Whether instantaneous unit provided | yes/no | yes | |  | |
| 2.8 | Mounting arrangement |  |  | |  | |
| 2.9 | Current setting range in inverse characteristic / step | A |  | |  | |
| 2.10 | Current setting range in instantaneous/ definite characteristic / step | A |  | |  | |
| 2.11 | Time setting range / step | Sec |  | |  | |
| 2.12 | Relay characteristic angle | deg |  | |  | |
| 2.13 | Drop-off / pick-up ratio |  |  | |  | |
| 2.14 | Hand reset operation indicator | yes/no |  | |  | |
| 2.15 | Power consumption | VA |  | |  | |
| 2.16 | Inrush current blocking | yes/no |  | |  | |
| 2.17 | Transient over reach | yes/no |  | |  | |
| 2.18 | Current reversal logic (for parallel lines) provided | yes/no |  | |  | |
| 2.19 | Echo feature for tele-protection provided | yes/no |  | |  | |
| **3** | **Current Differential Protection** |  | **132kV , 33kV** | |  | |
| 3.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 3.2 | Fault setting with maximum number of current transformers connected primary amperes for : |  |  | |  | |
|  | Phase/earth fault | A |  | |  | |
|  | Phase/phase fault | A |  | |  | |
| 3.3 | Basic sensitivity setting range | % |  | |  | |
| 3.4 | Rated current | A |  | |  | |
| 3.5 | Current setting range | A |  | |  | |
| 3.6 | Current transformer supervision alarm setting with maximum number of current transformer |  |  | |  | |
| 3.7 | Connected (primary amperes) | A |  | |  | |
| 3.8 | Pick up ration (slop) setting range | % |  | |  | |
| 3.9 | Pick-up time : |  |  | |  | |
|  | At “3” times fault setting | Ms |  | |  | |
|  | At “ 10” times fault setting | Ms |  | |  | |
| 3.10 | Maximum through fault current at which protection is stable | A |  | |  | |
| 3.11 | Current transformer requirement : |  |  | |  | |
|  | Knee point voltage | V |  | |  | |
|  | Winding resistance | Ohm |  | |  | |
|  | Maximum exciting current at knee point voltage | MA |  | |  | |
| 3.12 | Max operating time | Ms |  | |  | |
| 3.13 | Number of contacts available |  |  | |  | |
| 3.14 | Relay burden | VA |  | |  | |
| 3.15 | Built in distance function | yes/no | yes | |  | |
| 3.16 | Setting of series connected reinforcing contactor | A |  | |  | |
| 3.17 | Resistance of series connected | Ohm |  | |  | |
| 3.18 | Values of series resistance and wattage |  |  | |  | |
| 3.19 | Isolator Aux switches requirement : |  |  | |  | |
|  | Number of contacts normally open |  | >10 | |  | |
|  | Number of contacts normally closed |  | >10 | |  | |
|  | Timing sequence between aux switches and main contacts |  |  | |  | |
| 3.20 | Maximum total lead burden | VA |  | |  | |
| 3.21 | Recommended cable lead burden | Mm |  | |  | |
| 3.22 | CT circuit supervision time setting range | S |  | |  | |
| 3.23 | IEC 61850 communication protocol support | yes/no | yes | |  | |
| **4** | **Directional Earth Fault Relay (Include In Differential protection)** |  | **132kV , 33kV** | |  | |
| 4.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 4.2 | Applicable standard |  |  | |  | |
| 4.3 | Rated zero sequence current | A |  | |  | |
| 4.4 | Rated zero sequence polarizing voltage | V |  | |  | |
| 4.5 | Rated auxiliary DC voltage | V |  | |  | |
| 4.6 | Whether the following characteristics provided : | yes/no | yes | |  | |
|  | Normal inverse |  |  | |  | |
|  | Very inverse |  |  | |  | |
|  | Extremely inverse |  |  | |  | |
| 4.7 | Mounting arrangement |  |  | |  | |
| 4.8 | Whether instantaneous unit provided | yes/no |  | |  | |
| 4.9 | Current setting range | A |  | |  | |
| 4.10 | Drop-off / pick-up ratio |  |  | |  | |
| 4.11 | Hand reset operation indicator provided | yes/no |  | |  | |
| 4.12 | Power consumption | VA |  | |  | |
| 4.13 | IEC 61850 communication protocol support | yes/no |  | |  | |
| 4.14 | Normal inverse /Very inverse / Extremely inverse |  |  | |  | |
| 4.15 | Whether instantaneous unit provided | yes/no |  | |  | |
| 4.16 | Mounting arrangement |  |  | |  | |
| 4.17 | Current setting range in inverse characteristic / step | A |  | |  | |
| 4.18 | Current setting range in instantaneous/ definite characteristic / step | A |  | |  | |
| 4.19 | Time setting range / step | Sec |  | |  | |
| 4.20 | Relay characteristic angle | deg |  | |  | |
| 4.21 | Drop-off / pick-up ratio |  |  | |  | |
| 4.22 | Hand reset operation indicator | yes/no |  | |  | |
| 4.23 | Power consumption | VA |  | |  | |
| 4.24 | Inrush current blocking | yes/no |  | |  | |
| 4.25 | Transient over reach | yes/no |  | |  | |
| 4.26 | Current reversal logic (for parallel lines) provided | yes/no |  | |  | |
| 4.27 | Echo feature for tele-protection provided | yes/no |  | |  | |
| **5** | **Under & Over Voltage Relay** |  | **Under Voltage** | **Over Voltage** | **Under Voltage** | **Over Voltage** |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 5.2 | Applicable standard |  |  |  |  |  |
| 5.3 | Rated voltage | V |  |  |  |  |
| 5.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 5.5 | Resetting ratio |  |  |  |  |  |
| 5.6 | Time delay setting range / step | sec |  |  |  |  |
| 5.7 | Time characteristic |  |  |  |  |  |
| 5.8 | voltage Setting range / step | V |  |  |  |  |
| 5.9 | Power consumption | VA |  |  |  |  |
| 5.10 | Mounting arrangement |  |  |  |  |  |
| 5.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 5.12 | Manual blocking possibility | yes/no |  |  |  |  |
| **6** | **Autorecloser with Check synchro relay** |  | **132kV , 33kV** | |  | |
| 6.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 6.2 | Applied standard |  |  | |  | |
| 6.3 | number of auto recloser shots |  |  | |  | |
| 6.4 | Relay type | Static/ Microprocessor based | microprocessor | |  | |
| 6.5 | whether operation indicator provided | yes/no |  | |  | |
| 6.6 | provision for blocking and switching in the relay from : | Hz |  | |  | |
| 6.7 | control / relay panel | yes/no |  | |  | |
| 6.8 | remote control | yes/no |  | |  | |
| 6.9 | range of dead time adjustment / step | sec |  | |  | |
| 6.10 | range of reclaim time adjustment / step | sec |  | |  | |
| 6.11 | closing pulse time | sec |  | |  | |
| 6.12 | Method of blocking auto recloser |  |  | |  | |
| 6.13 | when circuit breaker is open |  |  | |  | |
| 6.14 | when closing into a fault |  |  | |  | |
| 6.15 | Single and 3 pole reclosing | yes/no | yes | |  | |
| 6.16 | whether operation counter provided | yes/no |  | |  | |
| 6.17 | whether following features provided for safe closing |  |  | |  | |
| 6.18 | synchronizing check in live bus / live line | yes/no | yes | |  | |
| 6.19 | live line / dead bus | yes/no | yes | |  | |
| 6.20 | live bus / dead line | yes/no | yes | |  | |
| 6.21 | dead bus / dead line | yes/no | yes | |  | |
| 6.22 | Time details (rag etc): |  |  | |  | |
|  | Number of timer |  |  | |  | |
|  | Auxiliary voltage | V |  | |  | |
|  | Timing range | sec |  | |  | |
| 6.23 | Number of phases |  |  | |  | |
| 6.24 | Range of voltage difference in percent of Un |  |  | |  | |
| 6.25 | Range of phase angle difference |  |  | |  | |
| 6.26 | Range of frequency difference |  |  | |  | |
| 6.27 | Limiting Short time thermal withstand value |  |  | |  | |
| 6.28 | Values of Auxiliary DC and its permissible variation | V |  | |  | |
| 6.29 | DC consumption | W |  | |  | |
| 6.30 | Contact data: |  |  | |  | |
|  | Number |  |  | |  | |
|  | Continuous rating at 110VDC | A |  | |  | |
| 6.31 | Mounting position | flush/Surface/etc |  | |  | |
| 6.32 | Accessories (if essential to relay performance) provided | yes/no |  | |  | |
| 6.33 | Hand reset operation indicator with inscription provided | yes/no |  | |  | |
| 6.34 | Burden | VA |  | |  | |
| 6.35 | Manual close inhibit timer |  |  | |  | |
| **7** | **Breaker Failure Protection (with End Fault)** |  | **132kV , 33kV** | |  | |
| 7.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 7.2 | Applied standard |  |  | |  | |
| 7.3 | Rated Value of Current |  |  | |  | |
| 7.4 | Setting range & accuracy class of characteristic quantity |  |  | |  | |
| 7.5 | Drop out current as % of pick up current |  |  | |  | |
| 7.6 | Pick up time | ms |  | |  | |
| 7.7 | Resetting time | ms |  | |  | |
| 7.8 | Frequency | Hz |  | |  | |
| 7.9 | Burden |  |  | |  | |
| 7.10 | Time details (rag etc.): |  |  | |  | |
|  | Number of timer |  |  | |  | |
|  | Auxiliary voltage | V |  | |  | |
|  | Timing range | sec |  | |  | |
| 7.11 | Number of phases |  |  | |  | |
| 7.12 | Limiting Short time thermal withstand value |  |  | |  | |
| 7.13 | Values of Auxiliary DC and its permissible variation | V |  | |  | |
| 7.14 | DC consumption | W |  | |  | |
| 7.15 | Contact data: |  |  | |  | |
|  | Number |  |  | |  | |
|  | Continuous rating at 110VDC | A |  | |  | |
| 7.16 | Mounting position | flush/Surface/etc |  | |  | |
| 7.17 | Accessories (if essential to relay performance) provided | yes/no |  | |  | |
| 7.18 | Hand reset operation indicator with inscription provided | yes/no |  | |  | |
| 7.19 | Burden | VA |  | |  | |
| 7.20 | Dielectric test voltage | KV/sec |  | |  | |
| 7.21 | IEC 61850 communication protocol support | yes/no | yes | |  | |
| **8** | **STUB Protection** |  | **132kV** | |  | |
| 8.1 | Manufacturer |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 8.2 | Applicable standard |  |  | |  | |
| 8.3 | Rated current |  |  | |  | |
| 8.4 | Current setting range |  |  | |  | |
| 8.5 | Mounting arrangement |  |  | |  | |
| 8.6 | Number of phases | ms |  | |  | |
| 8.7 | Rated aux DC voltage | ms |  | |  | |
| 8.8 | Hand reset operation indicator | Hz |  | |  | |
| 8.9 | Time setting range |  |  | |  | |
| 8.10 | Burden |  |  | |  | |
| 8.11 | IEC 61850 communication protocol support |  | yes | |  | |
| **9** | **Point On Wave Switching Relay** |  |  | |  | |
| 9.1 | Manufacturer |  |  | |  | |
|  | - Name |  |  | |  | |
|  | - Country |  |  | |  | |
|  | - Type designation |  |  | |  | |
| 9.2 | Applicable standard |  |  | |  | |
| 9.3 | ambient temperature | ̊C |  | |  | |
| 9.4 | controlled switching (opening , closing or both of them) |  | Both | |  | |
| 9.5 | operation modes | single mode / double mode |  | |  | |
| 9.6 | adaptation control function | yes/no |  | |  | |
| 9.7 | targets for controlled switching | rapid mode/ secured mode/ both of them |  | |  | |
| 9.8 | adaptation control function | yes/no |  | |  | |
| 9.9 | type of controlled load | transmission line/ power transformer/ capacitor/reactor |  | |  | |
| 9.10 | analogue inputs: |  |  | |  | |
|  | - Voltage reference input value / range | V |  | |  | |
|  | - Current measuring input value / range | A |  | |  | |
|  | - Control voltage input value / range | V |  | |  | |
|  | - Temperature variation sensor input / range |  |  | |  | |
|  | - Pressure variation sensor input / range |  |  | |  | |
| 9.11 | Drop-off / pick-up ratio |  |  | |  | |
| 9.12 | Hand reset operation indicator | yes/no |  | |  | |
| 9.13 | Mounting arrangement |  |  | |  | |
| 9.14 | Power Supply | V |  | |  | |
| 9.15 | Power consumption | VA |  | |  | |
| 9.16 | digital input data: | yes/no |  | |  | |
|  | - Number |  |  | |  | |
|  | - Application |  |  | |  | |
|  | - Continuous rating | A |  | |  | |
| 9.17 | open/ close power output data: | yes/no |  | |  | |
|  | - Number |  |  | |  | |
|  | - Continuous rating | A |  | |  | |
|  | - Breaking capacity | A |  | |  | |
|  | - Operating time | sec |  | |  | |
| 9.18 | signal output data | yes/no |  | |  | |
| 9.19 | - Number |  |  | |  | |
|  | - Continuous rating | A |  | |  | |
|  | - Breaking capacity | A |  | |  | |
| 9.20 | interface communication |  |  | |  | |
| 9.21 | Accessories (if essential to relay performance) provided | yes/no |  | |  | |
| 9.22 | EMC tests | KV/sec |  | |  | |
| \* | Power Transformer Protection | 132/33kV |  | |  | |
| 1 | Biased Differential Protection Relay |  | **132kV , 33kV** | |  | |
| 1.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 1.2 | Applicable standard |  |  | |  | |
| 1.3 | Relay type | Static/ Microprocessor based | microprocessor | |  | |
| 1.4 | Rated current | A |  | |  | |
| 1.5 | Rated auxiliary DC voltage | V |  | |  | |
| 1.6 | Bias setting range | (%) |  | |  | |
| 1.7 | Mounting arrangement |  |  | |  | |
| 1.8 | Hand reset operation indicator provided | yes/no |  | |  | |
| 1.9 | Method of preventing tripping during magnetizing inrush current |  |  | |  | |
| 1.10 | Maximum through fault current for which the relay is stable | A |  | |  | |
| 1.11 | Rated value of the auxiliary DC voltage | V |  | |  | |
| 1.12 | Fifth harmonic restrain feature | yes/no | yes | |  | |
| **2** | **Restricted Earth Fault Relay** |  | **132kV SIDE** | **33kV SIDE** |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Relay type | Static/ Microprocessor based | microprocessor | microprocessor |  |  |
| 2.3 | Hand reset operation indicator provided | yes/no |  |  |  |  |
| 2.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 2.5 | Mounting arrangement |  |  |  |  |  |
| 2.6 | Current setting range | A |  |  |  |  |
| 2.7 | Voltage setting range | V |  |  |  |  |
| 2.8 | Time setting range | sec |  |  |  |  |
| 2.9 | Resetting ratio | (%) |  |  |  |  |
| **3** | **Over Current Protection Relay** |  | **132kV SIDE** | **33kV SIDE** |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 3.2 | Applicable standard |  |  |  |  |  |
| 3.3 | Rated current | A |  |  |  |  |
| 3.4 | Current setting range in inverse characteristic / step | A |  |  |  |  |
| 3.5 | Current setting range in instantaneous/ definite characteristic / step | A |  |  |  |  |
| 3.6 | Time setting range / step | Sec |  |  |  |  |
| 3.7 | Number of contacts |  |  |  |  |  |
| 3.8 | Mounting arrangement |  |  |  |  |  |
| 3.9 | Number of phases |  |  |  |  |  |
| 3.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 3.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 3.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 3.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 3.14 | Minimum pick-up time | ms |  |  |  |  |
| 3.15 | Relay design (microprocessor-based, numerical) | Yes/No | Yes | Yes |  |  |
| **4** | **Neutral point Earth Fault Relay** |  | **132kV SIDE** | **33kV SIDE** |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 4.2 | Applicable standard |  |  |  |  |  |
| 4.3 | Rated current | A |  |  |  |  |
| 4.4 | Current setting range in inverse characteristic / step | A |  |  |  |  |
| 4.5 | Current setting range in instantaneous/ definite charactristic / step | A |  |  |  |  |
| 4.6 | Time setting range / step | Sec |  |  |  |  |
| 4.7 | Number of contacts |  |  |  |  |  |
| 4.8 | Mounting arrangement |  |  |  |  |  |
| 4.9 | Number of phases |  |  |  |  |  |
| 4.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 4.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 4.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 4.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 4.14 | Minimum pick-up time | ms |  |  |  |  |
| **5** | **Aux/Earthing Trans OC & EF Protection Relay** |  | **33kV** | **0.415kV** | **33kV** | **0.415kV** |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 5.2 | Applicable standard |  |  |  |  |  |
| 5.3 | Rated current | A |  |  |  |  |
| 5.4 | Current setting range in inverse characteristic / step | A |  |  |  |  |
| 5.5 | Current setting range in instantaneous/ definite characteristic / step | A |  |  |  |  |
| 5.6 | Time setting range / step | Sec |  |  |  |  |
| 5.7 | Number of contacts |  |  |  |  |  |
| 5.8 | Mounting arrangement |  |  |  |  |  |
| 5.9 | Number of phases |  |  |  |  |  |
| 5.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 5.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 5.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 5.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 5.14 | Minimum pick-up time | ms |  |  |  |  |
| **6** | **Directional Over Current Relay** |  | **132kV SIDE** | **33kV SIDE** |  |  |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 6.2 | Applicable standard |  |  |  |  |  |
| 6.3 | Rated current | A |  |  |  |  |
| 6.4 | Rated polarizing voltage | V |  |  |  |  |
| 6.5 | Whether the following characteristics provided : |  |  |  |  |  |
| 6.6 | Normal inverse /Very inverse / Extremely inverse |  |  |  |  |  |
| 6.7 | Whether instantaneous unit provided | yes/no |  |  |  |  |
| 6.8 | Mounting arrangement |  |  |  |  |  |
| 6.9 | Current setting range in inverse characteristic / step | A |  |  |  |  |
| 6.10 | Current setting range in instantaneous/ definite characteristic / step | A |  |  |  |  |
| 6.11 | Time setting range / step | Sec |  |  |  |  |
| 6.12 | Relay characteristic angle | deg |  |  |  |  |
| 6.13 | Drop-off / pick-up ratio |  |  |  |  |  |
| 6.14 | Hand reset operation indicator | yes/no |  |  |  |  |
| 6.15 | Power consumption | VA |  |  |  |  |
| 6.16 | Inrush current blocking | yes/no |  |  |  |  |
| 6.17 | Transient over reach | yes/no |  |  |  |  |
| 6.18 | Current reversal logic (for parallel lines) provided | yes/no |  |  |  |  |
| 6.19 | Echo feature for tele-protection provided | yes/no |  |  |  |  |
| **7** | **Directional Earth Fault Relay** |  | **132kV SIDE** | **33kV SIDE** |  |  |
| 7.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 7.2 | Applicable standard |  |  |  |  |  |
| 7.3 | Rated zero sequence current | A |  |  |  |  |
| 7.4 | Rated zero sequence polarizing voltage | V |  |  |  |  |
| 7.5 | Whether the following characteristics provided : |  |  |  |  |  |
| 7.6 | Normal inverse /Very inverse / Extremely inverse |  |  |  |  |  |
| 7.7 | Whether instantaneous unit provided | yes/no |  |  |  |  |
| 7.8 | Mounting arrangement |  |  |  |  |  |
| 7.9 | Current setting range in inverse characteristic / step | A |  |  |  |  |
| 7.10 | Current setting range in instantaneous/ definite characteristic / step | A |  |  |  |  |
| 7.11 | Time setting range / step | Sec |  |  |  |  |
| 7.12 | Relay characteristic angle | deg |  |  |  |  |
| 7.13 | Drop-off / pick-up ratio |  |  |  |  |  |
| 7.14 | Hand reset operation indicator | yes/no |  |  |  |  |
| 7.15 | Power consumption | VA |  |  |  |  |
| 7.16 | Inrush current blocking | yes/no |  |  |  |  |
| 7.17 | Transient over reach | yes/no |  |  |  |  |
| 7.18 | Current reversal logic (for parallel lines) provided | yes/no |  |  |  |  |
| 7.19 | Echo feature for tele-protection provided | yes/no |  |  |  |  |
| **8** | **Under & Over Relay** |  | **Under Voltage** | **Over Voltage** | **Under Voltage** | **Over Voltage** |
| 8.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 8.2 | Applicable standard |  |  |  |  |  |
| 8.3 | Rated voltage | V |  |  |  |  |
| 8.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 8.5 | Resetting ratio |  |  |  |  |  |
| 8.6 | Time delay setting range / step | sec |  |  |  |  |
| 8.7 | Time characteristic |  |  |  |  |  |
| 8.8 | voltage Setting range / step | V |  |  |  |  |
| 8.9 | Power consumption | VA |  |  |  |  |
| 8.10 | Mounting arrangement |  |  |  |  |  |
| 8.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 8.12 | Manual blocking possibility | yes/no |  |  |  |  |
| **9** | **Over Flux Relay** |  |  |  |  |  |
| 9.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 9.2 | Applicable standard |  |  |  |  |  |
| 9.3 | Rated voltage | V |  |  |  |  |
| 9.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 9.5 | Resetting ratio |  |  |  |  |  |
| 9.6 | Time delay setting range / step | sec |  |  |  |  |
| 9.7 | Time characteristic |  |  |  |  |  |
| 9.8 | voltage Setting range / step | V |  |  |  |  |
| 9.9 | Power consumption | VA |  |  |  |  |
| 9.10 | Mounting arrangement |  |  |  |  |  |
| 9.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 9.12 | Manual blocking possibility | yes/no |  |  |  |  |
| **11** | **Thermal over load Protection Relay** |  |  |  |  |  |
| 11.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 11.2 | Applicable standard |  |  |  |  |  |
| 11.3 | Rated current | A |  |  |  |  |
| 11.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 11.5 | Power consumption | VA |  |  |  |  |
| 11.6 | Mounting arrangement |  |  |  |  |  |
| 11.7 | Hand reset operation indicator | yes/no |  |  |  |  |
| 11.8 | Current setting range of inverse unit / step |  |  |  |  |  |
| 11.9 | Number of phases |  |  |  |  |  |
| 11.10 | fifth harmonic blocking feature | yes/no |  |  |  |  |
| 11.11 | Current setting range / step of instantaneous unit |  |  |  |  |  |
| 11.12 | type of characteristic |  |  |  |  |  |
| **13** | **Breaker Failure Protection (with End Fault)** |  | **132kV SIDE** | **33kV SIDE** |  |  |
| 13.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 13.2 | Applied standard |  |  |  |  |  |
| 13.3 | Rated Value of Current |  |  |  |  |  |
| 13.4 | Setting range & accuracy class of characteristic quantity |  |  |  |  |  |
| 13.5 | Drop out current as % of pick up current |  |  |  |  |  |
| 13.6 | Pick up time | ms |  |  |  |  |
| 13.7 | Resetting time | ms |  |  |  |  |
| 13.8 | Frequency | Hz |  |  |  |  |
| 13.9 | Burden |  |  |  |  |  |
| 13.10 | Time details (rag etc): |  |  |  |  |  |
|  | Number of timer |  |  |  |  |  |
|  | Auxiliary voltage | V |  |  |  |  |
|  | Timing range | sec |  |  |  |  |
| 13.11 | Number of phases |  |  |  |  |  |
| 13.12 | Limiting Short time thermal withstand value |  |  |  |  |  |
| 13.13 | Values of Auxiliary DC and its permissible variation | V |  |  |  |  |
| 13.14 | DC consumption | W |  |  |  |  |
| 13.15 | Contact data: |  |  |  |  |  |
|  | Number |  |  |  |  |  |
|  | Continuous rating at 110VDC | A |  |  |  |  |
| 13.16 | Mounting position | flush/Surface/etc |  |  |  |  |
| 13.17 | Accessories (if essential to relay performance) provided | yes/no |  |  |  |  |
| 13.18 | Hand reset operation indicator with inscription provided | yes/no |  |  |  |  |
| 13.19 | Burden | VA |  |  |  |  |
| 13.20 | Dielectric test voltage | KV/sec |  |  |  |  |
| 13.21 | IEC 61850 communication protocol support | yes/no | yes | yes |  |  |
| **14** | **AVR Relay** |  | **132kV , 33kV** | |  | |
| 14.1 | Manufacturer : |  |  | |  | |
|  | Name |  |  | |  | |
|  | Country |  |  | |  | |
|  | Type designation |  |  | |  | |
| 14.2 | Applicable standard |  |  | |  | |
| 14.3 | Relay rated current | A |  | |  | |
| 14.4 | Relay rated voltage | V |  | |  | |
| 14.5 | Rated auxiliary DC voltage | Vdc |  | |  | |
| 14.6 | Current circuit power consumption | VA |  | |  | |
| 14.7 | Voltage circuit power consumption | VA |  | |  | |
| 14.8 | Rated frequency range | Hz |  | |  | |
| 14.9 | Regulating voltage setting range / step | V |  | |  | |
| 14.10 | Dead band voltages setting / step | V |  | |  | |
| 14.11 | Initial time delay setting / step : |  |  | |  | |
|  | Inverse |  |  | |  | |
|  | Definite |  |  | |  | |
| 14.12 | Inter tap delay |  |  | |  | |
| 14.13 | Under voltage setting /step | V |  | |  | |
| 14.14 | Over voltage setting / step | V |  | |  | |
| 14.15 | Load over current setting / step | A |  | |  | |
| 14.16 | Circulating current setting /step |  |  | |  | |
| 14.17 | Line drop compensation setting / step : |  |  | |  | |
|  | Reactive setting |  |  | |  | |
|  | Reactive setting |  |  | |  | |
| 14.18 | Out-put contacts : |  |  | |  | |
|  | Number |  |  | |  | |
|  | Type | NO/NC |  | |  | |
|  | Rated breaking capacity | VA |  | |  | |
|  | Rated continuous current | A |  | |  | |
| 14.19 | Mounting arrangement |  |  | |  | |
| 14.20 | Hand reset operation indicator | yes/no |  | |  | |
| 14.21 | IEC 61850 communication protocol support | yes/no | yes | |  | |
| **\*** | **Busbar Protection** | | | | | |
| **1** | **Differential Protection Relay** |  | **132kV** | **33kV** |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Type reference |  |  |  |  |  |
| 1.3 | Applicable standard |  |  |  |  |  |
| 1.4 | Relay type, static or elec. Mech. or other system of measuring basis ( Low imp, restrain current , directional comparison, etc) |  | Low Imp | Low Imp |  |  |
| 1.5 | Relay rated current | A |  |  |  |  |
| 1.6 | Relay burden | VA |  |  |  |  |
| 1.7 | Frequency | Hz |  |  |  |  |
| 1.8 | Current setting range : |  |  |  |  |  |
| 1.9 | Phase / earth fault | A |  |  |  |  |
| 1.10 | Phase / Phase fault | A |  |  |  |  |
| 1.11 | Time between fault commencement and initiation of trip: |  |  |  |  |  |
| 1.12 | At 3 times fault setting | ms |  |  |  |  |
| 1.13 | At 10 times fault setting | ms |  |  |  |  |
| 1.14 | Max through fault current for which relay is stable | KA |  |  |  |  |
| 1.15 | CT supervision relay | yes/no |  |  |  |  |
| 1.16 | Current Transformer requirement : |  |  |  |  |  |
|  | Formula for knee point voltage |  |  |  |  |  |
|  | Max of magnetization current |  |  |  |  |  |
| 1.17 | CT Supervision relay details: |  |  |  |  |  |
|  | Type and manufacturer |  |  |  |  |  |
|  | Alarm pick up current |  |  |  |  |  |
|  | Alarm pick up time |  |  |  |  |  |
|  | short circuit CT lead provided | yes/no |  |  |  |  |
|  | Blocking trip after a preset time provided | yes/no |  |  |  |  |
| 1.18 | Relay allowable saturation factor |  |  |  |  |  |
| 1.19 | Hand reset operation indicator provided | yes/no |  |  |  |  |
| 1.20 | Mounting position (flush , surface , etc) |  |  |  |  |  |
| 1.21 | Rated values of auxiliary energizing quantity & its permissible variation | VDC |  |  |  |  |
| 1.22 | Short time rating | KA/sec |  |  |  |  |
| 1.23 | Fault setting with maximum number of CTs connected |  |  |  |  |  |
| 1.24 | Isolating auxiliary switches provided | yes/no |  |  |  |  |
| 1.25 | Accessories (Essential to really performance) provided | yes/no |  |  |  |  |
| 1.26 | No of tripping relays |  |  |  |  |  |
| 1.27 | Interference test (Mhz) | KV |  |  |  |  |
| 1.28 | Surge test (12/50 micro second) | KV |  |  |  |  |
| 1.29 | Self monitoring of its important circuit possible | yes/no |  |  |  |  |
| 1.30 | Automatic testing is possible | yes/no |  |  |  |  |
| 1.31 | IEC 61850 communication protocol support | yes/no | yes | yes |  |  |
|  |  |  |  |  |  |  |
| **2** | **U/O Voltage Relay for Distribution Busbars** |  | **Under Voltage** | **Over Voltage** | **Under Voltage** | **Over Voltage** |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Applicable standard |  |  |  |  |  |
| 2.3 | Rated voltage | V |  |  |  |  |
| 2.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 2.5 | Resetting ratio |  |  |  |  |  |
| 2.6 | Time delay setting range / step | sec |  |  |  |  |
| 2.7 | Time characteristic |  |  |  |  |  |
| 2.8 | voltage Setting range / step | V |  |  |  |  |
| 2.9 | Power consumption | VA |  |  |  |  |
| 2.10 | Mounting arrangement |  |  |  |  |  |
| 2.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 2.12 | Manual blocking possibility | yes/no |  |  |  |  |
| **3** | **High Speed Auxiliary Relay (self reset)** |  | **132kV** | **33kV** |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 3.2 | Rated voltage | VDC |  |  |  |  |
| 3.3 | Targets | yes/no |  |  |  |  |
| 3.4 | Number of contacts |  |  |  |  |  |
| 3.5 | Pick up time: |  |  |  |  |  |
|  | Make Contact (NO) | ms |  |  |  |  |
|  | Break contact (NC) | ms |  |  |  |  |
| 3.6 | Pickup/ drop off ratio |  |  |  |  |  |
| 3.7 | Permitted ambient temperature - indoor | °c |  |  |  |  |
| 3.8 | Permitted ambient temperature - outdoor | °c |  |  |  |  |
| 3.9 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V |  |  |  |  |
|  | Maximum system voltages |  |  |  |  |  |
| 3.10 | Current carrying capacity: |  |  |  |  |  |
|  | short time | A |  |  |  |  |
|  | continuously | A |  |  |  |  |
|  | Making and conducting capacity |  |  |  |  |  |
|  | Breaking Capacity |  |  |  |  |  |
| 3.11 | Type of Mounting |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **\*** | **Bus Coupler & Section Feeder Protection** |  | **132kV** | 33kV | 132kV | 33kV |
| **1** | **Over Current Protection Relay** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Applicable standard |  |  |  |  |  |
| 1.3 | Rated current | A |  |  |  |  |
| 1.4 | Current setting range in inverse charactristic / step | A |  |  |  |  |
| 1.5 | Current setting range in instantaneous/ definite charactristic / step | A |  |  |  |  |
| 1.6 | Time setting range / step | Sec |  |  |  |  |
| 1.7 | Number of contacts |  |  |  |  |  |
| 1.8 | Mounting arrangement |  |  |  |  |  |
| 1.9 | Number of phases |  |  |  |  |  |
| 1.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 1.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 1.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 1.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 1.14 | Minimum pick-up time | ms |  |  |  |  |
|  |  |  |  |  |  |  |
| **2** | **Earth Fault Protection Relay** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Applicable standard |  |  |  |  |  |
| 2.3 | Rated current | A |  |  |  |  |
| 2.4 | Current setting range in inverse charactristic / step | A |  |  |  |  |
| 2.5 | Current setting range in instantaneous/ definite charactristic / step | A |  |  |  |  |
| 2.6 | Time setting range / step | Sec |  |  |  |  |
| 2.7 | Number of contacts |  |  |  |  |  |
| 2.8 | Mounting arrangement |  |  |  |  |  |
| 2.9 | Number of phases |  |  |  |  |  |
| 2.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 2.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 2.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 2.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 2.14 | Minimum pick-up time | ms |  |  |  |  |
| **3** | **Breaker Failure Protection (with End Fault)** |  |  | **33kV SIDE** |  | **33kV SIDE** |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 3.2 | Applied standard |  |  |  |  |  |
| 3.3 | Rated Value of Current |  |  |  |  |  |
| 3.4 | Setting range & accuracy class of characteristic quantity |  |  |  |  |  |
| 3.5 | Drop out current as % of pick up current |  |  |  |  |  |
| 3.6 | Pick up time | ms |  |  |  |  |
| 3.7 | Resetting time | ms |  |  |  |  |
| 3.8 | Frequency | Hz |  |  |  |  |
| 3.9 | Burden |  |  |  |  |  |
| 3.10 | Time details (rag etc): |  |  |  |  |  |
|  | Number of timer |  |  |  |  |  |
|  | Auxiliary voltage | V |  |  |  |  |
|  | Timing range | sec |  |  |  |  |
| 3.11 | Number of phases |  |  |  |  |  |
| 3.12 | Limiting Short time thermal withstand value |  |  |  |  |  |
| 3.13 | Values of Auxiliary DC and its permissible variation | V |  |  |  |  |
| 3.14 | DC consumption | W |  |  |  |  |
| 3.15 | Contact data: |  |  |  |  |  |
|  | Number |  |  |  |  |  |
|  | Continuous rating at 110VDC | A |  |  |  |  |
| 3.16 | Mounting position | flush/Surface/etc |  |  |  |  |
| 3.17 | Accessories (if essential to relay performance) provided | yes/no |  |  |  |  |
| 3.18 | Hand reset operation indicator with inscription provided | yes/no |  |  |  |  |
| 3.19 | Burden | VA |  |  |  |  |
| 3.20 | Dielectric test voltage | KV/sec |  |  |  |  |
|  |  |  |  |  |  |  |
| **\*** | **Distribution Feeder Protection** |  |  |  |  |  |
| **1** | **Over Current Protection Relay** |  |  | **33kV** |  | **33kV** |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Applicable standard |  |  |  |  |  |
| 1.3 | Rated current | A |  |  |  |  |
| 1.4 | Current setting range in inverse characteristic / step | A |  |  |  |  |
| 1.5 | Current setting range in instantaneous/ definite characteristic / step | A |  |  |  |  |
| 1.6 | Time setting range / step | Sec |  |  |  |  |
| 1.7 | Number of contacts |  |  |  |  |  |
| 1.8 | Mounting arrangement |  |  |  |  |  |
| 1.9 | Number of phases |  |  |  |  |  |
| 1.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 1.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 1.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 1.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 1.14 | Minimum pick-up time | ms |  |  |  |  |
| **2** | **Earth Fault Protection Relay** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Applicable standard |  |  |  |  |  |
| 2.3 | Rated current | A |  |  |  |  |
| 2.4 | Current setting range in inverse charactristic / step | A |  |  |  |  |
| 2.5 | Current setting range in instantaneous/ definite charactristic / step | A |  |  |  |  |
| 2.6 | Time setting range / step | Sec |  |  |  |  |
| 2.7 | Number of contacts |  |  |  |  |  |
| 2.8 | Mounting arrangement |  |  |  |  |  |
| 2.9 | Number of phases |  |  |  |  |  |
| 2.10 | Rated auxiliary DC voltage | V |  |  |  |  |
| 2.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 2.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 2.13 | Second harmonic blocking feature | yes/no |  |  |  |  |
| 2.14 | Minimum pick-up time | ms |  |  |  |  |
| **3** | **Distance Protection (Backup Protection)** |  |  | 33kV |  | 33kV |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 3.2 | Applicable standard |  |  |  |  |  |
| 3.3 | Type | Static/ Microprocessor based |  |  |  |  |
| 3.4 | Rated current |  |  |  |  |  |
| 3.5 | Rated voltage |  |  |  |  |  |
| 3.6 | Rated auxiliary DC |  |  |  |  |  |
| 3.7 | Method of starting |  |  |  |  |  |
| 3.8 | Number of zones : |  |  |  |  |  |
|  | Forward reach |  |  |  |  |  |
|  | Reverse reach |  |  |  |  |  |
| 3.9 | Mounting arrangement |  |  |  |  |  |
| 3.10 | Maximum zone 1 operating time |  |  |  |  |  |
| 3.11 | Time setting range for : |  |  |  |  |  |
|  | Zone 2 |  |  |  |  |  |
|  | Zone 3 |  |  |  |  |  |
| 3.12 | power swing blocking provided | yes/no |  |  |  |  |
| 3.13 | Dielectric test voltage |  |  |  |  |  |
| 3.14 | Type of relay characteristics |  |  |  |  |  |
| 3.15 | Type of characteristics for phase-ground and three phase faults |  |  |  |  |  |
| 3.16 | Number of measuring units |  |  |  |  |  |
| 3.17 | Type of impedance measuring characteristic for phase to ground faults /setting range / step |  |  |  |  |  |
|  | Zone 1 |  |  |  |  |  |
|  | Zone 2 |  |  |  |  |  |
|  | Zone 3 |  |  |  |  |  |
| 3.18 | Type of impedance measuring characteristic for phase to phase faults /setting range / step |  |  |  |  |  |
|  | Zone 1 |  |  |  |  |  |
|  | Zone 2 |  |  |  |  |  |
|  | Zone 3 |  |  |  |  |  |
| 3.19 | Method of ensuring correct discrimination for three phase close up faults |  |  |  |  |  |
| 3.20 | Fault locator feature built in | yes/no |  |  |  |  |
| 3.21 | Built in directional overcurrent/ earth fault relay | yes/no |  |  |  |  |
| 3.22 | Built in disturbance Recorder | yes/no |  |  |  |  |
| 3.23 | Built in DTT | yes/no |  |  |  |  |
| 3.24 | Built in SOTF | yes/no |  |  |  |  |
| 3.25 | Mutual compensation provided | yes/no |  |  |  |  |
| 3.26 | internal Fuse failure blocking provided | yes/no |  |  |  |  |
| 3.27 | Filtering against CVT transients provided | yes/no |  |  |  |  |
| 3.28 | Current carrying /making/breaking capacity for trip contacts | A |  |  |  |  |
| 3.29 | Weak-end in feed trip feature provided | yes/no |  |  |  |  |
| 3.30 | Current reversal logic (for double lines) provided | yes/no |  |  |  |  |
| **4** | **Under & Over Voltage Relay** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 4.2 | Applicable standard |  |  |  |  |  |
| 4.3 | Rated voltage | V |  |  |  |  |
| 4.4 | Rated auxiliary DC voltage | V |  |  |  |  |
| 4.5 | Resetting ratio |  |  |  |  |  |
| 4.6 | Time delay setting range / step | sec |  |  |  |  |
| 4.7 | Time characteristic |  |  |  |  |  |
| 4.8 | voltage Setting range / step | V |  |  |  |  |
| 4.9 | Power consumption | VA |  |  |  |  |
| 4.10 | Mounting arrangement |  |  |  |  |  |
| 4.11 | Hand reset operation indicator | yes/no |  |  |  |  |
| 4.12 | Manual blocking possibility | yes/no |  |  |  |  |
|  |  |  |  |  |  |  |
| **5** | **Autorecloser with Check synchro relay** |  |  |  |  |  |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 5.2 | Applied standard |  |  |  |  |  |
| 5.3 | number of auto recloser shots |  |  |  |  |  |
| 5.4 | Relay type | Static/ Microprocessor based | microprocessor | microprocessor |  |  |
| 5.5 | whether operation indicator provided | yes/no |  |  |  |  |
| 5.6 | provision for blocking and switching in the relay from : | Hz |  |  |  |  |
| 5.7 | control / relay panel | yes/no |  |  |  |  |
| 5.8 | remote control | yes/no |  |  |  |  |
| 5.9 | range of dead time adjustment / step | sec |  |  |  |  |
| 5.10 | range of reclaim time adjustment / step | sec |  |  |  |  |
| 5.11 | closing pulse time | sec |  |  |  |  |
| 5.12 | Method of blocking auto recloser |  |  |  |  |  |
| 5.13 | when circuit breaker is open |  |  |  |  |  |
| 5.14 | when closing into a fault |  |  |  |  |  |
| 5.15 | Single and 3 pole reclosing | yes/no |  |  |  |  |
| 5.16 | whether operation counter provided | yes/no |  |  |  |  |
| 5.17 | whether following features provided for safe closing |  |  |  |  |  |
| 5.18 | synchronizing check in live bus / live line | yes/no |  |  |  |  |
| 5.19 | live line / dead bus | yes/no |  |  |  |  |
| 5.20 | live bus / dead line | yes/no |  |  |  |  |
| 5.21 | dead bus / dead line | yes/no |  |  |  |  |
| 5.22 | Time details (rag etc): |  |  |  |  |  |
|  | Number of timer |  |  |  |  |  |
|  | Auxiliary voltage | V |  |  |  |  |
|  | Timing range | sec |  |  |  |  |
| 5.23 | Number of phases |  |  |  |  |  |
| 5.24 | Range of voltage difference in percent of Un |  |  |  |  |  |
| 5.25 | Range of phase angle difference |  |  |  |  |  |
| 5.26 | Range of frequency difference |  |  |  |  |  |
| 5.27 | Limiting Short time thermal withstand value |  |  |  |  |  |
| 5.28 | Values of Auxiliary DC and its permissible variation | V |  |  |  |  |
| 5.29 | DC consumption | W |  |  |  |  |
| 5.30 | Contact data: |  |  |  |  |  |
|  | Number |  |  |  |  |  |
|  | Continuous rating at 110VDC | A |  |  |  |  |
| 5.31 | Mounting position | flush/Surface/etc |  |  |  |  |
| 5.32 | Accessories (if essential to relay performance) provided | yes/no |  |  |  |  |
| 5.33 | Hand reset operation indicator with inscription provided | yes/no |  |  |  |  |
| 5.34 | Burden | VA |  |  |  |  |
| 5.35 | Manual close inhibit timer |  |  |  |  |  |
| **6** | **Directional Over Current Relay** |  |  |  | **Short Line** | **Cable Feeder** |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 6.2 | Applicable standard |  |  |  |  |  |
| 6.3 | Rated zero sequence current | A |  |  |  |  |
| 6.4 | Rated zero sequence polarizing voltage | V |  |  |  |  |
| 6.5 | Whether the following characteristics provided : |  |  |  |  |  |
|  | Normal inverse |  |  |  |  |  |
|  | Very inverse |  |  |  |  |  |
|  | Extremely inverse |  |  |  |  |  |
| 6.6 | Mounting arrangement |  |  |  |  |  |
| 6.7 | Current setting range | A |  |  |  |  |
| 6.8 | Whether instantaneous unit provided | yes/no |  |  |  |  |
| 6.9 | Drop-off / pick-up ratio |  |  |  |  |  |
| 6.10 | Hand reset operation indicator | yes/no |  |  |  |  |
| 6.11 | Power consumption | VA |  |  |  |  |
| 6.12 | IEC 61850 communication protocol support | yes/no |  |  |  |  |
|  |  |  |  |  |  |  |
| **7** | **Directional Earth Fault Relay** |  |  |  |  |  |
| 7.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 7.2 | Applicable standard |  |  |  |  |  |
| 7.3 | Rated zero sequence current | A |  |  |  |  |
| 7.4 | Rated zero sequence polarizing voltage | V |  |  |  |  |
| 7.5 | Rated auxiliary DC voltage | V |  |  |  |  |
| 7.6 | Whether the following characteristics provided : |  |  |  |  |  |
|  | Normal inverse |  |  |  |  |  |
|  | Very inverse |  |  |  |  |  |
|  | Extremely inverse |  |  |  |  |  |
| 7.7 | Mounting arrangement |  |  |  |  |  |
| 7.8 | Whether instantaneous unit provided | yes/no |  |  |  |  |
| 7.9 | Current setting range | A |  |  |  |  |
| 7.10 | Drop-off / pick-up ratio |  |  |  |  |  |
| 7.11 | Hand reset operation indicator provided | yes/no |  |  |  |  |
| 7.12 | Power consumption | VA |  |  |  |  |
| 7.13 | IEC 61850 communication protocol support | yes/no |  |  |  |  |
| **\*** | **General Relays** | | | | | |
| **1** | **Self-Reset Trip Relay** |  |  |  | **Heavy Duty** | **High Speed** |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Number of contacts |  |  |  |  |  |
| 1.3 | Pick-up time | msec |  |  |  |  |
| 1.4 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  |  |  |  |  |
|  | Reset |  |  |  |  |  |
| 1.5 | Continuous current carrying capacity of already |  |  |  |  |  |
| 1.6 | closed contacts | A |  |  |  |  |
| 1.7 | Current breaking capacity (L/R >10 msec) | A |  |  |  |  |
| 1.8 | Current making capacity (L/R >10 msec) | A |  |  |  |  |
| 1.9 | Mounting arrangement |  |  |  |  |  |
| **2** | **Fuse Failure relay** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Applicable standard |  |  |  |  |  |
| 2.3 | Operating time | ms |  |  |  |  |
| 2.4 | Rated voltage | V |  |  |  |  |
| 2.5 | Mounting voltage |  |  |  |  |  |
| 2.6 | Monitoring fuse fail of 1, 2 or 3 phase | yes/no |  |  |  |  |
| 2.7 | Hand reset operation indicator | yes/no |  |  |  |  |
| 2.8 | setting range |  |  |  |  |  |
| **3** | **Close Relay** |  |  |  |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 3.2 | Number of contacts |  |  |  |  |  |
| 3.3 | Pick-up time | msec |  |  |  |  |
| 3.4 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  |  |  |  |  |
|  | Reset |  |  |  |  |  |
| 3.5 | Closed contacts continuous current capacity | A |  |  |  |  |
| 3.6 | Current breaking capacity (L/R >10 msec) | A |  |  |  |  |
| 3.7 | Current making capacity (L/R >10 msec) | A |  |  |  |  |
| 3.8 | Mounting arrangement |  |  |  |  |  |
| **4** | **Lockout Relay** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 4.2 | Number of contacts |  |  |  |  |  |
| 4.3 | Pick-up time | msec |  |  |  |  |
| 4.4 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  |  |  |  |  |
|  | Reset |  |  |  |  |  |
| 4.5 | Continuous current carrying capacity of already |  |  |  |  |  |
| 4.6 | closed contacts | A |  |  |  |  |
| 4.7 | Current breaking capacity (L/R >10 msec) | A |  |  |  |  |
| 4.8 | Current making capacity (L/R >10 msec) | A |  |  |  |  |
| 4.9 | Hand reset operation indicator | yes/no |  |  |  |  |
| 4.10 | Mounting arrangement |  |  |  |  |  |
| **5** | **TCS & CCS relay** |  | **TCS** | **CCS** | **TCS** | **CCS** |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 5.2 | Rated auxiliary DC voltage | V |  |  |  |  |
| 5.3 | Supervision of CB open and close position | yes/no |  |  |  |  |
| 5.4 | Hand reset operation indicator provided | yes/no |  |  |  |  |
| 5.5 | Mounting arrangement |  |  |  |  |  |
| 5.6 | Circuit breaker trip coil current | mA |  |  |  |  |
| 5.7 | Pick-up time | msec |  |  |  |  |
| 5.8 | Continuous current carrying for closed contacts | A |  |  |  |  |
| **6** | **Pole Discordance Relay** |  | **132kV** | **33kV** |  |  |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 6.2 | Applied standard |  |  |  |  |  |
| 6.3 | Rated Value of Current |  |  |  |  |  |
| 6.4 | Setting range & accuracy of characteristic quantity |  |  |  |  |  |
| 6.5 | Drop out current as % of pick up current |  |  |  |  |  |
| 6.6 | Pick up time | ms |  |  |  |  |
| 6.7 | Resetting time | ms |  |  |  |  |
| 6.8 | Frequency | Hz |  |  |  |  |
| 6.9 | Burden |  |  |  |  |  |
| 6.10 | Number of timers |  |  |  |  |  |
| 6.11 | Auxiliary voltage | V |  |  |  |  |
| **7** | **Auxiliary Relay With Flag** |  |  |  |  |  |
| 7.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 7.2 | Type designation |  |  |  |  |  |
| 7.3 | Number of contacts |  |  |  |  |  |
| 7.4 | Pick-up time | msec |  |  |  |  |
| 7.5 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  |  |  |  |  |
|  | Reset |  |  |  |  |  |
| 7.6 | Continuous current carrying capacity of already |  |  |  |  |  |
| 7.7 | closed contacts | A |  |  |  |  |
| 7.8 | Current breaking capacity (L/R >10 msec) | A |  |  |  |  |
| 7.9 | Current making capacity (L/R >10 msec) | A |  |  |  |  |
| 7.10 | Hand reset operation indicator | yes/no |  |  |  |  |
| 7.11 | Mounting arrangement |  |  |  |  |  |
| **8** | **Auxiliary relay (self reset)** |  |  |  |  |  |
| 8.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 8.2 | Rated voltage | VDC |  |  |  |  |
| 8.3 | Targets | yes/no |  |  |  |  |
| 8.4 | Number of contacts |  |  |  |  |  |
| 8.5 | Pick up time : |  |  |  |  |  |
|  | Make Contact (NO) | ms |  |  |  |  |
|  | Break contact (NC) | ms |  |  |  |  |
| 8.6 | Pickup / drop off ratio |  |  |  |  |  |
| 8.7 | Permitted ambient temperature - indoor | °c |  |  |  |  |
| 8.8 | Permitted ambient temperature - outdoor | °c |  |  |  |  |
| 8.9 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V |  |  |  |  |
|  | Maximum system voltages |  |  |  |  |  |
| 8.10 | Current carrying capacity: |  |  |  |  |  |
|  | short time | A |  |  |  |  |
|  | continuously | A |  |  |  |  |
|  | Making and conducting capacity | A |  |  |  |  |
|  | Breaking Capacity | A |  |  |  |  |
| 8.11 | Type of Mounting |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **9** | **High Speed Auxiliary Relay (self reset)** |  |  |  |  |  |
| 9.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 9.2 | Rated voltage | VDC |  |  |  |  |
| 9.3 | Targets | yes/no |  |  |  |  |
| 9.4 | Number of contacts |  |  |  |  |  |
| 9.5 | Pick up time: |  |  |  |  |  |
|  | Make Contact (NO) | ms |  |  |  |  |
|  | Break contact (NC) | ms |  |  |  |  |
| 9.6 | Pickup/ drop off ratio |  |  |  |  |  |
| 9.7 | Permitted ambient temperature - indoor | °c |  |  |  |  |
| 9.8 | Permitted ambient temperature - outdoor | °c |  |  |  |  |
| 9.9 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V |  |  |  |  |
|  | Maximum system voltages |  |  |  |  |  |
| 9.10 | Current carrying capacity: |  |  |  |  |  |
|  | short time | A |  |  |  |  |
|  | continuously | A |  |  |  |  |
|  | Making and conducting capacity |  |  |  |  |  |
|  | Breaking Capacity |  |  |  |  |  |
| 9.11 | Type of Mounting |  |  |  |  |  |
| **10** | **Time Delay Relay** |  |  |  |  |  |
| 10.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 10.2 | Rated voltage | VDC |  |  |  |  |
| 10.3 | Output contact function |  |  |  |  |  |
| 10.4 | Reset time |  |  |  |  |  |
| 10.5 | Target provided |  |  |  |  |  |
| 10.6 | Number of contacts |  |  |  |  |  |
| 10.7 | Consistency in operate time |  |  |  |  |  |
| 10.8 | Principle of operation |  |  |  |  |  |
| 10.9 | Permitted ambient temperature - indoor | °c |  |  |  |  |
| 10.10 | Permitted ambient temperature - outdoor | °c |  |  |  |  |
| 10.11 | Type of mounting |  |  |  |  |  |
| 10.12 | Setting range |  |  |  |  |  |
| **11** | **Protection Relay Test Block** |  |  |  |  |  |
| 11.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 11.2 | Type designation |  |  |  |  |  |
| 11.3 | Rated voltage | V |  |  |  |  |
| 11.4 | Rated Current | A |  |  |  |  |
| 11.5 | short circuit current capacity | A/s |  |  |  |  |
| 11.6 | Number of contacts |  |  |  |  |  |
| 11.7 | Type of mounting |  |  |  |  |  |
| 11.8 | number of current contacts |  |  |  |  |  |
| 11.9 | secondary CT contacts are shorted | yes/no |  |  |  |  |
| 11.10 | storage/ working temperature range |  |  |  |  |  |
| 11.11 | impulse withstand voltage | kV |  |  |  |  |
| 11.12 | test plug type designation |  |  |  |  |  |
|  | **Control System Equipment** | | | | | |
| **1** | **Synchronizing Equipment** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Applicable standard |  |  |  |  |  |
| 1.3 | Rated auxiliary DC voltage | V |  |  |  |  |
| 1.4 | Rated frequency | Hz |  |  |  |  |
| 1.5 | Rated CVT secondary voltage | V |  |  |  |  |
| 1.6 | Mounting arrangement |  |  |  |  |  |
| 1.7 | Maximum slip frequency at which CB closes | Hz |  |  |  |  |
| 1.8 | Maximum phase difference at which CB closes |  |  |  |  |  |
| 1.9 | Accuracy |  |  |  |  |  |
| 1.10 | Continuous over voltage rating | V |  |  |  |  |
| 1.11 | Short time rating |  |  |  |  |  |
| **2** | **Double voltmeter:** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Setting Range / step |  |  |  |  |  |
| 2.3 | Overall dimensions | mm\*mm |  |  |  |  |
| 2.4 | Type of mounting |  |  |  |  |  |
| 2.5 | Method of mounting |  |  |  |  |  |
| 2.6 | Total deflection angle |  |  |  |  |  |
| 2.7 | Total scale length |  |  |  |  |  |
| 2.8 | Burden |  |  |  |  |  |
| 2.9 | Accuracy |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **3** | **Double frequency meter:** |  |  |  |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 3.2 | Range |  |  |  |  |  |
| 3.3 | Overall dimensions |  |  |  |  |  |
| 3.4 | Type of mounting |  |  |  |  |  |
| 3.5 | Method of mounting |  |  |  |  |  |
| 3.6 | Total deflection angle |  |  |  |  |  |
| 3.7 | Total scale length |  |  |  |  |  |
| 3.8 | Burden |  |  |  |  |  |
| 3.9 | Accuracy |  |  |  |  |  |
| 3.10 | Synchroscope: |  |  |  |  |  |
| 3.11 | Overall dimensions |  |  |  |  |  |
| 3.12 | Type of mounting |  |  |  |  |  |
| 3.13 | Method of mounting |  |  |  |  |  |
| **4** | **Synchro-scope meter:** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 4.2 | Type and manufacturer |  |  |  |  |  |
| 4.3 | Rated voltage / frequency |  |  |  |  |  |
| 4.4 | Voltage difference setting range |  |  |  |  |  |
| 4.5 | Phase angle difference setting range |  |  |  |  |  |
| 4.6 | Frequency difference setting range (slip) |  |  |  |  |  |
|  | Paralleling |  |  |  |  |  |
|  | Synchronizing |  |  |  |  |  |
| 4.7 | Operating time |  |  |  |  |  |
| 4.8 | Resetting time |  |  |  |  |  |
| 4.9 | Duration of output signal |  |  |  |  |  |
| 4.10 | Dead voltage limit |  |  |  |  |  |
| 4.11 | Live voltage limit |  |  |  |  |  |
| 4.12 | Over load capacity |  |  |  |  |  |
| 4.13 | Pick-up to drop-off ratio |  |  |  |  |  |
| 4.14 | Duration of output signal |  |  |  |  |  |
| **5** | **Synchronizing relay** |  |  |  |  |  |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 5.2 | Applied standard |  |  |  |  |  |
| 5.3 | number of auto recloser shots |  |  |  |  |  |
| 5.4 | Relay type (microprocessor) | V |  |  |  |  |
| 5.5 | whether operation indicator provided | yes/no |  |  |  |  |
| 5.6 | provision for blocking and switching in the relay from : | Hz |  |  |  |  |
| 5.7 | control / relay panel | yes/no |  |  |  |  |
| 5.8 | remote control | yes/no |  |  |  |  |
| 5.9 | range of dead time adjustment | sec |  |  |  |  |
| 5.10 | range of reclaim time adjustment | sec |  |  |  |  |
| 5.11 | closing pulse time | sec |  |  |  |  |
| 5.12 | Method of blocking auto recloser |  |  |  |  |  |
| 5.13 | when circuit breaker is open |  |  |  |  |  |
| 5.14 | when closing into a fault |  |  |  |  |  |
| 5.15 | whether operation counter provided | yes/no |  |  |  |  |
| 5.16 | whether following features provided for safe closing |  |  |  |  |  |
| 5.17 | synchronizing check in live bus / live line | yes/no |  |  |  |  |
| 5.18 | live line / dead bus | yes/no |  |  |  |  |
| 5.19 | live bus / dead line | yes/no |  |  |  |  |
| 5.20 | dead bus / dead line | yes/no |  |  |  |  |
| 5.21 | Time details (rag etc): |  |  |  |  |  |
|  | Number of timer |  |  |  |  |  |
|  | Auxiliary voltage | V |  |  |  |  |
|  | Timing range | sec |  |  |  |  |
| 5.22 | Number of phases |  |  |  |  |  |
| 5.23 | Limiting Short time thermal withstand value |  |  |  |  |  |
| 5.24 | Values of Auxiliary DC and its permissible variation | V |  |  |  |  |
| 5.25 | DC consumption | W |  |  |  |  |
| 5.26 | Contact data: |  |  |  |  |  |
|  | Number |  |  |  |  |  |
|  | Continuous rating at 110VDC | A |  |  |  |  |
| 5.27 | Mounting position | flush/Surface/etc |  |  |  |  |
| 5.28 | Accessories (if essential to relay performance) provided | yes/no |  |  |  |  |
| 5.29 | Hand reset operation indicator with inscription provided | yes/no |  |  |  |  |
| 5.30 | Burden | VA |  |  |  |  |
| 5.31 | Dielectric test voltage | KV/sec |  |  |  |  |
| **\*** | **Annunciators** |  |  |  |  |  |
| **1** | **DC Operated** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Applicable standard |  |  |  |  |  |
| 1.3 | Rated auxiliary DC supply voltage |  |  |  |  |  |
| 1.4 | Speed of operation msec |  |  |  |  |  |
| 1.5 | Dimensions of each window mm |  |  |  |  |  |
| 1.6 | Type of reset | manual / auto |  |  |  |  |
| 1.7 | Urgent and non-urgent alarm discrimination | yes/no |  |  |  |  |
| 1.8 | Type of audible alarm for : |  |  |  |  |  |
|  | Urgent cases |  |  |  |  |  |
|  | Non-Urgent cases |  |  |  |  |  |
| 1.9 | Whether suitable for normally open contacts | yes/no |  |  |  |  |
| 1.10 | Type (solid state/digital type ) | solidstate/ digitaltype |  |  |  |  |
| 1.11 | Total power consumption per alarm point : |  |  |  |  |  |
|  | Normal condition | W |  |  |  |  |
|  | Flashing condition | W |  |  |  |  |
|  | Steady condition | W |  |  |  |  |
| 1.12 | Number of windows : |  |  |  |  |  |
| 1.13 | On each control panel |  |  |  |  |  |
| 1.14 | Total |  |  |  |  |  |
| 1.15 | 10% spare windows provided | yes/no |  |  |  |  |
| 1.16 | Suitable for normally open contacts | yes/no |  |  |  |  |
| 1.17 | Whether lamp test , acknowledge , accept and reset push button is provided for each panel | yes/no |  |  |  |  |
| **\*** | **Metering and Measuring equipment** | | | | | |
| **1** | **Ammeter (Separate from MC)** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 1.2 | Applicable standard |  |  |  |  |  |
| 1.3 | Type | digital |  |  |  |  |
| 1.4 | Range | A |  |  |  |  |
| 1.5 | Accuracy class |  |  |  |  |  |
| 1.6 | Rated frequency |  |  |  |  |  |
| 1.7 | CT secondary current | A |  |  |  |  |
| 1.8 | Total deflection angle |  |  |  |  |  |
| 1.9 | Continuous overload rating of current coil in Percent of rated current |  |  |  |  |  |
| 1.10 | Mounting arrangement |  |  |  |  |  |
| 1.11 | Dimensions | mm\*mm |  |  |  |  |
| **2** | **Voltmeters (Separate from MC)** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 2.2 | Applicable standard |  |  |  |  |  |
| 2.3 | Type | Moving coil / digital |  |  |  |  |
| 2.4 | Range | kV |  |  |  |  |
| 2.5 | Accuracy class |  |  |  |  |  |
| 2.6 | Rated frequency |  |  |  |  |  |
| 2.7 | PT secondary voltage V |  |  |  |  |  |
| 2.8 | Total deflection angle Degree |  |  |  |  |  |
| 2.9 | Continuous over voltage rating of voltage coil in percent of rated voltage |  |  |  |  |  |
| 2.10 | Mounting arrangement |  |  |  |  |  |
| 2.11 | Dimensions | mm\*mm |  |  |  |  |
|  |  |  |  |  |  |  |
| **3** | **PF and Freq. meters (Separate from MC)** |  |  |  | **PF** | **Freq** |
| 3.1 | Type and manufacturer |  |  |  |  |  |
| 3.2 | Accuracy class |  |  |  |  |  |
| 3.3 | Permitted ambient temperature C |  |  |  |  |  |
| 3.4 | Voltage rating |  |  |  |  |  |
| 3.5 | Current rating |  |  |  |  |  |
| 3.6 | Total deflection angle |  |  |  |  |  |
| 3.7 | Continuous overload rating of current circuit A |  |  |  |  |  |
| 3.8 | Continuous overload rating of voltage circuit V |  |  |  |  |  |
| 3.9 | Short time overload rating of current circuit(3 sec)A |  |  |  |  |  |
| 3.10 | Short time overload rating of voltage circuit (3 sec)V |  |  |  |  |  |
| 3.11 | Lead-lag measuring Yes/No |  |  |  |  |  |
| 3.12 | Measuring range |  |  |  |  |  |
| 3.13 | Wide range between 0/8 to 1 on both sides (lead & leg) with transducer | yes / no |  |  |  |  |
| 3.14 | Output voltage / current range of the transducer |  |  |  |  |  |
| 3.15 | Overall dimensions | mm\*mm |  |  |  |  |
| 3.16 | Rated frequency | Hz |  |  |  |  |
| 3.17 | Type of mounting |  |  |  |  |  |
| 3.18 | Insulation test voltage for one minute | KVrms |  |  |  |  |
| 3.19 | Low reflection glass | yes / no |  |  |  |  |
| 3.20 | Protection degree |  |  |  |  |  |
| **4** | **MW and MVAR meters (Separate from MC)** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 4.2 | Applicable standard |  |  |  |  |  |
| 4.3 | Accuracy |  |  |  |  |  |
| 4.4 | Frequency |  |  |  |  |  |
| 4.5 | Current range A |  |  |  |  |  |
| 4.6 | Voltage range V |  |  |  |  |  |
| 4.7 | Continuous rating of : |  |  |  |  |  |
|  | Current circuit | % In |  |  |  |  |
|  | Voltage circuit | % Vn |  |  |  |  |
| 4.8 | Dimensions | mm\* mm |  |  |  |  |
| 4.9 | Mounting arrangement |  |  |  |  |  |
| 4.10 | Type (static) |  |  |  |  |  |
| **5** | **Measuring center** |  |  |  |  |  |
| 5.1 | Type |  |  |  |  |  |
| 5.2 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Country |  |  |  |  |  |
|  | Type designation |  |  |  |  |  |
| 5.3 | Accuracy : |  |  |  |  |  |
|  | Active and reactive energy |  |  |  |  |  |
|  | Voltage |  |  |  |  |  |
|  | Current |  |  |  |  |  |
|  | Power |  |  |  |  |  |
|  | Frequency |  |  |  |  |  |
| 5.4 | Voltage input : |  |  |  |  |  |
|  | Rated voltage |  |  |  |  |  |
|  | Measuring range with separate auxiliary supply |  |  |  |  |  |
|  | Measuring range - self Powered |  |  |  |  |  |
|  | Burden with auxiliary supply |  |  |  |  |  |
|  | Burden ­- self powered |  |  |  |  |  |
|  | Rated frequency |  |  |  |  |  |
|  | Frequency range |  |  |  |  |  |
|  | Overload capacity |  |  |  |  |  |
| 5.5 | Current input : |  |  |  |  |  |
|  | Rated current |  |  |  |  |  |
|  | Maximum current |  |  |  |  |  |
|  | Burden |  |  |  |  |  |
|  | Overload capacity |  |  |  |  |  |
| 5.6 | AC auxiliary supply : |  |  |  |  |  |
|  | Auxiliary voltages |  |  |  |  |  |
|  | Optional auxiliary voltages |  |  |  |  |  |
|  | Supply voltage range |  |  |  |  |  |
|  | Burden |  |  |  |  |  |
|  | Overload |  |  |  |  |  |
| 5.7 | Display : |  |  |  |  |  |
|  | LCD (No of lines) |  |  |  |  |  |
|  | Number of digits |  |  |  |  |  |
|  | Height of digits |  |  |  |  |  |
|  | Width of digits |  |  |  |  |  |
| 5.8 | Output relays : |  |  |  |  |  |
|  | Contact rating |  |  |  |  |  |
|  | Maximum switching power |  |  |  |  |  |
|  | Maximum number of pulses |  |  |  |  |  |
|  | Pulse duration |  |  |  |  |  |
| 5.9 | Design : |  |  |  |  |  |
|  | Degree of protection |  |  |  |  |  |
|  | Weight |  |  |  |  |  |
|  | Dimensions |  |  |  |  |  |
|  | Mounting |  |  |  |  |  |
| 5.10 | Ambient conditions : |  |  |  |  |  |
|  | Temperature - operation |  |  |  |  |  |
|  | Temperature - storage |  |  |  |  |  |
|  | Humidity |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **6** | **Tariff Metering System** |  | **132kV** | **33kV** |  |  |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | * Name |  |  |  |  |  |
|  | * Country |  |  |  |  |  |
|  | * Model |  |  |  |  |  |
| 6.2 | Applicable standard |  |  |  |  |  |
| 6.3 | Construction |  |  |  |  |  |
|  | Measuring Principle |  | 3ph, 4wire | 3ph, 4wire |  |  |
|  | Type |  | Numerical | Numerical |  |  |
|  | Display/Reading digits |  | ≥7 | ≥7 |  |  |
|  | Backlit LCD |  | Yes | Yes |  |  |
| 6.4 | Frequency | Hz |  |  |  |  |
| 6.5 | Current range suitable for | A |  |  |  |  |
| 6.6 | Auxiliary voltage range |  |  |  |  |  |
|  | DC (Vn = 110Vdc) | Vdc | 88→125 | 88→125 |  |  |
|  | AC | Vac | 230 | 230 |  |  |
| 6.7 | Reverse running stop provided | yes/no |  |  |  |  |
| 6.8 | Impulse contact provided | yes/no | yes | yes |  |  |
| 6.9 | Whether test blocks provided | yes/no |  |  |  |  |
| 6.10 | Mounting arrangement |  |  |  |  |  |
| 6.11 | CT analog inputs |  |  |  |  |  |
|  | Rated current | A | 1 | 1 |  |  |
|  | Current measuring range | pu | 1.2 | 1.2 |  |  |
|  | Power consumption (burden) | VA |  |  |  |  |
|  | CT analog inputs |  |  |  |  |  |
| 6.12 | VT analog inputs |  |  |  |  |  |
|  | Rated voltage | V | 110 | 110 |  |  |
|  | Voltage measuring range | pu | 0.8 – 1.15 | 0.8 – 1.15 |  |  |
|  | Power consumption (burden) | VA |  |  |  |  |
| 6.13 | Accuracy Class |  |  |  |  |  |
|  | Watt hour (IEC 602053-22) |  | 0.2s | 0.2s |  |  |
|  | VAr hour (IEC 602053-23) |  | 2.0 | 2.0 |  |  |
| 6.14 | Measurements |  |  |  |  |  |
|  | kWh, MWh, kVArh, MVArh (Accumulated values) | Yes/No | Yes | Yes |  |  |
|  | kW, kVAr, MW, MWAr | Yes/No | Yes | Yes |  |  |
|  | V, I | Yes/No | Yes | Yes |  |  |
|  | Four quadrant reactive energy | Yes/No | Yes | Yes |  |  |
|  | Max Demand | Yes/No | Yes | Yes |  |  |
|  | THD | Yes/No | Yes | Yes |  |  |
| 6.15 | Outputs |  |  |  |  |  |
|  | Pulsed Outputs (IEC 62053-31) |  | 5 (min) | 5 (min) |  |  |
| 6.16 | Data Logging |  |  |  |  |  |
|  | Integral Logging/Storage function |  |  |  |  |  |
|  | * Duration | days | 180 | 180 |  |  |
|  | * Channels |  | 4 | 4 |  |  |
|  | * Programmable Periods | Yes/No | Yes | Yes |  |  |
|  | Inputs from external meters | Yes/No |  |  |  |  |
| 6.17 | Other functions |  |  |  |  |  |
|  | Battery Back-up | Yes/No | Yes | Yes |  |  |
|  | Back-up duration | days | ≥14 | ≥14 |  |  |
|  | GPS clock | Yes/No | Yes | Yes |  |  |
|  | Self-monitoring and alarm facility | Yes/No | Yes | Yes |  |  |
|  | Dual supply changeover (VT) | Yes/No | Yes | Yes |  |  |
|  | Remote Transmission of Energy and Power Values | Yes/No | Yes | Yes |  |  |
|  | Remote Interrogation via TCP/IP Link | Yes/No | Yes | Yes |  |  |
| 6.18 | Communications |  |  |  |  |  |
|  | Communication ports (Front/rear etc.) |  |  |  |  |  |
|  | * RS232 | Yes/No |  |  |  |  |
|  | * RS485 | Yes/No | Yes | Yes |  |  |
|  | * Optical (IEC 62056-21) | Yes/No | Yes | Yes |  |  |
|  | * Ethernet-IEC 61850 | Yes/No | Yes | Yes |  |  |
|  | Protocols supported |  |  |  |  |  |
|  | * IEC 62056-21, DLMS | Yes/No | Yes | Yes |  |  |
|  | * IEC 61850 | Yes/No | Yes | Yes |  |  |
|  | * Others (please list) |  |  |  |  |  |
| 6.19 | Type Tests |  |  |  |  |  |
| 6.19.1 | Atmospheric Environment |  |  |  |  |  |
|  | Operation -25°C and 55°C for 96hrs, IEC 60068-2-1 | Yes/No | Yes | Yes |  |  |
|  | Transport/storage -25°C and 70°C for 96hrs, IEC 60068-2-2 | Yes/No | Yes | Yes |  |  |
| 6.19.2 | Relative Humidity |  |  |  |  |  |
|  | Operation at 93% | Yes/No | Yes | Yes |  |  |
|  | Tested to IEC 60068-2-3 with severity class 56 days | Yes/No | Yes | Yes |  |  |
| 6.19.3 | Enclosure |  |  |  |  |  |
|  | IEC 60529 |  | IP50 | IP50 |  |  |
| 6.19.4 | Mechanical Environment |  |  |  |  |  |
|  | Vibration IEC 60255-21-1 | Yes/No | Yes | Yes |  |  |
|  | Shock and bump IEC 60255-21-2 | Yes/No | Yes | Yes |  |  |
|  | Seismic IEC 60255-21-3 | Yes/No | Yes | Yes |  |  |
| 6.19.5 | Insulation |  |  |  |  |  |
|  | Rated insulation |  |  |  |  |  |
|  | * 1000V high impedance protection CT inputs | Yes/No | Yes | Yes |  |  |
|  | * 250V for other circuits | Yes/No | Yes | Yes |  |  |
|  | * 1000V open contact withstand | Yes/No | Yes | Yes |  |  |
|  | Dielectric Tests   * IEC 60255-5 – Series C of table 1 | Yes/No | Yes | Yes |  |  |
|  | Impulse voltage   * IEC 60255-5 test voltage 5kV | Yes/No | Yes | Yes |  |  |
| 6.19.6 | Electromagnetic compatibility |  |  |  |  |  |
|  | 1MHz Burst disturbance test,   * IEC 60255-22-1 severity class III | Yes/No | Yes | Yes |  |  |
|  | Electrostatic Discharge   * IEC 60255-22-2 severity class III | Yes/No | Yes | Yes |  |  |
|  | Radiated Electromagnetic Field Disturbance   * IEC 60255-22-3 severity class III * Test method A, 27MHz through 500MHz | Yes/No | Yes | Yes |  |  |
|  | Electromagnetic Emissions   * IEC 60255-25 | Yes/No | Yes | Yes |  |  |
|  | Fast Transient Disturbance   * IEC 60255-22-4 severity level IV | Yes/No | Yes | Yes |  |  |
| 6.19.7 | Type test certificate provided | Yes/No | Yes | Yes |  |  |
| **\*** | **Transducer** | | | | | |
| **1** | **MW/MVAR** |  |  |  |  |  |
| 1.1 | Make and type |  |  |  |  |  |
| 1.2 | Compliance with IEC 60688 |  |  |  |  |  |
| 1.3 | Auxiliary power voltage range | V |  |  |  |  |
| 1.4 | Combined or separate units |  |  |  |  |  |
| 1.5 | Service conditions (temperature & RH) |  |  |  |  |  |
| 1.6 | Connections (eg two voltage & two current) |  |  |  |  |  |
| 1.7 | Input voltage range | V |  |  |  |  |
| 1.8 | Input current range | A |  |  |  |  |
| 1.9 | Output current | A |  |  |  |  |
| 1.10 | Accuracy class |  |  |  |  |  |
| 1.11 | Burden | VA |  |  |  |  |
| 1.12 | Overload | % |  |  |  |  |
| 1.13 | Case or rack mounted |  |  |  |  |  |
| **2** | **Voltage** |  |  |  |  |  |
| 2.1 | Make and type |  |  |  |  |  |
| 2.2 | Compliance with IEC 69688 |  |  |  |  |  |
| 2.3 | Auxiliary power voltage range | V |  |  |  |  |
| 2.4 | Service conditions (temperature & RH) |  |  |  |  |  |
| 2.5 | Input current Amps | A |  |  |  |  |
| 2.6 | Output current Amps | A |  |  |  |  |
| 2.7 | Accuracy class | % |  |  |  |  |
| 2.8 | Burden | VA |  |  |  |  |
| 2.9 | Overload | % |  |  |  |  |
| 2.10 | Case or rack mounted |  |  |  |  |  |
| **3** | **Current** |  |  |  |  |  |
| 3.1 | Make and type |  |  |  |  |  |
| 3.2 | Compliance with IEC 60688 |  |  |  |  |  |
| 3.3 | Auxiliary power voltage range | V |  |  |  |  |
| 3.4 | Service conditions (temperature & RH) |  |  |  |  |  |
| 3.5 | Input current range | A |  |  |  |  |
| 3.6 | Output current | A |  |  |  |  |
| 3.7 | Accuracy class | % |  |  |  |  |
| 3.8 | Burden | VA |  |  |  |  |
| 3.9 | Overload | % |  |  |  |  |
| 3.10 | Case or rack mounted |  |  |  |  |  |
| **4** | **Frequency** |  |  |  |  |  |
| 4.1 | Make and type |  |  |  |  |  |
| 4.2 | Compliance with IEC 60688 |  |  |  |  |  |
| 4.3 | Auxiliary power voltage rang Watts | W |  |  |  |  |
| 4.4 | Service conditions (temperature e& RH) |  |  |  |  |  |
| 4.5 | Input frequency range (eg nominal = 5%) | Hz |  |  |  |  |
| 4.6 | Output current Amps | A |  |  |  |  |
| 4.7 | Accuracy class | % |  |  |  |  |
| 4.8 | Burden | VA |  |  |  |  |
| 4.9 | Overload | % |  |  |  |  |
| 4.10 | Case or rack mounted |  |  |  |  |  |
| **5** | **Auxiliary relay (self reset)** |  |  |  |  |  |
| 5.1 | Manufacturer |  |  |  |  |  |
| 5.2 | Type |  |  |  |  |  |
| 5.3 | Rated voltage | Vdc |  |  |  |  |
| 5.4 | Targets | yes/no |  |  |  |  |
| 5.5 | Number of contacts |  |  |  |  |  |
| 5.6 | Pick up time : |  |  |  |  |  |
|  | Make Contact (NO) | ms |  |  |  |  |
|  | Break contact (NC) | ms |  |  |  |  |
| 5.7 | Pickup / drop off ratio |  |  |  |  |  |
| 5.8 | Permitted ambient temperature - indoor | °c |  |  |  |  |
| 5.9 | Permitted ambient temperature - outdoor | °c |  |  |  |  |
| 5.10 | Type of Mounting |  |  |  |  |  |
| 5.11 | Utilization category |  |  |  |  |  |
| 5.12 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V |  |  |  |  |
|  | Maximum system voltages | V |  |  |  |  |
|  | Current carrying capacity | A |  |  |  |  |
|  | short time | A |  |  |  |  |
|  | continuously | A |  |  |  |  |
|  | Making and conducting capacity | A |  |  |  |  |
|  | Breaking Capacity | A |  |  |  |  |
| **6** | **Time Delay Relay** |  |  |  |  |  |
| 6.1 | Manufacturer/Country |  |  |  |  |  |
| 6.2 | Type |  |  |  |  |  |
| 6.3 | Rated voltage | Vdc |  |  |  |  |
| 6.4 | Output contact function |  |  |  |  |  |
| 6.5 | Reset time |  |  |  |  |  |
| 6.6 | Target provided |  |  |  |  |  |
| 6.7 | Number of contacts |  |  |  |  |  |
| 6.8 | Consistency in operate time |  |  |  |  |  |
| 6.9 | Principle of operation |  |  |  |  |  |
| 6.10 | Permitted ambient temperature - indoor | °c |  |  |  |  |
| 6.11 | Permitted ambient temperature - outdoor | °c |  |  |  |  |
| 6.12 | Type of mounting |  |  |  |  |  |
| 6.13 | Setting range / step |  |  |  |  |  |

i) LOW VOLTAGE AC SYSTEM

| 1. LOW VOLTAGE AC SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| **1** | **General** |  |  |  |
| 1.1 | Rated power of station service transformers | kVA | As Per Drawings |  |
| 1.2 | Rated frequency | Hz | 50 |  |
| 1.3 | Max. Permissible voltage variation | % | 10 |  |
| 1.4 | Max. Permissible voltage drop | % | 5 |  |
| 1.5 | Number of phases |  | 3 |  |
| 1.6 | Number of wires |  | 4 |  |
| 1.7 | Short circuit current/time | kA/S | 25/1 |  |
| 1.8 | System grounding |  | Solid |  |
| 1.9 | Control phase Unit | Yes/No | Yes |  |
| 1.10 | Automatic Transfer Scheme provided | Yes/No | Yes |  |
| **2** | **AC Main and Distribution Panels** |  |  |  |
| 2.1 | Manufacturer of panels: |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 2.2 | Degree of protection of panels: |  |  |  |
|  | -         Indoor |  | IP54 |  |
|  | -         Outdoor |  | IP55 |  |
| 2.3 | Panel color |  | RAL7035 |  |
| 2.4 | Minimum thickness of steel panels | mm | 2.5 |  |
| 2.5 | Type of main circuit breakers | ACB/ MCCB | ACB |  |
| 2.6 | Type of outgoing circuit breakers | MCB/ MCCB | MCCB/MCB |  |
| 2.7 | Continuous rating of busbars | A | >1000 |  |
| 2.8 | Min. power frequency withstand voltage | kV | 2.5 |  |
| 2.9 | Single front /double front |  |  |  |
| 2.10 | Single front /double front |  |  |  |
| 2.11 | Type of insulation on busbars and connections |  |  |  |
| 2.12 | Main and earth busbar type and material |  |  |  |
| 2.13 | Maximum temperature rise inside panel | ̊C |  |  |
| 2.14 | Method of neutral grounding |  |  |  |
| 2.15 | Method of grounding incoming supply circuit |  |  |  |
| 2.16 | Type of protection provided within cubicles (shutters , insulating cover , .....) |  |  |  |
| 2.17 | Rear or front access |  |  |  |
| 2.18 | Type of Main cubicles construction |  | Single Front Compartmented/Fix |  |
| 2.19 | Type of Distribution cubicles construction |  | withdrawable |  |
| **3** | **Air Circuit Breaker (ACB)** |  |  |  |
| 3.1 | Manufacturer of : |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 3.2 | Degree of protection | IP |  |  |
| 3.3 | Type of circuit breaker | Drawout/ Plug-in/Fix | Draw out |  |
| 3.4 | Type of mounting |  |  |  |
| 3.5 | Rated voltage | V | 415/240 |  |
| 3.6 | Type of operating mechanism |  |  |  |
| 3.7 | Type of motor |  |  |  |
| 3.8 | Normal voltage for operation of motors | VDC | 110 |  |
| 3.9 | Normal voltage for trip coils | VDC | 110 |  |
| 3.10 | Voltage of operating mechanism motor | V |  |  |
| 3.11 | Rated making current | kA |  |  |
| 3.12 | Number of Air circuit breaker poles |  | 4 |  |
| 3.13 | Breaking current : |  |  |  |
|  | Symmetrical | kA |  |  |
|  | Asymmetrical | kA |  |  |
| 3.14 | Make time with 100% rated making current | ms |  |  |
| 3.15 | Number of N/C auxiliary contact |  | >10NO+ >10NC |  |
| 3.16 | Number of N/O auxiliary contact |  | >10NO+ >10NC |  |
| 3.17 | Operating duty cycle |  | CO-15sec-CO |  |
| 3.18 | Over load relay is required | Yes/No |  |  |
| 3.19 | Short circuit relay is required | Yes/No |  |  |
| **4** | **Molded Case Circuit Breaker (MCCB)** |  |  |  |
| 4.1 | Manufacturer of: |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 4.2 | Degree of protection | IP |  |  |
| 4.3 | Type of MCCB | Drawout/ Plug-in/Fix | Fix |  |
| 4.4 | Rated voltage | V | 415/240 |  |
| 4.5 | Rated current | A |  |  |
| 4.6 | Number of poles |  | 3 |  |
| 4.7 | Type of operating mechanism |  |  |  |
| 4.8 | Whether circuit breakers are motorized | Yes/No | NO |  |
| 4.9 | Normal voltage for operation of motors | VDC | 110 |  |
| 4.10 | Normal voltage for trip coils | VDC | 110 |  |
| 4.11 | Rated making current | KA |  |  |
| 4.12 | Breaking current : |  |  |  |
|  | Symmetrical | KA |  |  |
|  | Asymmetrical | KA |  |  |
| 4.13 | Make time with 100% rated making current | ms |  |  |
| 4.14 | Number Of N/C auxiliary contact |  | >10NO+ >10NC |  |
| 4.15 | Number of N/O auxiliary contact |  | >10NO+ >10NC |  |
| 4.16 | Over load relay is required…… | Yes/No | YES |  |
| 4.17 | Short circuit relay is required… | Yes/No | YES |  |
| **5** | **Miniature Circuit Breakers (MCB)** |  |  |  |
| 5.1 | Manufacturer of: |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 5.2 | Degree of protection | IP |  |  |
| 5.3 | Rated voltage | V | 415/240 |  |
| 5.4 | Rated current | A |  |  |
| 5.5 | Number of MCB poles |  | 3/1 |  |
| 5.6 | Rated short time withstand current (1 sec.) | kA | 25 |  |
| 5.7 | Number of poles |  |  |  |
| 5.8 | Service short circuit breaking capacity | kA |  |  |
| 5.9 | Rated short circuit making capacity | kA |  |  |
| 5.10 | Total fault elimination time | ms |  |  |
| 5.11 | Type of MCB characteristic |  |  |  |
| **6** | **Fuse Switches** |  |  |  |
| 6.1 | Manufacturer of : |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 6.2 | Degree of protection | IP |  |  |
| 6.3 | Type of mounting | Fix/plugin/ Drawable |  |  |
| 6.4 | Rated voltage | V | 415/240 |  |
| 6.5 | Rated current | A |  |  |
| 6.6 | Max. load break capacity |  |  |  |
| 6.7 | Making capacity | kA |  |  |
| 6.8 | Breaking capacity | kA |  |  |
| 6.9 | Type of operating mechanism |  |  |  |
| 6.10 | Number of N/C auxiliary contact |  | >10NO+ >10NC |  |
| 6.11 | Number of N/O auxiliary contract |  | >10NO+ >10NC |  |
| **7** | **Fuses** |  |  |  |
| 7.1 | Manufacturer of : |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 7.2 | Rated voltage | V | 415/240 |  |
| 7.3 | Rated current | A |  |  |
| 7.4 | Max. breaking capacity | kA |  |  |
| 7.5 | Operation indicator | Yes/No |  |  |
| 7.6 | Bases, carrier and holder required | Yes/No |  |  |
| **8** | **Load Breaker Switch (LBS)** |  |  |  |
| 8.1 | Manufacturer of : |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 8.2 | Rated voltage | V | 415/240 |  |
| 8.3 | Rated current | A |  |  |
| 8.4 | Max. breaking capacity | KA |  |  |
| 8.5 | Operation indicator | Yes/No | YES |  |
| 8.6 | Bases, carrier and holder required | Yes/No | YES |  |
| 8.7 | Number of poles |  |  |  |
| **9** | **Contactors** |  |  |  |
| 9.1 | Manufacturer of: |  |  |  |
|  | Name |  |  |  |
|  | Type |  |  |  |
|  | Country |  |  |  |
| 9.2 | Type of mounting | Fix/plugin/Drawable |  |  |
| 9.3 | Rated voltage | V |  |  |
| 9.4 | Contact rating | A |  |  |
| 9.5 | Number of auxiliary contacts |  | >10NO+ >10NC |  |

j) LOW VOLTAGE DC SYSTEM

| 1. LOW VOLTAGE DC SYSTEM | | **UNIT** | **DATA** | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | | **OFFERED** | |
| **1** | **GENERAL** |  | **110V** | **48V(N/A)** | **110V** | **48V** |
| 1.1 | Variation of DC voltage | % | -15 , +10 | -15 , +10 |  |  |
| 1.2 | Grounding of DC system |  | High Resistance | High Resistance |  |  |
| **2** | **DC MAIN AND DISTRIBUTION PANEL** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 2.2 | Type of cubicles construction |  | Single Front/ Compartmented/ Fix | Single Front/ Compartmented/ Fix |  |  |
| 2.3 | Finishing colour |  | RAL7035 | RAL7035 |  |  |
| 2.4 | Continuous rating of busbars | A |  |  |  |  |
| 2.5 | Continuous rating of incoming/bus coupler CBs | A |  |  |  |  |
| 2.6 | Short circuit current/time | kA/S |  |  |  |  |
| 2.7 | Applicable standards |  |  |  |  |  |
| 2.8 | Rated current of main indoor DC panel | A |  |  |  |  |
| 2.9 | Min. power frequency withstand voltage (kVrms) | kV | 2.5 | 2.5 |  |  |
| 2.10 | Rated short time withstand current (1 sec) | KA | 10 | 6 |  |  |
| 2.11 | Degree of protection for indoor panels | IP | IP51 | IP51 |  |  |
| 2.12 | Degree of protection for outdoor panels | IP | IP55 | IP55 |  |  |
| 2.13 | Reference ambient temperature | ̊C |  |  |  |  |
| 2.14 | Altitude above sea level |  |  |  |  |  |
| 2.15 | Padlocking facility for switches required | Yes/No |  |  |  |  |
| 2.16 | Rated short time withstand of busbars and connections (1 sec) | KA |  |  |  |  |
| 2.17 | Type of insulation on busbars and connections |  |  |  |  |  |
| 2.18 | Whether down dropper connections segregated from incoming/outgoing connections | Yes/No |  |  |  |  |
| 2.19 | Automatic changeover operation provided in DC main panel | Yes/No | Yes | Yes |  |  |
| 2.20 | Main and earth busbar type and material |  |  |  |  |  |
| 2.21 | Maximum temperature rise inside panel | oC |  |  |  |  |
| 2.22 | Method of neutral grounding |  |  |  |  |  |
| 2.23 | Method of grounding incoming supply circuit |  |  |  |  |  |
| 2.24 | Type of protection provided within cubicles (shutters, insulating cover....) |  |  |  |  |  |
| 2.25 | Rear or front access |  |  |  |  |  |
| 2.26 | Wall thickness | mm | 2.5 | 2.5 |  |  |
| 2.27 | Height of main indoor distribution panels | mm | 2.5 | 2.5 |  |  |
| 2.28 | Width of main indoor distribution panels | mm | 2.5 | 2.5 |  |  |
|  |  |  |  |  |  |  |
| **3** | **Batteries** |  |  |  |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 3.2 | Battery voltage : |  |  |  |  |  |
|  | Normal | V |  |  |  |  |
|  | Equalizing | V |  |  |  |  |
|  | Initial | V |  |  |  |  |
|  | Min. after 10 hr discharge period | V |  |  |  |  |
| 3.3 | Rated discharge capacity : |  |  |  |  |  |
|  | 1 hr rate | Ah |  |  |  |  |
|  | 10 hr rate | Ah |  |  |  |  |
| 3.4 | Type of cells | lead acid/ sealed acid/ nickel-cadmium | nickel-cadmium | nickel-cadmium |  |  |
| 3.5 | Amper hour capacity of each battery at 15°c, 10 hr rate to give final cell voltage of 1.85 V | Ah |  |  |  |  |
| 3.6 | Amper hour capacity of each battery at max temp, 10 hr rate to give final cell voltage | Ah |  |  |  |  |
| 3.7 | Charging current (continuous) | A |  |  |  |  |
| 3.8 | Discharge duty : |  |  |  |  |  |
|  | Continuous load/duration |  |  |  |  |  |
|  | Emergency load/duration |  |  |  |  |  |
|  | Momentary load/duration |  |  |  |  |  |
| 3.9 | Voltage per cell at end of 10 hr discharge period | V |  |  |  |  |
| 3.10 | Min. temperature | °C |  |  |  |  |
| 3.11 | Max. temperature | °C |  |  |  |  |
| 3.12 | Quantity of cells |  |  |  |  |  |
| 3.13 | Quantity of cell per battery |  |  |  |  |  |
| 3.14 | Quantity of cells per battery set |  |  |  |  |  |
| 3.15 | Type of positive plate |  |  |  |  |  |
| 3.16 | Type of negative plate |  |  |  |  |  |
| 3.17 | Weight of one battery with electrolyte | Kg |  |  |  |  |
| 3.18 | Complete mass of battery set | Kg |  |  |  |  |
| 3.19 | Complete battery set dimensions |  |  |  |  |  |
| 3.20 | Expected life of battery | year |  |  |  |  |
| 3.21 | Method of battery charging |  | Boost / Float | Boost / Float |  |  |
| 3.22 | Rated discharge capacity of batteries | Ah | 400 | 200 |  |  |
| 3.23 | Number of battery set |  | 1 | 0 |  |  |
| 3.24 | Number of cells | lead- acid /nickel -cadmium | 55/92 | 24/40 | f |  |
| 3.25 | Cell nominal voltage | lead -acid /nickel -cadmium | 2/1.2 | 2/1.2 |  |  |
| 3.26 | Min. final cell voltage | V | 1.85/1.14 | 1.85/1.14 |  |  |
| 3.27 | Material of stands |  |  |  |  |  |
| **4** | **Battery chargers** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 4.2 | Type |  | Solid State | Solid State |  |  |
| 4.3 | Number of battery charger set |  | 1 | 0 |  |  |
| 4.4 | Input voltage | V | 415/240 | 415/240 |  |  |
| 4.5 | Maximum current rating | A | >100 | >40 |  |  |
| 4.6 | Voltage ripple when charging battery | % |  |  |  |  |
| 4.7 | AC system data : |  |  |  |  |  |
|  | Supply voltage | V | 415/240 | 415/240 |  |  |
|  | Supply frequency | Hz | 50 | 50 |  |  |
|  | Variation in supply voltage | % | 0.5 | 0.5 |  |  |
|  | Variation in supply frequency | % |  |  |  |  |
|  | Short circuit level for AC supply at charger terminals for 3 Sec./1 Sec | KA |  |  |  |  |
| 4.8 | Load current limiter provided | Yes/No |  |  |  |  |
| 4.9 | Float charging current of the battery | A |  |  |  |  |
| 4.10 | Equalize charging current of the battery | A |  |  |  |  |
| 4.11 | Initial charging current of the battery | A |  |  |  |  |
| 4.12 | Voltage rating : |  |  |  |  |  |
|  | Input voltage | V(AC) |  |  |  |  |
|  | Output voltage | V(AC) |  |  |  |  |
|  | Rated output voltage (float) | V |  |  |  |  |
|  | Rated output voltage (boost) | V |  |  |  |  |
|  | Period adjustable for equalizing charging | Hz |  |  |  |  |
| 4.13 | Method of cooling |  |  |  |  |  |
| 4.14 | Permissive ripple of battery charger | % |  |  |  |  |
| 4.15 | Type of outgoing feeder short circuit protection |  |  |  |  |  |
| 4.16 | Boost charge with relevant timer provided | Yes/No |  |  |  |  |
| 4.17 | Ground fault protection provided | Yes/No |  |  |  |  |
| 4.18 | Percent of regulation with AVR for float charge |  |  |  |  |  |
| 4.19 | Rectifier transformer : |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Rating |  |  |  |  |  |
| 4.20 | Semi-conductor rectifiers : |  |  |  |  |  |
|  | Manufacture |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Type of cooling |  |  |  |  |  |
|  | Type of voltage surge suppression |  |  |  |  |  |
| 4.21 | Ambient conditions : |  |  |  |  |  |
| 4.22 | Temperature | °C |  |  |  |  |
| 4.23 | Altitude | m |  |  |  |  |
| 4.24 | Humidity | % |  |  |  |  |
| 4.25 | Type of protections : |  |  |  |  |  |
|  | AC phase failure | Yes/No |  |  |  |  |
|  | AC phase sequence | Yes/No |  |  |  |  |
|  | Blocking diode | Yes/No |  |  |  |  |
| 4.26 | Dropper | Yes/No |  |  |  |  |
|  | Inrush current | Yes/No |  |  |  |  |
|  | Battery reverse | Yes/No |  |  |  |  |
| 4.27 | Alarm & Indications : |  |  |  |  |  |
|  | Over voltage alarm for AC/ DC |  |  |  |  |  |
|  | Under voltage alarm for AC/ DC |  |  |  |  |  |
|  | Earth fault alarm for AC/ DC |  |  |  |  |  |
|  | Current indication for AC/ DC |  |  |  |  |  |
| 4.28 | Rated discharge period hours |  | 10 | 10 |  |  |
| 4.29 | Type |  | Solid State | Solid State |  |  |
| 4.30 | Number of battery charger set |  | 2 | 2 |  |  |
| 4.31 | Automatic changeover operation provided in charger | Yes/No | Yes | Yes |  |  |
| 4.32 | Charger can be parallel to another | Yes/No | Yes | Yes |  |  |
| 4.33 | Panel : |  |  |  |  |  |
| 4.34 | Total weight | Kg |  |  |  |  |
| 4.35 | Dimensions (WxHxD) | cm |  |  |  |  |
| 4.36 | Color | RAL |  |  |  |  |
| 4.37 | protection degree | IP | IP51 | IP51 |  |  |
| 4.38 | Rear or front access |  |  |  |  |  |
|  |  |  |  |  |  |  |
| **5** | **Molded Case Circuit Breaker (MCCB)** |  |  |  |  |  |
| 5.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 5.2 | Type of mounting | Fix/plugin/ Drawable | Fix | Fix |  |  |
| 5.3 | Degree of protection | IP |  |  |  |  |
| 5.4 | Applicable standard |  |  |  |  |  |
| 5.5 | Rated voltage | V | 110 | 48 |  |  |
| 5.6 | Rated current | A |  |  |  |  |
| 5.7 | Rated short time withstand current (1 sec.) | KA |  |  |  |  |
| 5.8 | Number of poles |  | 2 | 2 |  |  |
| 5.9 | Type of operating mechanism |  |  |  |  |  |
| 5.10 | Type of motor |  |  |  |  |  |
| 5.11 | One minute power frequency withstand level | KV |  |  |  |  |
| 5.12 | Whether circuit breakers are motorized | Yes/No |  |  |  |  |
| 5.13 | Normal voltage for operation of motors | VDC | 110 | 110/48 |  |  |
| 5.14 | Normal voltage for trip coils | VDC | 110 | 110/48 |  |  |
| 5.15 | Rated making current | KA |  |  |  |  |
| 5.16 | Breaking current : |  |  |  |  |  |
|  | Symmetrical | KA |  |  |  |  |
|  | Asymmetrical | KA |  |  |  |  |
| 5.17 | Make time with 100% rated making current | ms |  |  |  |  |
| 5.18 | Design: | Fix/plugin/ Drawable |  |  |  |  |
| 5.19 | Number Of N/C auxiliary contact |  | >10NO+ >10NC | >10NO+ >10NC |  |  |
| 5.20 | Number of N/O auxiliary contact |  | >10NO+ >10NC | >10NO+ >10NC |  |  |
| 5.21 | Antipumping feature is required | Yes/No |  |  |  |  |
| 5.22 | Over load relay is required | Yes/No |  |  |  |  |
| 5.23 | Short circuit relay is required | Yes/No |  |  |  |  |
| **6** | **Miniature Circuit Breakers (MCB)** |  |  |  |  |  |
| 6.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 6.2 | Type of mounting (Fix/plug in/Drawable) |  |  |  |  |  |
| 6.3 | Applicable standard |  |  |  |  |  |
| 6.4 | Rated voltage | V | 110 | 48 |  |  |
| 6.5 | Rated current | A |  |  |  |  |
| 6.6 | Rated short time withstand current (1 sec.) | KA |  |  |  |  |
| 6.7 | Number of poles |  | 2 | 2 |  |  |
| 6.8 | Service short circuit breaking capacity | KA |  |  |  |  |
| 6.9 | Rated short circuit making capacity | KA |  |  |  |  |
| 6.10 | Total fault elimination time | ms |  |  |  |  |
| 6.11 | Type of MCB characteristic |  |  |  |  |  |
| 6.12 | Degree of protection | IP |  |  |  |  |
| **7** | **Fuse Switches** |  |  |  |  |  |
| 7.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 7.2 | Type of mounting | Fix/plugin/ Drawable |  |  |  |  |
| 7.3 | Degree of protection | IP |  |  |  |  |
| 7.4 | Applicable standard |  |  |  |  |  |
| 7.5 | Rated voltage | V | 110 | 48 |  |  |
| 7.6 | Rated current | V |  |  |  |  |
| 7.7 | Max. load break capacity |  |  |  |  |  |
| 7.8 | Making capacity | KA |  |  |  |  |
| 7.9 | Breaking capacity | KA |  |  |  |  |
| 7.10 | Type of operating mechanism |  |  |  |  |  |
| 7.11 | Number of N/C auxiliary contact |  | >10NO+ >10NC | >10NO+ >10NC |  |  |
| 7.12 | Number of N/O auxiliary contract |  | >10NO+ >10NC | >10NO+ >10NC |  |  |
| **8** | **Fuses** |  |  |  |  |  |
| 8.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 8.2 | Type of mounting (Fix/plug in/Drawable) | Fix/plugin/ Drawable |  |  |  |  |
| 8.3 | Applicable standard |  |  |  |  |  |
| 8.4 | Rated voltage | V | 110 | 48 |  |  |
| 8.5 | Rated current | V |  |  |  |  |
| 8.6 | Rated frequency | Hz |  |  |  |  |
| 8.7 | Max. breaking capacity | KA |  |  |  |  |
| 8.8 | Operation indicator | Yes/No |  |  |  |  |
| 8.9 | Bases, carrier and holder required | Yes/No |  |  |  |  |
| **9** | **Load Breaker Switch (LBS)** |  |  |  |  |  |
| 9.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 9.2 | Type of mounting (Fix/plug in/Drawable) |  |  |  |  |  |
| 9.3 | Applicable standard |  |  |  |  |  |
| 9.4 | Rated voltage | V | 110 | 48 |  |  |
| 9.5 | Rated current | V |  |  |  |  |
| 9.6 | Rated frequency | Hz |  |  |  |  |
| 9.7 | Max. breaking capacity |  |  |  |  |  |
| 9.8 | Operation indicator | Yes/No |  |  |  |  |
| 9.9 | Bases, carrier and holder required | Yes/No |  |  |  |  |
| 9.10 | Number of poles |  |  |  |  |  |
| **10** | **Contactors** |  |  |  |  |  |
| 10.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  |  |  |  |  |
|  | Type |  |  |  |  |  |
|  | Country |  |  |  |  |  |
| 10.2 | Type of mounting | Fix/plugin/ Drawable |  |  |  |  |
| 10.3 | Applicable standard |  |  |  |  |  |
| 10.4 | Rated voltage | V |  |  |  |  |
| 10.5 | Contact rating | A |  |  |  |  |
| 10.6 | Number of auxiliary contacts |  | >10NO+ >10NC | >10NO+ >10NC |  |  |
| **11** | **UPS System** |  |  |  |  |  |
| 11.1 | Manufacturer/model |  |  |  |  |  |
| 11.2 | Type of switch |  |  |  |  |  |
| 11.3 | Type of MCB |  |  |  |  |  |
| 11.4 | Distribution circuits (numbers and ratings) |  |  |  |  |  |
| 11.5 | Nomber of cubicles |  |  |  |  |  |
| 11.6 | Forced limits at one meter |  |  |  |  |  |
| 11.7 | Noise limits at one meter |  |  |  |  |  |
| 11.8 | Instrumention |  |  |  |  |  |
| 11.9 | Alarms |  |  |  |  |  |
| 11.10 | Efficiency and power factor at 25.50% & 100% outputs |  |  |  |  |  |
| 11.11 | Modular desing/system extention facilities |  |  |  |  |  |
| 11.12 | Provision of maintenance switch |  | Yes |  |  |  |
| 11.13 | Radio frequency interference |  |  |  |  |  |

k) SUBSTATION AUTOMATION SYSTEM (SAS)

| 1. SUBSTATION AUTOMATION SYSTEM (SAS) | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| 1 | **GENERAL** |  |  |  |
| 1.1 | Protocol communication |  | IEC61850 |  |
| 1.2 | Communication protocol for all Measuring Centers |  | MODBUS |  |
| 1.3 | Vertical communication (base on Client/Server) | Yes/No | Yes |  |
| 1.4 | Horizontal communication (base on peer to peer) | Yes/No | Yes |  |
| 1.5 | Type of computers (Industrial / Commercial) |  | Industrial |  |
| 1.6 | Communication technology |  | Ethernet LAN |  |
| 1.7 | Communication topology |  | Dual Ring |  |
| 1.8 | Monitoring protocol in station level |  | SNMP |  |
| 1.9 | Supported protocol for time synchronizing |  | SNTP |  |
| 1.10 | Redundant configuration |  | Yes |  |
| 1.11 | Number of servers | No. | 2 |  |
| 1.12 | Number of monitors for each workstation | No. | 2 |  |
| 1.13 | Number of gateways | No. | 2, Equal IEC 104 Slaves |  |
| 1.14 | Indoor communication media |  | Fiber optic/Copper (twisted pair) |  |
| 1.15 | Outdoor communication media |  | Fiber optic |  |
| 1.16 | Workstation LAN Protocol communication |  | Compliant with ISO/IEEE 802.3 |  |
| 1.17 | Rated voltage | V | 240 AC / 110V DC |  |
| 1.18 | Variation of Aux. AC/DC | % | -15 , +10 |  |
| 1.19 | Nominal system frequency for AC | Hz | 50 |  |
| 1.20 | maximum noise level for the operation of any equipment | dB | 50 |  |
| 1.21 | Separate BCU provided |  | Yes |  |
| 1.22 | Consideration of future extension in SW (Yes/No) |  | Yes |  |
| 1.23 | Consideration of future extension in HW (Yes/No) |  | Yes |  |
| 1.24 | SCADA remote center |  | N.C.C, R.C.C, N.S.C.C |  |
| 1.25 | SCADA remote center protocols |  | IEC 60870-5-104 |  |
| **2** | **Substation Automation System (SAS) Design** |  |  |  |
| 2.1 | Manufacturer's Name |  |  |  |
| 2.2 | Manufacturer's Country |  |  |  |
| 2.3 | Type designation |  |  |  |
| 2.4 | No. of references, indicating similar transmission level projects included in the reference list (Manufacturer’s Reference list) |  | 5 references system having been in operation for at least 5 years in the KETRACO network without failures. |  |
| 2.5 | No. of references in similar transmission level projects included in the reference list. |  | 5 references system having been in operation for at least 5 years in the KETRACO network without failures. |  |
| 2.6 | User friendly Software (As generally accepted, comparing Microsoft products) |  | Software that have been used in the KETRACO SCADA/SAS system for more than 5 years without failures |  |
| 2.7 | Maintenance, modification or extension of components without a shutdown of the whole station automation system. |  | Yes |  |
| 2.8 | Is protection an integral part of the SAS system? | Yes/No | Yes |  |
| 2.9 | Possibility to read and alter relay settings, extract fault, event and disturbance records from SA |  | Yes |  |
| 2.10 | Analysis software for protection relays provided |  | Yes |  |
| 2.11 | Years of experience in design and supply of numerical equipment related to SA |  | At least 10 |  |
| 2.12 | Specify the Kind of LAN used for IED & protection level |  | Dual Ring |  |
| 2.13 | Specify Data exchange rate between the electronic devices on IED level LAN (Preferably at 10/100 M bit/s) |  |  |  |
| 2.14 | Ethernet LAN used for Station level |  | Dual Ring |  |
| 2.15 | Data exchange between the electronic devices on Station level shall take place via LAN at 10/100 M bit/s |  |  |  |
| 2.16 | Possibility to control, monitor and protect each individual bay from the respective bay level equipment for maintenance purposes or if the communication to a particular bay should fail. |  | Yes |  |
| 2.17 | Prevent initiation of operation of a single switch at the same time from more than one of the various control levels via, control center, remote computer, station level, bay level. |  | Yes, Implement Hierarchy of Control |  |
| 2.18 | Does ‘System’ functioning require multiple alarm acknowledgement or manual entries (at different workstations) for the same data. |  | Yes |  |
| 2.19 | Substation, by single line displays with paging |  | Yes |  |
| 2.20 | Multiple windows facility with size selectable |  | Yes |  |
| 2.21 | Event processing facility |  | Yes |  |
| 2.22 | Alarm processing facility |  | Yes |  |
| 2.23 | Separate loud ringing audible alarm |  | Yes |  |
| 2.24 | Analogue measurement handling (e.g. ‘change of state’ or other methods) |  | Yes |  |
| 2.25 | MWH & MVARH data from substation or calculated |  | Yes |  |
| 2.26 | Individual and sequence control facilities |  | Yes |  |
| 2.27 | Event printing highlighting |  | Yes |  |
| 2.28 | Scheduled logging facility |  | Yes |  |
| 2.29 | Page logging facility to hard copy color printer |  | Yes |  |
| 2.30 | Method of storage of historical data |  | Yes |  |
| 2.31 | Trend displays of analogues |  | Yes |  |
| 2.32 | Plant database schedule |  | Yes |  |
| 2.33 | Record of number of operations of plant |  | Yes |  |
| 2.34 | Operator manual entry facility etc. |  | Yes |  |
| 2.35 | SCMS equipment status display |  | Yes |  |
| 2.36 | Fault incident record facility |  | Yes |  |
| 2.37 | Operator defined formats |  | Yes |  |
| 2.38 | Transfer of control between SCS & SMS and SCADA |  | Yes |  |
| 2.39 | Tap position by binary or digital input |  | Yes |  |
| 2.40 | Provision of simple method of database and display updating system manager tasks. Details of proposals included |  | Yes |  |
| 2.41 | Tagging facility |  | Yes |  |
| 2.42 | Interlocking / redundancy feature |  | Yes |  |
| 2.43 | Distributed Synchro-check facility |  | Yes |  |
| 2.44 | Automatic and manual tap change control via SCMS |  | Yes |  |
| 2.45 | Protection relay and fault recorder data, work station display |  | Yes |  |
| 2.46 | Dynamic busbar coloring feature |  | Yes |  |
| 2.47 | Possibility of displaying of all substation and AC interlocking by the special picture |  | Yes |  |
| 2.48 | IEC61850 Standard Protocol Supporting |  | Yes |  |
| **3** | **SCMS Hardware and Software** |  |  |  |
| 3.1 | Identification of any special hardware and software required to be developed, with estimate of the work required |  |  |  |
| 3.2 | Design life, in service experience, design history and future development plans |  |  |  |
| 3.3 | Computer equipping for ultimate system |  |  |  |
| 3.4 | Integrated SCS & SMS database/more than one database |  | Yes |  |
| 3.5 | Database tools compliant with ODBC |  | Yes |  |
| 3.6 | Compatibility of database tools with tools at SCADA control center |  | YES |  |
| 3.7 | Editing tools for sequential / logic functions |  | Yes |  |
| 3.8 | Analogue accuracy from bay unit to display |  | Yes |  |
| 3.9 | Automatic/manual diagnostics provided for all SCS & SMS equipment |  | Yes |  |
| 3.10 | Automatic system restart following power interruption |  | Yes |  |
| 3.11 | Stall alarm facility |  |  |  |
| 3.12 | Fault / event record files auto upload to SCMS |  | Yes |  |
| 3.13 | No. of levels of system access protection |  |  |  |
| 3.14 | Multiple passwords available within each level of system access |  | Yes |  |
| 3.15 | Any specified SCS & SMS function propose |  |  |  |
| 3.16 | System redundancy in station computer configuration |  | Yes |  |
| 3.17 | System redundancy in LAN communication configuration |  | Yes |  |
| 3.18 | System redundancy in communication server configuration |  | Yes |  |
| 3.19 | Communication between bay level and station level |  | Yes |  |
| **4** | **Station Computer (Server)** |  |  |  |
| 4.1 | Manufacturer / model |  | Advantech |  |
| 4.2 | Type | Industrial/Commercial | Industrial |  |
| 4.3 | Real time industrial strength equipment |  |  |  |
| 4.4 | AC voltage working range. | V | 240 |  |
| 4.5 | Service conditions (temperature & RH) |  | -40°C to 85°C |  |
| 4.6 | Power consumption. | W |  |  |
| 4.7 | Architecture |  |  |  |
| 4.8 | Individual processors for each function |  |  |  |
| 4.9 | Operating system software |  | Windows |  |
| 4.10 | Method of processor Expansion (e.g. Number of free slots when supplied) |  |  |  |
| 4.11 | Main (semiconductor) memory |  |  |  |
|  | Type |  |  |  |
|  | Supplied size |  |  |  |
|  | Maximum size |  |  |  |
| 4.12 | Hard Disc storage |  | 2 TB |  |
|  | Type |  | Industrial |  |
|  | Supplied size |  |  |  |
|  | Maximum size |  |  |  |
| 4.13 | Clock |  |  |  |
| 4.14 | Type |  |  |  |
|  | Drift per day (when not synchronized to master clock) |  |  |  |
|  | Method of synchronization with master clock |  | SNTP |  |
|  | Battery back up |  | Power Supply from the 110VDC through a pure sine wave inverter |  |
| 4.15 | Details of mass storage devices and data archiving devices |  | Yes |  |
| **5** | **Operator/Engineering Workstation (MMI)** |  |  |  |
| 5.1 | Manufacturer / model |  | Advantech |  |
| 5.2 | Type | Industrial/Commercial | Industrial |  |
| 5.3 | AC voltage working range | V |  |  |
| 5.4 | Service conditions (temperature and RH) |  | -40°C to 85°C |  |
| 5.5 | Power consumption | W |  |  |
| 5.6 | Architecture |  |  |  |
| 5.7 | Operating system software |  |  |  |
| 5.8 | Method of processor expansion (e.g. number of free slots when supplied) |  |  |  |
| 5.9 | Main (semiconductor) memory |  |  |  |
|  | Type |  |  |  |
|  | Supplied size |  |  |  |
|  | Maximum size |  |  |  |
| 5.10 | Hard Disc storage |  | 2TB |  |
|  | Type |  |  |  |
|  | Supplied size |  |  |  |
|  | Maximum size |  |  |  |
| 5.11 | Clock |  |  |  |
|  | Type |  |  |  |
|  | Drift per day (when not synchronized to master clock) |  |  |  |
|  | Method of synchronization with master clock |  | SNTP |  |
| 5.12 | Processing system intercommunications interface |  |  |  |
|  | Number supported |  |  |  |
|  | Type (e.g. LAN etc.) |  | Dual Ring compliant |  |
|  | Speed |  | 3Ghz |  |
| 5.13 | Video Display Unit (VDU) |  |  |  |
|  | Type |  |  |  |
|  | Number to be supplied at a workstation |  |  |  |
|  | Screen size |  | 27 Inches |  |
|  | Screen pixel resolution |  | Full HD (1920 x 1080 pixels): |  |
|  | Compliance with recognized EMC and safety standards |  | Yes |  |
|  | Type of interface |  | Ethernet |  |
| 5.14 | Keyboard |  | Yes |  |
|  | Type |  |  |  |
|  | Number to be supplied |  | One for each computer |  |
|  | Total number of keys |  |  |  |
|  | Alphanumeric character key set |  |  |  |
|  | Control keys provided |  |  |  |
|  | Number of special function keys |  |  |  |
|  | Type of interface |  |  |  |
| 5.15 | Cursor control device (Mouse) |  |  |  |
|  | Number to be supplied |  |  |  |
|  | Number of buttons |  |  |  |
|  | Type (e.g. optical) |  |  |  |
|  | Mat |  |  |  |
|  | Type of interface |  |  |  |
| 5.16 | C.D Writer |  |  |  |
|  | Manufacturer |  |  |  |
|  | Speed |  |  |  |
|  | Type |  |  |  |
| 5.17 | D.V.D Writer |  |  |  |
|  | Manufacturer |  |  |  |
|  | Speed |  |  |  |
|  | Type |  |  |  |
| **6** | **Event Printer** |  |  |  |
| 6.1 | Manufacturer/model |  |  |  |
| 6.2 | Type | Dot matrix/Other type |  |  |
| 6.3 | AC voltage working range. | V |  |  |
| 6.4 | Power consumption. | W |  |  |
| 6.5 | Service conditions (temperature & RH) |  |  |  |
| 6.6 | Print speed | ppm. |  |  |
| 6.7 | Printing pitch/width |  |  |  |
| 6.8 | No. of print pins/jets or resolution |  |  |  |
| 6.9 | No. of fonts/character sets |  |  |  |
| 6.10 | Paper feed proposed/width |  |  |  |
| 6.11 | Self-test facility |  |  |  |
| 6.12 | Number of colors |  |  |  |
| 6.13 | Type of interface |  |  |  |
| 6.14 | Stand/trays |  |  |  |
| 6.15 | Acoustic noise at one meter | dB |  |  |
| 6.16 | Alarms local and remote |  |  |  |
| 6.17 | Configuration/dual network connection |  |  |  |
| **7** | **Hard Copy Color Laser Printer** |  |  |  |
| 7.1 | Manufacturer/model |  |  |  |
| 7.2 | Type |  |  |  |
| 7.3 | AC voltage working range | V |  |  |
| 7.4 | Power consumption | W |  |  |
| 7.5 | Service conditions (temperature & RH). |  |  |  |
| 7.6 | Print speed for color graphics printing (PPM) | Ppm. |  |  |
| 7.7 | No. of colors/toners |  |  |  |
| 7.8 | Resolution |  |  |  |
| 7.9 | Paper handling |  |  |  |
| 7.10 | Paper size |  |  |  |
| 7.11 | Type of interface |  |  |  |
| 7.12 | Stand / trays |  |  |  |
| 7.13 | Acoustic noise at one meter | dB |  |  |
| 7.14 | Alarms local and remote |  |  |  |
| 7.15 | Configuration/dual network connection |  |  |  |
| **8** | **Master Clock/G.P.S** |  |  |  |
| 8.1 | Manufacturer/model |  | Industrial GPS Clock with 2 SNTP ports and 1 IRIG-B port with time server capacity of 60 devices, 110VDC Power Supply. |  |
| 8.2 | Type |  | Industrial GPS |  |
| 8.3 | AC/DC voltage working range | V | 110VDC |  |
| 8.4 | Power consumption | W |  |  |
| 8.5 | Service conditions (temperature & RH) |  |  |  |
| 8.6 | Battery standby capacity |  |  |  |
| 8.7 | Type, speed and no. of output interfaces |  |  |  |
| 8.8 | Time and date facility |  |  |  |
| 8.9 | Seasonal changeover/automatic |  | Yes |  |
| 8.10 | Local display |  | Yes |  |
|  | Day : Mon : Yr |  | Yes |  |
|  | HH : MM : SS |  | Yes |  |
| 8.11 | Drift per day (when not synchronized to radio signal) |  |  |  |
| 8.12 | Receiver for UT from NVASTAR satellites |  |  |  |
| 8.13 | Loss of radio synch alarm |  |  |  |
| 8.14 | Other alarms |  |  |  |
| 8.15 | Local alarms and contacts for alarms to SCMS |  |  |  |
| 8.16 | Synchronization of station servers with G.P.S |  | Yes |  |
| 8.17 | Accuracy class |  |  |  |
| **9** | **Furniture** |  |  |  |
| 9.1 | Workstation desk |  | Yes, enough to hold four 27” Monitors and 4 seats |  |
| 9.2 | Material of desk |  |  |  |
| 9.3 | Durable desk top surface |  | Yes |  |
| 9.4 | Writing area |  | Yes |  |
| 9.5 | Drawers/shelves |  | Yes |  |
| 9.6 | Support for VDUs |  |  |  |
| 9.7 | Size |  |  |  |
| 9.8 | Height |  |  |  |
| 9.9 | Workstation chair |  | Yes |  |
| 9.10 | Material |  | High Quality |  |
| 9.11 | Swivel and castor action |  |  |  |
| 9.12 | High backed design |  | Yes |  |
| 9.13 | Arm rests |  | Yes |  |
| 9.14 | Desk lighting |  |  |  |
| 9.15 | Window blinds |  |  |  |
| **10** | **Workstation LAN** |  |  |  |
| 10.1 | Manufacturer/model |  |  |  |
| 10.2 | Type |  | Dual Ring |  |
| 10.3 | Coaxial / optical fiber cable |  |  |  |
| 10.4 | Operating speed. | Hz |  |  |
| 10.5 | Protocols/compliance with IEC Standard- |  | Yes |  |
| 10.6 | Media connection |  |  |  |
| 10.7 | Network functionality |  | Seamless Availability |  |
| 10.8 | Network management software |  | SNMP |  |
| 10.9 | Software packages |  |  |  |
| 10.10 | Dual redundant configuration |  | Yes |  |
| **11** | **Real Time LAN** |  |  |  |
| 11.1 | Manufacturer/model |  |  |  |
| 11.2 | Type |  | Dual Ring |  |
| 11.3 | Coaxial/optical fiber cable |  |  |  |
| 11.4 | Operating speed. | Hz |  |  |
| 11.5 | Protocols/compliance with IEC Standard |  | Yes |  |
| 11.6 | Media connection |  |  |  |
| 11.7 | Network functional |  | Seamless Availability |  |
| 11.8 | Network management |  |  |  |
| 11.9 | Software packages |  |  |  |
| 11.10 | Dual redundant configuration |  | Yes |  |
| 11.11 | Deterministic operational behavior |  |  |  |
| 11.12 | Peer to peer communications |  | Yes |  |
| **12** | **Communications** |  |  |  |
| 12.1 | Manufacturer/model |  |  |  |
| 12.2 | Type |  |  |  |
| 12.3 | Protocol/between station computer and BCU/BCPU |  | IEC 61850 |  |
|  | Manufacturer/model |  |  |  |
|  | Compliant with IEC 60870-5-101 and IEC61850 |  |  |  |
|  | Info transfer efficiency | data bits/total bits |  |  |
|  | Hamming distance |  |  |  |
|  | Security of control messages |  |  |  |
|  | Interface |  |  |  |
|  | Transmission rate |  |  |  |
| 12.4 | Type and no. of communication cables to BCU/BCPU |  | As required |  |
| 12.5 | Type & no. of communications cables to protection relay and disturbance recorder |  | As required |  |
| 12.6 | Peer to Peer signaling/client server architecture |  | Yes |  |
| 12.7 | Cyclic & event-initiated transmissions initiated by BCU/BCPU |  |  |  |
| 12.8 | Continued functioning of station computer and data management in the event of workstations out of service. Limitations applicable |  |  |  |
| 12.9 | Protocol between SCMS and SCADA |  | IEC 60870-5-104 |  |
|  | Emulation of functionality of existing SCADA RTU |  |  |  |
|  | Support Protocol Indactic 33 |  | No |  |
|  | Support Protocol HDLC |  | Not Required |  |
|  | Support Protocol IEC101 |  | No |  |
|  | Download of database from SCADA control center |  | Yes |  |
| 12.10 | LDC modem |  |  |  |
|  | Manufacturer and model |  |  |  |
|  | Type |  |  |  |
|  | DC voltage working range. | V |  |  |
|  | Service conditions (temperature and RH). |  |  |  |
|  | Signaling method |  |  |  |
|  | Transmission rate and frequency |  |  |  |
|  | Range of transmitter output |  |  |  |
|  | Range of receiver input |  |  |  |
|  | Low level receive alarm |  |  |  |
|  | Compliant with ITU-T recommendations |  |  |  |
|  | Modem switchover |  |  |  |
| 12.11 | Laptop workstation and SCMS fault analysis |  |  |  |
|  | Modem manufacturer and model |  |  |  |
|  | Type |  |  |  |
|  | DC voltage working range | V |  |  |
|  | Service conditions (temperature and RH) |  |  |  |
|  | Signaling method |  |  |  |
|  | Transmission rate and frequency |  |  |  |
|  | Range of transmitter output |  |  |  |
|  | Range of receiver input |  |  |  |
|  | Low level receive alarm |  |  |  |
|  | Compliant with ITU-T recommendations |  |  |  |
| 12.12 | Communications with adjacent SCMS system |  |  |  |
|  | Details of gateway |  |  |  |
|  | Provision of optical fiber link |  |  |  |
|  | Protocol |  |  |  |
|  | Transmission rate |  |  |  |
| **13** | **BCU/BCPU** |  |  |  |
| 13.1 | Manufacturer/model |  |  |  |
| 13.2 | Type |  |  |  |
| 13.3 | DC voltage working range | V |  |  |
| 13.4 | Service conditions (temperature) |  |  |  |
| 13.5 | Power consumption | W |  |  |
| 13.6 | Architecture |  |  |  |
| 13.7 | Memory type |  |  |  |
| 13.8 | Memory maximum |  |  |  |
| 13.9 | Memory supplied |  |  |  |
| 13.10 | System bus interface/speed |  |  |  |
| 13.11 | Provision of two redundant interfaces to LANs. |  |  |  |
| 13.12 | Method of loading/extending database |  |  |  |
| 13.13 | Logic functions & sequences |  |  |  |
| 13.14 | Clock |  |  |  |
|  | Type |  |  |  |
|  | Drift per day (when not synchronized to master clock) |  |  |  |
|  | Method of synchronization to master clock |  |  |  |
| 13.15 | I/O equipping including 10% spare provided |  |  |  |
| 13.16 | Method of data exchange with station computer (e.g. peer to peer). |  |  |  |
| 13.17 | Provision of logic functions and sequences |  |  |  |
| 13.18 | Direct AC input from CT/VT for analogue values |  |  |  |
|  | Model |  |  |  |
|  | Maximum no. inputs per card |  |  |  |
|  | Outputs available per input |  |  |  |
|  | Resolution/accuracy |  |  |  |
|  | Scan cycle |  |  |  |
|  | Burden | VA |  |  |
|  | Input CT/VT range |  |  |  |
|  | Input isolation |  |  |  |
|  | Analogue limit monitoring facility at BCU |  |  |  |
|  | No. of limits per analogue |  |  |  |
|  | Analogue threshold monitoring range/steps available |  |  |  |
| 13.19 | Trancducer |  |  |  |
|  | Model |  |  |  |
|  | Maximum no. inputs per card |  |  |  |
|  | Outputs available per input |  |  |  |
|  | Resolution/accuracy |  |  |  |
|  | Scan cycle |  |  |  |
|  | Burden | VA |  |  |
|  | Input CT/VT range |  |  |  |
|  | Input isolation |  |  |  |
|  | Analogue limit monitoring facility at BCU |  |  |  |
|  | No. of limits per analogue |  |  |  |
|  | Analogue threshold monitoring range/steps available |  |  |  |
| 13.20 | Conventional DC analogue inputs |  |  |  |
|  | Model |  |  |  |
|  | Maximum no. of inputs per card |  |  |  |
|  | ADC resolution/accuracy |  |  |  |
|  | Current input values supported |  |  |  |
|  | Solid state switching of inputs to ADC |  |  |  |
|  | Scan cycle per ADC |  |  |  |
|  | Input isolation (common/series mode) |  |  |  |
|  | Series and common mode noise rejection |  |  |  |
|  | Analogue limit monitoring facility at BCU |  |  |  |
|  | No. of limits per analogue |  |  |  |
|  | Analogue threshold monitoring range/steps available |  |  |  |
| 13.21 | Digital inputs |  |  |  |
|  | Number of inputs per module |  |  |  |
|  | Digital/software filtering to suppress plant contact bounce |  |  |  |
|  | Plant common connection at +48V (earth) |  |  |  |
|  | Maximum input contact frequency |  |  |  |
|  | Minimum contact closure capture time |  |  |  |
|  | Time tagging resolution |  |  |  |
|  | Isolation withstand |  |  |  |
| 13.22 | Pulse counter signal inputs |  |  |  |
|  | Number of inputs per module |  |  |  |
|  | Digital / software filtering to suppress plant contact bounce |  |  |  |
|  | Plant common connection at +48V (earth) |  |  |  |
|  | Maximum input contact frequency |  |  |  |
|  | Minimum contact closure capture time |  |  |  |
|  | Time tagging resolution |  |  |  |
|  | Isolation withstand |  |  |  |
| 13.23 | Digital outputs |  |  |  |
|  | Number of outputs per module |  |  |  |
|  | Select/check back/execute facility |  |  |  |
|  | Measurement of output circuit facility |  |  |  |
|  | Double pole switching of output |  |  |  |
|  | Output rating (VER) |  |  |  |
|  | Range of output pulse |  |  |  |
|  | Isolation withstand |  |  |  |
| 13.24 | Set point outputs |  |  |  |
|  | Maximum numbers |  |  |  |
|  | Number of outputs per module |  |  |  |
|  | Output rating |  |  |  |
|  | Digital set point / number of digits possible |  |  |  |
|  | Analogue set point/output values |  |  |  |
|  | Isolation withstand |  |  |  |
| 13.25 | Serial link to protection relay |  |  |  |
|  | Protocols supported |  |  |  |
|  | Protocols required for this project |  |  |  |
|  | Interface |  |  |  |
|  | Transmission rate |  |  |  |
|  | Optical fiber cable |  |  |  |
| 13.26 | Hardware interlocking with backup mimic (if the BCU fail) |  |  |  |
| **14** | **Gateway** |  |  |  |
| 14.1 | Manufacturer / model |  |  |  |
| 14.2 | Type |  | Industrial |  |
| 14.3 | Service conditions (temperature, RH) |  | -400C to 800C |  |
| 14.4 | Protocol supporting | IEC101/103/DNO3/HDLC/INDUCTIC33 | IEC 60870-5-104, IEC 104, MODBUS, SNMP |  |
| 14.5 | Designation type (Hardware/Software) |  | Both |  |
| 14.6 | Processor speed |  |  |  |
| 14.7 | Size of hard disc |  | 2TB |  |
| 14.8 | Size of RAM |  | 16GB |  |
| 14.9 | Operating system |  | Windows |  |
| 14.10 | Modem / speed / connecting lead |  |  |  |
| **15** | **External Modem** |  |  |  |
| 15.1 | Manufacturer / model |  |  |  |
| 15.2 | Type |  |  |  |
| 15.3 | Service conditions |  |  |  |
| 15.4 | Speed |  |  |  |
| 15.5 | Connecting lead |  |  |  |
| 15.6 | Software and provide compatible with AT & T , |  |  |  |
| **16** | **System Software** |  |  |  |
| 16.1 | Manufacturer/model |  |  |  |
| 16.2 | Type |  |  |  |
| 16.3 | Make and version of operating systems |  | As required with valid life-time configuration and runtime licenses |  |
| 16.4 | Details of programming languages |  |  |  |
| 16.5 | Release versions of software |  |  |  |
| 16.6 | Details of any software development |  |  |  |
| 16.7 | Software licensing details |  |  |  |
| 16.8 | Fault and event analysis software |  |  |  |
| 16.9 | SCADA protocol |  | IEC 60870-5-104 |  |
| 16.10 | SCMS protocol to BCUs/BCPUs and speed |  | IEC-61850 |  |
| 16.11 | Reconfiguration system software (Yes/No) |  |  |  |
| 16.12 | Supporting Future extension according to SLD |  |  |  |
| 16.13 | Geographical information system software |  |  |  |
| 16.14 | Diagnose software |  |  |  |
| **17** | **LAPTOP** |  |  |  |
| 17.1 | Manufacturer/model |  |  |  |
| 17.2 | Type |  |  |  |
| 17.3 | Service conditions |  |  |  |
| 17.4 | Method of processor expansion (e.g. number of free slots when supplied). |  |  |  |
| 17.5 | Amount of main memory |  |  |  |
| 17.6 | Size of hard disc. |  |  |  |
| 17.7 | Processor speed |  |  |  |
| 17.8 | Size of color display |  |  |  |
| 17.9 | Build in mouse |  |  |  |
| 17.10 | Operating system software |  | Windows |  |
| 17.11 | SCMS application software |  |  |  |
| 17.12 | Relay and fault recorder analysis software |  |  |  |
| 17.13 | Mains power supply unit |  |  |  |
| 17.14 | Battery backup period |  | 8 Hours |  |
| 17.15 | Carry case |  |  |  |
| 17.16 | Modem/speed/connecting lead |  |  |  |
| 17.17 | Other Accessories |  |  |  |
| **18** | **Performance/Availability** |  |  |  |
| 18.1 | Compliance with performance requirements (start and restart) |  |  |  |
|  | Time for redundant station computer to assume online duties |  |  |  |
|  | Time for full updating of information |  |  |  |
|  | Confirmation the redundant station computer database is in step with the one line computer |  |  |  |
| 18.2 | Inclusion of availability calculations |  |  |  |
| **19** | **Inverter System** |  |  |  |
| 19.4 | Manufacturer/model |  |  |  |
| 19.5 | Type |  |  |  |
| 19.6 | Input DC voltage and range | V | 110 |  |
| 19.7 | Input AC voltage and range | V |  |  |
| 19.8 | Service conditions (temperature and RH) |  |  |  |
| 19.9 | Output AC voltage range | V | 240 |  |
| 19.10 | Output AC voltage dynamic response | V |  |  |
| 19.11 | Output AC voltage and static regulation | % |  |  |
| 19.12 | Output frequency regulation (unsynchronized) | % |  |  |
| 19.13 | Output AC voltage harmonic distortion | V |  |  |
| 19.14 | Output rating Watts / Max raking | W |  |  |
| 19.15 | Output current overload | A |  |  |
| 19.16 | Output frequency tracking range | Hz |  |  |
| 19.17 | Thermal trip | A |  |  |
| 19.18 | Output load power factor |  |  |  |
| 19.19 | Efficiency at 25, 50, 75 and 100% output |  |  |  |
| **20** | **AC Main Power Transient Protector** |  |  |  |
| 20.1 | Manufacturer/model |  |  |  |
| 20.2 | Type |  |  |  |
| 20.3 | Nominal AC voltage and range. | V |  |  |
| 20.4 | Input AC frequency and range | Hz |  |  |
| 20.5 | Service conditions (temperature and RH). |  |  |  |
| 20.6 | Power factor |  |  |  |
| 20.7 | Peak discharge current | A |  |  |
| 20.8 | Leakage current |  |  |  |
| 20.9 | Connection details |  |  |  |
| 20.10 | Dimensions/housing |  |  |  |
| **21** | **Inverter Distribution** |  |  |  |
| 21.1 | Manufacturer/model |  |  |  |
| 21.2 | Type of switch |  |  |  |
| 21.3 | Type of MCB |  |  |  |
| 21.4 | Distribution circuits (numbers and ratings) |  |  |  |
| 21.5 | Number of cubicles |  |  |  |
| 21.6 | Forced limits at one meter |  |  |  |
| 21.7 | Noise limits at one meter |  |  |  |
| 21.8 | Instrumentation |  |  |  |
| 21.9 | Alarms |  |  |  |
| 21.10 | Efficiency and power factor at 25.50% & 100% outputs |  |  |  |
| 21.11 | Modular tesing/system extension facilities |  |  |  |
| 21.12 | Provision of maintenance switch |  |  |  |
| 21.13 | Radio frequency interference |  |  |  |

l) FAULT MONITORING SYSTEM

| 1. FAULT MONITORING SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **Required** | **Offered** |
| 1. | FAULT MONITORING SYSTEM |  |  |  |
| 1.1 | Manufacturer |  |  |  |
| 1.2 | Type reference |  |  |  |
|  | * DAU unit type |  |  |  |
|  | * Master Station type |  |  |  |
|  | * HMI type |  |  |  |
|  | * Printer type |  |  |  |
| 1.3 | Auxiliary voltage range (Vn = 110Vdc) | Vdc | 88→150 |  |
| 1.4 | Analogue Inputs |  | 24 |  |
| 1.5 | Binary inputs |  | 48 |  |
| 1.6 | A/D converter | bit | 16bit |  |
| 1.7 | Current input max amplitude | In | 30 |  |
| 1.8 | Current/voltage accuracy | % fsd | ≤0.5 |  |
| 1.9 | Scan Rate |  |  |  |
|  | * Analogue Channel | Hz | ≥4000 |  |
|  | * Event Channel | Hz | ≥2000 |  |
| 1.10 | Time stamp resolution | ms | 1 |  |
| 1.11 | Recording range |  |  |  |
|  | * Pre Fault | ms | ≥500 |  |
|  | * Post Fault | ms | ≥2000 |  |
| 1.12 | Trigger response time |  |  |  |
|  | * Analogue | ms |  |  |
|  | * Event | ms |  |  |
| 1.13 | Memory |  |  |  |
|  | * RAM (Non Volatile) | GB | 8 |  |
|  | * HDD | Terabyte | 1 |  |
| 1.14 | Battery back-up duration | days | ≥14 |  |
| 1.15 | GPS clock input | Yes/No | Yes |  |
| 1.16 | System software |  |  |  |
| 1.17 | Self-monitoring and alarm facility | Yes/No | Yes |  |
| 1.18 | Communications |  |  |  |
|  | * Communication ports (Front/rear etc.) |  |  |  |
|  | RS232 | Yes/No |  |  |
|  | RS485 | Yes/No |  |  |
|  | RJ45 | Yes/No | Yes |  |
|  | Other | Yes/No |  |  |
|  | * Protocols supported |  |  |  |
|  | IEC 61850 | Yes/No | Yes |  |
|  | Others (please list) |  |  |  |
|  | * Graphical data presentation on SCADA HMI | Yes/No | Yes |  |
| 1.19 | Type Tests |  |  |  |
| 1.19.1 | Atmospheric Environment |  |  |  |
|  | * Operation -25°C and 55°C for 96hrs, IEC 60068-2-1 | Yes/No | Yes |  |
|  | * Transport/storage -25°C and 70°C for 96hrs, IEC 60068-2-2 | Yes/No | Yes |  |
| 1.19.2 | Relative Humidity |  |  |  |
|  | * Operation at 93% | Yes/No | Yes |  |
|  | * Tested to IEC 60068-2-3 with severity class 56 days | Yes/No | Yes |  |
| 1.19.3 | Enclosure |  |  |  |
|  | * IEC 60529 |  | IP50 |  |
| 1.19.4 | Mechanical Environment |  |  |  |
|  | * Vibration IEC 60255-21-1 | Yes/No | Yes |  |
|  | * Shock and bump IEC 60255-21-2 | Yes/No | Yes |  |
|  | * Seismic IEC 60255-21-3 | Yes/No | Yes |  |
| 1.19.5 | Insulation |  |  |  |
|  | * Rated insulation |  |  |  |
|  | 1000V high impedance protection CT inputs | Yes/No | Yes |  |
|  | 250V for other circuits | Yes/No | Yes |  |
|  | 1000V open contact withstand | Yes/No | Yes |  |
|  | * Dielectric Tests   IEC 60255-5 – Series C of table 1 | Yes/No | Yes |  |
|  | * Impulse voltage   IEC 60255-5 test voltage 5kV | Yes/No | Yes |  |
| 1.19.6 | Electromagnetic compatibility |  |  |  |
|  | * 1MHz Burst disturbance test,   IEC 60255-22-1 severity class III | Yes/No | Yes |  |
|  | * Electrostatic Discharge   IEC 60255-22-2 severity class III | Yes/No | Yes |  |
|  | * Radiated Electromagnetic Field Disturbance   IEC 60255-22-3 severity class III  Test method A, 27MHz through 500MHz | Yes/No | Yes |  |
|  | * Electromagnetic Emissions   IEC 60255-25 | Yes/No | Yes |  |
|  | * Fast Transient Disturbance   IEC 60255-22-4 severity level IV | Yes/No | Yes |  |
| 1.19.7 | Type test certificate provided | Yes/No | Yes |  |

m) SDH AND MULTIPLEXER

| 1. SDH AND MULTIPLEXER | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| **1** | **SDH** |  |  |  |
| 1.1 | Manufacturer's name |  |  |  |
| 1.2 | Year of Manufacturing |  |  |  |
| 1.3 | Product Trade Name |  |  |  |
| 1.4 | Type of Model/Version Number |  | FOX 61x SERIES OR EQUIVALENT |  |
| 1.5 | FAT Location |  |  |  |
| 1.6 | Applicable Standard(s) |  | ITU-T,IEEE,IEC |  |
| 1.7 | Platform |  | To be defined |  |
| 1.8 | Type tests reports and certification docs |  | Required |  |
| 1.9 | Availability (based on MTBF) |  | To be defined |  |
| 1.10 | Flexibility |  | Required |  |
| 1.11 | Expandability |  | Required |  |
| 1.12 | Automatic Laser Shutdown (ALS) |  | G.664 Appendix III.2 |  |
| **1.13** | **Rack & Shelf Information** |  |  |  |
| 1.13.1 | 19" or ETSI rack mounting (44U) |  | Required |  |
| 1.13.2 | Sub rack Dimension |  | To be defined |  |
| 1.13.3 | Rack Dimension |  | To be defined |  |
| 1.13.4 | Sub rack Weight (fully populated) | kg | To be defined |  |
| 1.13.5 | Power Consumption (fully populated) | watt | To be defined |  |
| 1.13.6 | Power Supply | watt | (-48 VDC) |  |
| 1.13.7 | No of Slots (Total & Traffic) |  | To be defined |  |
| 1.13.8 | No of Traffic Slots |  | To be defined |  |
| 1.13.9 | Traffic Slot Capacity (Full duplex) |  | To be defined |  |
| **1.14** | **Environment Condition** |  |  |  |
| **1.14.1** | **Transport** |  |  |  |
| 1.14.1.1 | Max. Transport Temperature | ºC | (+ 60) |  |
| 1.14.1.2 | Min. Transport Temperature | ºC | (- 20) |  |
| 1.14.1.3 | Humidity |  | (0% to 90%) |  |
| **1.14.2** | **Storage** |  |  |  |
| 1.14.2.1 | Max. Transport Temperature | ºC | (+ 60) |  |
| 1.14.2.2 | Min. Transport Temperature | ºC | (- 10) |  |
| 1.14.2.3 | Humidity (0% to 90%) |  | TBD |  |
| **1.14.3** | **Operation** |  |  |  |
| 1.14.3.1 | Max. Transport Temperature | ºC | (+ 55) |  |
| 1.14.3.2 | Min. Transport Temperature | ºC | (- 5) |  |
| 1.14.3.3 | Humidity |  | (0% to 90%) |  |
| **1.15** | **Certifications (MANDATORY)** |  |  |  |
| 1.15.1 | EMC |  | Required |  |
| 1.15.2 | EMI |  | Required |  |
| 1.15.5 | Reference List only for Proposed systems |  | Required |  |
| **1.16** | **Redundancy** |  |  |  |
| 1.16.1 | CPU |  | (1+1) |  |
| 1.16.2 | CXC (Cross connection) |  | (1+1) |  |
| 1.16.3 | Power supply |  | (1+1) |  |
| 1.16.4 | 2M Electrical port (E1) |  | 1:N (N shall be specified) |  |
| 1.16.5 | clock card |  | shall be specified |  |
| 1.16.6 | Protection for STM1/16-1 Cards in Linear Links (G.841 - clause 7.1) |  | 1+1 Linear MSP |  |
| **1.17** | **Network Side Protection** |  |  |  |
| 1.17.1 | 1+1 Linear MSP |  | Required |  |
| 1.17.2 | SNCP |  | Required |  |
| **1.18** | **Switch Capacity Centralized architecture** |  |  |  |
| 1.18.1 | TDM- STM 16 system | G | Min 20 |  |
| 1.18.2 | TDM- STM 1 system | G | Min 10 |  |
| 1.18.2 | Packet |  | Advantage |  |
| **1.19** | **Ethernet interfaces** |  |  |  |
| 1.19.1 | 10/100 Base-TX L2 switching Ethernet port |  | Required |  |
| 1.19.2 | Auto-negotiation |  | Required |  |
| 1.19.3 | Auto-crossover |  | Required |  |
| 1.19.4 | Unique MAC address to each Ethernet port |  | Required |  |
| **1.20** | **Ethernet services** |  |  |  |
| 1.20.1 | E-Line |  | Required |  |
| 1.20.2 | E-LAN |  | Required |  |
| **1.21** | **Ethernet protection** |  |  |  |
| 1.21.1 | Spanning Tree Protocol |  | Required |  |
| 1.21.2 | Rapid Spanning Tree Protocol |  | Required |  |
| **1.22** | **NG-SDH Management LCT Functionalities** |  |  |  |
| 1.22.1 | local and remote management of NE's over the network |  | Required |  |
| 1.22.2 | Alarm display |  | Required |  |
| 1.22.3 | Fault Management |  | Required |  |
| 1.22.4 | Performance Monitoring and Management |  | Required |  |
| 1.22.5 | Configuration Management |  | Required |  |
| 1.22.6 | Remote operation |  | Required |  |
| 1.22.7 | Access and testing functions |  | Required |  |
| 1.22.8 | Graphical view of entire network |  | Required |  |
| 1.22.9 | Local Craft terminal Port |  | Required |  |
| **1.23** | **LCT Hardware (Laptop specification)** |  |  |  |
| 1.23.1 | Type & CPU | G | CPU: Core I7 |  |
| 1.23.2 | HHD Capacity | G | >500 |  |
| 1.23.3 | RAM |  | 6 |  |
| 1.23.4 | LCD size (inch) |  | Less than 15 |  |
| **2** | **Access Mux** |  |  |  |
| **2.1** | **GENERAL** |  |  |  |
| 2.1.1 | Manufacturer name |  |  |  |
| 2.1.2 | Year of manufacturing |  |  |  |
| 2.1.3 | Product trade name |  |  |  |
| 2.1.4 | Type of designation and model number |  |  |  |
| 2.1.5 | Date of manufacturing |  |  |  |
| 2.1.6 | FAT location |  |  |  |
| 2.1.7 | Applicable Standard(s) |  | ITU-T |  |
| 2.1.8 | Type tests reports and certification documents |  | To be defined |  |
| 2.1.9 | Availability (based on MTBF) |  | To be defined |  |
| 2.1.1 | Flexibility |  | Required |  |
| 2.1.11 | Expandability |  | Required |  |
| **2.2** | **Rack and shelf information** |  |  |  |
| 2.2.1 | 19" or ETSI rack mounting |  | To be defined |  |
| 2.2.2 | Shelf Dimension (height x width x length) |  | To be defined |  |
| 2.2.3 | Shelf Weight(fully populated) |  | To be defined |  |
| 2.2.4 | Power Consumption(fully populated) |  | To be defined |  |
| 2.2.5 | Power Supply |  | To be defined |  |
| 2.2.6 | No of Slots (Total & Traffic) |  | To be defined |  |
| 2.2.7 | No of Traffic Slots |  | To be defined |  |
| **2.3** | **General Functionality** |  |  |  |
| 2.3.1 | Time multiplexing/ de-multiplexing  of all voice and data channels |  | Required |  |
| 2.3.2 | Sub rate data multiplexing based on  ITU-T V-Series synch/a synch data |  | Required |  |
| 2.3.3 | Cross-Connecting |  | at n×64 Kbps, 64 Kbps,  Time Slot and Bit levels |  |
| 2.3.4 | Cross-connect capacity |  | To be defined |  |
| 2.3.5 | Drop/Insert |  | Required |  |
| 2.3.6 | IP routing |  | Optional |  |
| 2.3.7 | VF operation |  | Required |  |
| 2.3.8 | Signaling |  | To be defined |  |
| 2.3.9 | Transmission delay | µs | <250 |  |
| **2.4** | **Line Interface** |  |  |  |
| 2.4.1 | E1 |  | Required |  |
| 2.4.2 | STM1 |  | Advantage |  |
| **2.5** | **Interfaces** |  |  |  |
| 2.5.1 | 6 wire E&M signaling with ring generator |  | Required |  |
| 2.5.2 | 2 wire voice channel |  | Required |  |
| 2.5.3 | FXO/FXS |  | Required |  |
| 2.5.4 | 0.3-64 Kbps Sync./Async. V.24/V.28 |  | Required |  |
| 2.5.5 | N × 64 Kbps Sync./Async. |  | Required |  |
| 2.5.6 | RS-232, RS-485 |  | Required |  |
| 2.5.7 | Ethernet |  | Required |  |
| **2.6** | **Redundancy** |  |  |  |
| 2.6.1 | Line card redundancy |  | 1+1 |  |
| 2.6.2 | Power Supply redundancy |  | 1+1 |  |
| 2.6.3 | Cross Connection redundancy |  | 1+1 |  |
| 2.6.4 | Redundancy of Processor |  | 1+1 |  |
| 2.6.5 | Clock |  | To be defined |  |
| 2.6.6 | Cooling fans redundancy |  | To be defined |  |
| **2.7** | **Environmental condition** |  |  |  |
| 2.7.1 | Operating Temperature (Long/Short term) |  | To be defined |  |
| 2.7.2 | Storage & Transportation temperature |  | To be defined |  |
| 2.7.3 | Humidity (St., Tr., Op.) (%) |  | To be defined |  |
| **2.8** | **Configurations** |  |  |  |
| 2.8.1 | Terminal with Multiplexing & Sub multiplexing |  | Required |  |
| 2.8.2 | ADM in Linear & Ring |  | Required |  |
| 2.8.3 | CXC in Mesh & Tree |  | Advantage |  |
| **2.9** | **Access MUX Management LCT Functionalities** |  |  |  |
| 2.9.1 | local and remote management of NE's over the network |  | Required |  |
| 2.9.2 | Alarm display |  | Required |  |
| 2.9.3 | Fault Management |  | Required |  |
| 2.9.4 | Performance Monitoring and Management |  | Required |  |
| 2.9.5 | Configuration Management |  | Required |  |
| 2.9.6 | Remote operation |  | Required |  |
| 2.9.7 | Access and testing functions |  | Required |  |
| 2.9.8 | Graphical view of entire network |  | Required |  |

n) TPS SYSTEM

| 1. TPS SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| 1 | MANUFACTURER |  |  |  |
| 1.1 | NAME AND COUNTRY |  |  |  |
| 1.2 | TYPE REFERENCE |  |  |  |
| 2 | COMMANDS |  |  |  |
| 2.1 | COMMANDS PRIORITY |  | Yes |  |
| 2.2 | TYPE OF COMMAND TRANSMISSION: |  |  |  |
| 2.2.1 | CODED |  |  |  |
| 2.2.2. | NONCODED |  |  |  |
| 3 | ALL OF THE PERIPHERAL EQUIPMENTS, TOOLS, HARDWARE, SOFTWAER AND TECHNICAL DOCUMENTS INCLUDED WITH EACH TPS TERMINAL |  |  |  |
| 4 | Power consumption |  | shall be defined |  |
| 5 | High voltage interfaces |  |  |  |
| 5.1 | Type of command contacts |  |  |  |
| 5.2 | Type of alarm contacts |  |  |  |
| 6 | Tripping type: |  |  |  |
| 6.1 | Inter-tripping (Direct) |  | Yes |  |
| 6.2 | Permissive tripping (under reach) |  | Yes |  |
| 6.3 | Permissive tripping (over reach) |  | Yes |  |
| 6.4 | Blocking |  | Yes |  |
| 7 | **Operation time** |  |  |  |
| 7.1 | Direct tripping | ms | < 14 |  |
| 7.2 | Permissive tripping | ms | < 14 |  |
| 7.3 | Blocking tripping | ms | < 14 |  |
| 7.4 | Minimum initialization time for command | ms | 2 |  |
| 7.5 | Maximum acceptable propagation time for telecommunication link | ms | 100 |  |
|  |
| 7.6 | Additional delay by noise range | ms | 40 |  |
| 7.7 | Distortion of the total pulse at the output of the receiving compared to the sending equipment | ms | 4 |  |
| 8 | **Transmitter** |  |  |  |
| 8.1 | Tx level range for : |  |  |  |
|  | Command | dBm | -15 to 0 |  |
|  | Guard | dBm | -25 to -10 |  |
| 8.2 | Return loss | dBm | 20 ≤ |  |
| 8.3 | Number of signals for each command |  | 1 |  |
| 8.4 | Harmonic distortion |  | ≤ 5% |  |
| 8.5 | Level boosting of commands | dB | 9 ≤ |  |
| 9 | **Receiver** |  |  |  |
| 9.1 | Rx level range for : |  |  |  |
|  | Command | dBm | -15 to 0 |  |
|  | Guard | dBm | -25 to -10 |  |
| 9.2 | Return loss | dB | 20 ≤ |  |
| 9.3 | Dynamic range | dB | 25 ≤ |  |
| 9.4 | Receiver selectivity – 300 Hz out of guard's and command's range | dBm0 | 55 ≤ |  |
|  |
| 9.5 | S/N Ratio | dB | 5 ≤ |  |
| 10 | **High voltage interfaces** |  |  |  |
| 10.1 | Command and start input voltage ranges | V | 48 ~ 220 |  |
|  |
| 10.2 | Number of contacts for each command |  | 6 ≤ |  |
| 10.3 | Number of alarm contact for each command |  | 4 ≤ |  |
| 10.4 | Command and alarm contacts ratings | VA | 250 |  |
| 10.5 | Duration time before operating of alarm relays | ms |  |  |
| 11 | **Alarm conditions** |  |  |  |
| 11.1 | Transmitter failed |  | Yes |  |
| 11.2 | PLC failed |  | Yes |  |
| 11.3 | Guard signal absence |  | Yes |  |
| 11.4 | Low S/N Ratio |  | Yes |  |
| 11.5 | No card located |  | Yes |  |
| 11.6 | Any damaged board |  | Yes |  |
| 11.7 | Far-end TPS turned off |  | Yes |  |
| 11.8 | Presence of guard and command signal simultaneously |  | Yes |  |
| 11.9 | Presence of command signal continuously |  | Yes |  |
| 11.10 | Watch dog activation alarm |  | Yes |  |
| 12 | **Basis of time** |  |  |  |
| 12.1 | Internal time base |  | Yes |  |
| 12.2 | External time base – real time |  | Yes |  |
| clock such as GPS interface |  |
| 13 | **Dependability and security (pu<10-6)** |  |  |  |
| 13.1 | S / N Ratio | dB | ≤ 5 |  |
| 13.2 | Operating time | ms | ≤ 15 |  |
| 14 | **Power supply** |  |  |  |
| 14.1 | Nominal supply voltage | V dc | 48 |  |
| 14.2 | Supply tolerance |  | -15%,+20% |  |
| 14.3 | Power supply ripple |  | 5%> |  |
| 15 | **Environmental condition** |  |  |  |
| 15.1 | **Operation** |  |  |  |
| 15.1.1 | Temperature range | °C | -5 ~+55°C |  |
| 15.1.2 | Relative Humidity | % | ≥ 95% @ 40°C |  |
| 15.1.3 | Class of standard for mechanical |  | IEC 721 .3.3 |  |
| CLASS 3 M 1 |  |
| 15.2 | **Storage** |  |  |  |
| 15.2.1 | Temperature range | °C | 40 ~ +70°C |  |
| 15.2.2 | Relative humidity | % | ≥ 95% @ 40°C |  |
| 15.2.3 | Class of standard for mechanical |  | IEC.721.3.3 |  |
| CLASS 1 K 5 |  |
| 16 | **Electromagnetic and insulation** |  |  |  |
| 16.1 | HF disturbance |  | 2500 V / IEC.255.22.1 |  |
| 16.2 | Fast transient burst |  | 2000 V / IEC.801.4 |  |
| 16.3 | Electromagnetic discharge |  | 8000 V / IEC.801.2 |  |
| 17 | **Valid Test Reference** |  |  |  |
| 17.1 | According to IEC-60834 and other relative standards |  | Yes |  |
| 18 | **Interfaces** |  |  |  |
| 18.1 | Interface between TPS and PLC Based on IEC495 Clause 3.10.5.1 |  | ANALOG 600Ω, 300~2400Hz |  |
| 18.2 | Interface between TPS and other telecommunication systems such as Fiber Optic or Digital channel |  | OPTICAL INTERFACE / G.703-64Kbps |  |
| 19 | **Commands** |  |  |  |
| 19.1 | Number of independent commands |  | ≤ 4 |  |
| 19.2 | Number of simultaneous commands at least |  | 2 |  |
| 20 | **Software Facilities** |  |  |  |
| 20.1 | TPS hardware assignment |  | Yes |  |
| 20.2 | TPS configuration |  | Yes |  |
| 20.3 | Command assignment |  | Yes |  |
| 20.4 | Command and alarm assignment |  | Yes |  |
| 20.5 | Operation time assignment for each command independently |  | Yes |  |
| 20.6 | Duration and Delay time assignment for each command independently |  | Yes |  |
| 20.7 | Record for counters, Events and Faults with Time Tag |  | Yes |  |
| 20.8 | Remote TPS configuration and monitoring |  | Yes |  |
| 21 | **Test Facilities** |  |  |  |
| 21.1 | Local test |  | Yes |  |
| 21.2 | Local loop test |  | Yes |  |
| 21.3 | Remote loop test |  | Yes |  |
| 21.4 | Periodically auto test |  | Yes |  |
| 22 | **Diagnostic** |  |  |  |
| 22.1 | Online maintenance and diagnostic |  | Yes |  |
| 22.2 | Checking Facilities: |  |  |  |
| Power Supply | Yes |  |
| Others | Yes |  |
| 23 | Interfaces for connecting distance protection devices: |  | Yes |  |
| 23.1 | - IEC 61850 interface (GOOSE) |  | Yes |  |
|
| 23.2 | - Binary command I/O interface |  | Yes |  |
| 24 | Interfaces for integration into telecommunication networks: |  | Yes |  |
|
| 24.1 | Digital electrical interface (PDH, SDH) |  | Yes |  |
| 24.2 | Ethernet line interface (MPLS-TP) |  | Yes |  |
| 25 | Combinations of path protection for alternative transmission routes |  | Yes |  |
|
| 26 | Event memory with time stamp 8000 events ,1 ms resolution, |  | Yes |  |
| 27 | date- and time-stamped, nonvolatile |  | Yes |  |
|
| 28 | Remote access to devices via TCP/IP and Remote readout of the event recorder |  | Yes |  |
| 29 | SNMP agent for NMS integration |  | Yes |  |
|
| 30 | Message authentication to ensure Cyber Security Real-time clock, external synchronization sources (NTP) |  | Yes |  |
|  |

o) LIGHTING AND TELEPHONE SYSTEM

| 1. LIGHTING AND TELEPHONE SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| **1** | **General** |  |  |  |
| 1.1 | Rated voltage | V | 415/240 |  |
| 1.2 | Rated frequency | HZ | 50 |  |
| 1.3 | Max. Permissible voltage drop | % | 2 |  |
| 1.4 | Number of phases |  | 3 |  |
| 1.5 | Number of wires |  | 4 |  |
| 1.6 | Short circuit current/time | kA/S | Acc. To short circuit level of main LVAC panel |  |
| **2** | **Degree of protection** |  |  |  |
| 2.1 | Outdoor equipment | IP | IP55 |  |
| 2.2 | Indoor equipment | IP | IP52 |  |
| **3** | **Normal illumination level:** |  |  |  |
| 3.1 | Control areas/room | Lux | 250-500 |  |
| 3.2 | Data printers | Lux | 300 |  |
| 3.3 | Project Managers/offices | Lux | 300 |  |
| 3.4 | Monitoring room | Lux | 300 |  |
| 3.5 | Telecoms room | Lux | 300 |  |
| 3.6 | Mess room | Lux | 200 |  |
| 3.7 | Metering room | Lux | 200 |  |
| 3.8 | Switch room | Lux | 200 |  |
| 3.9 | Toilets | Lux | 150 |  |
| 3.10 | Access corridors | Lux | 150 |  |
| 3.11 | HV equipment floors | Lux | 150 |  |
| 3.12 | Marshalling room/stairwells | Lux | 150 |  |
| 3.13 | Cable floor/cable risers | Lux | 50 |  |
| 3.14 | Battery room | Lux | 150 |  |
| 3.15 | Entrance | Lux | 150 |  |
| 3.16 | Fuel oil plant room | Lux | 150 |  |
| 3.17 | Stairwells/corridors | Lux | 150 |  |
| 3.18 | Station unit switch room | Lux | 200 |  |
| 3.19 | Workshop/store | Lux | 300 |  |
| 3.20 | C&I equipment | Lux | 300 |  |
| 3.21 | Electronics room | Lux | 300 |  |
| 3.22 | Switchgear room | Lux | 200 |  |
| 3.23 | Prayer room | Lux | 250 |  |
| 3.24 | Stores | Lux | 200-300 |  |
| 3.25 | Kitchens | Lux | 500 |  |
| 3.26 | Conference rooms | Lux | 300-500 |  |
| 3.27 | Locker rooms | Lux | 200 |  |
| 3.28 | Cable tunnels | Lux | 50 |  |
| 3.29 | Transformer compounds | Lux | 30 |  |
| 3.30 | * Transformer area | Lux | 30 |  |
| 3.31 | * Operating plant areas: |  |  |  |
| 3.32 | * + Machinery areas | Lux | 200 |  |
| 3.33 | * + Platforms/ladders (active) | Lux | 50 |  |
| 3.34 | * + Walkways | Lux | 50 |  |
| 3.35 | * + Road, platform/ladders (inactive), | Lux | 30 |  |
| **4** | **Minimum illumination level (emergency lighting):** |  |  |  |
| 4.1 | Control room | Lux | 50 |  |
| 4.2 | AC/DC room | Lux |  |  |
| 4.3 | Relay room | Lux |  |  |
| 4.4 | Battery room | Lux |  |  |
| 4.5 | Transformers and circuit breakers | Lux |  |  |
| **5** | **Lighting factors taken in to consideration** |  |  |  |
| 5.1 | Uniformity factor(Emin/Eave), (Emin/Emax) |  | 1:3, 1:6 |  |
| 5.2 | Maintenance factor for indoor lighting |  | 0.7 |  |
| 5.3 | Maintenance factor for outdoor lighting |  | 0.65 |  |
| 5.4 | The minimum p.f. of the lighting |  | 0.9 |  |
| **6** | **Switchyard lighting:** |  |  |  |
| 6.1 | Manufacturer |  |  |  |
| 6.2 | Type of fixture |  | Flood light |  |
| 6.3 | Type of lamp | w | 176 W (Min) (LED) |  |
| 6.4 | Type of fixture mounting |  | Structure mounted |  |
| 6.5 | lamp life | hr |  |  |
| 6.6 | Lamp efficiency | Lum/w |  |  |
| 6.7 | Lamp flux | lm | 20000 (Min) |  |
| 6.8 | Fixture mounted height | m |  |  |
| 6.9 | Number of fixture |  |  |  |
| **7** | **Access and main road lighting** |  |  |  |
| 7.1 | Manufacturer |  |  |  |
| 7.2 | Type of fixture |  | Street light |  |
| 7.3 | Type of lamp | w | 104 W (Min) (LED) |  |
| 7.4 | Type of mounting |  | Pole mounted |  |
| 7.5 | Pole distance from road | m | 0.9 |  |
| 7.6 | Pole height | m |  |  |
| 7.7 | Fixture mounting heigh | m |  |  |
| 7.8 | lamp life | hr |  |  |
| 7.9 | Lamp flux | lm | 20000 (Min) |  |
| 7.10 | Lamp efficiency | Lum/w |  |  |
| 7.11 | Type of lighting poles |  | Hot dip galvanized steel |  |
| 7.12 | Thickness of painting | μm | 80 |  |
| **8** | **110 V DC emergency lighting:** |  |  |  |
| 8.1 | Manufacturer |  |  |  |
| 8.2 | Type of fitting |  |  |  |
| 8.3 | Type of outdoor lamp |  | LED |  |
| 8.4 | Type of indoor lamp |  | LED |  |
| 8.5 | Location mounted for outdoor DC lighting |  |  |  |
| 8.6 | Degree of protection | IP | 55/42 |  |
| **9** | **Main indoor lighting equipment** |  |  |  |
| 9.1 | Manufacturer |  |  |  |
| 9.2 | Type of lighting fixture |  | LED |  |
| 9.3 | Type of lamp | w | bi-pin cap & white type lamp |  |
| **10** | **Lighting Panel** |  |  |  |
| 10.1 | Type of incoming circuit breaker |  | MCCB |  |
| 10.2 | Type of outgoing circuit breakers |  | (MCCB or MCB) |  |
|  |  |  |  |  |
| **11** | **Minimum cross section of lighting cables** | **mm²** |  |  |
| 11.1 | Minimum cross section of outdoor lighting cables |  | 4 |  |
| 11.2 | Minimum cross section of indoor lighting cables |  | 1.5 |  |
| 11.3 | Minimum cross section of socket cables |  | 2.5 |  |
| **12** | **Photo-cell** |  |  |  |
| 12.1 | Type |  |  |  |
| 12.2 | Location |  |  |  |
| **13** | **Electrical Socket** |  |  |  |
| 13.1 | Manufacturer |  |  |  |
| 13.2 | Type(s) |  |  |  |
| 13.3 | Voltage Rating |  | 415/240 |  |
| 13.4 | Phases |  | 1/3 |  |
| 13.5 | Rating of socket |  |  |  |
| 13.6 | Single phase | A | >16 |  |
| 13.7 | Three phase | A | Acc. To calculation |  |
| 13.8 | Current Rating |  |  |  |
| 13.9 | Quantity |  |  |  |
| **14** | **Telephone System** |  |  |  |
| 14.1 | Subsets |  |  |  |
| 14.2 | Manufacturer |  |  |  |
| 14.3 | Type |  | Desk mounted / wall mounted/VOIP |  |
| 14.4 | Type of control & communication cable in telephone system |  | Ethernet Cable |  |
| 14.5 | Degree of protection for terminal boxes |  |  |  |
| 14.6 | Indoor | IP | 51 |  |
| 14.7 | Outdoor | IP | 55 |  |
| 14.8 | Quantities Required (minimum): |  |  |  |
| 14.9 | Desk Mounted Type |  |  |  |
| 14.10 | Wall Type |  |  |  |
| 14.11 | Spare Units: |  |  |  |
| 14.12 | Desk Mounted Type |  |  |  |
| 14.13 | Wall Type |  |  |  |
| 14.14 | Outdoor Wall Type |  |  |  |
| **15** | **Type of equipment in battery room** |  | explosion proof |  |

p) FIRE FIGHTING SYSTEM

| 1. FIRE FIGHTING SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
|  | **Transformer Nitrogen Injection and Oil Evacuation Fire Protection System** |  |  |  |
| 1.1 | Manufacturer |  |  |  |
| 1.2 | Country of manufacturing |  |  |  |
| 1.3 | Details of System equipment (Model name) |  |  |  |
| 1.4 | Applicable standards |  | UL, FM, VdS, LPCB, NFPA |  |
| 1.5 | Certified By |  |  |  |
| 1.6 | Power Supply for control |  | 110/ 48 V DC, variation ±15% |  |
| 1.7 | Power supply for service/lighting |  | 220 V AC, variation ± 10% |  |
| 1.8 | Fire Extinguishing cubicle (FEC) |  |  |  |
| 1.8.1 | Dimension | L x W x H mm |  |  |
| 1.8.2 | Weight | Kg |  |  |
| 1.8.3 | Capacity of nitrogen cylinder | m3 |  |  |
| 1.8.4 | Number of cylinders | nos. |  |  |
| 1.8.5 | Pressure of nitrogen filling | Kg/cm2 |  |  |
| 1.8.6 | Minimum distance of FEC from the transformer | m |  |  |
| 1.8.7 | Method of mounting |  |  |  |
| 1.8.8 | Whether the following items are provided in FEC. If so, furnish make, type and other details |  |  |  |
| 1.8.8.1 | Contact Manometer |  |  |  |
| 1.8.8.2 | Pressure Regulator |  |  |  |
| 1.8.8.3 | Oil release unit |  |  |  |
| 1.8.8.4 | Gas release unit |  |  |  |
| 1.8.8.5 | Oil drain assembly |  |  |  |
| 1.8.8.6 | Pressure switch : Back up for nitrogen release |  |  |  |
| 1.8.8.7 | Limit switch: No. of contacts and spare contacts (NO & NC) |  |  |  |
| 1.8.9 | Oil drain valve (above FEC) |  |  |  |
| 1.8.9.1 | Make |  |  |  |
| 1.8.9.2 | Type |  |  |  |
| 1.8.9.3 | Size |  |  |  |
| 1.8.9.4 | Type of metal |  |  |  |
| 1.8.10 | Nitrogen injection valve (above FEC) |  |  |  |
| 1.8.10.1 | Make |  |  |  |
| 1.8.10.2 | Type |  |  |  |
| 1.8.10.3 | Size |  |  |  |
| 1.8.11 | Oil drain pipe |  |  |  |
| 1.8.11.1 | Size |  |  |  |
| 1.8.11.2 | Length |  |  |  |
| 1.8.11.3 | Number of openings in the transformer tank |  |  |  |
| 1.8.11.4 | Material |  |  |  |
| 1.9 | Control Box |  |  |  |
| 1.9.1 | Dimension | L x W x H mm |  |  |
| 1.9.2 | Weight | Kg |  |  |
| 1.9.3 | Type & thickness of sheet steel |  |  |  |
| 1.9.4 | Details of components provided in the control box |  |  |  |
| 1.9.5 | Control voltage | V |  |  |
| 1.9.6 | Method of mounting |  |  |  |
| 1.9.7 | Whether audio and visual alarms provided? | Yes/No |  |  |
| 1.10 | Transformer Conservator isolation valve (TCIV) |  |  |  |
| 1.10.1 | Make |  |  |  |
| 1.10.2 | Type |  |  |  |
| 1.10.3 | Location of installation |  |  |  |
| 1.10.4 | Whether suitable for pipe of size 80mm diameter | Yes/No |  |  |
| 1.10.5 | Provision for glass window for inspection | Yes/No |  |  |
| 1.10.6 | No. of contacts & spare contacts (NO & NC) | Nos. |  |  |
| 1.10.7 | Padlocking provision for service position | Yes/No |  |  |
| 1.10.8 | Padlocking provision for filtration/filing/refilling position | Yes/No |  |  |
| 1.11 | Fire Detectors |  |  |  |
| 1.11.1 | Make |  |  |  |
| 1.11.2 | Type |  |  |  |
| 1.11.3 | Quantity required | Nos. |  |  |
| 1.11.4 | Method of fixing |  |  |  |
| 1.11.5 | Effective heat sensing area | m2 |  |  |
| 1.11.6 | Temperature recommended for effective heat sensing | °C |  |  |
| 1.11.7 | Number of contacts NO/NC | Nos. |  |  |
| 1.11.8 | Necessity and condition of refilling |  |  |  |
| 1.12 | Manufacturer quality system in accordance with ISO 9000, 9001, 9002, 9003 and 9004 | Yes/No | Yes |  |
|  | **Firefighting Equipment for Hydrants and Sprinkler Systems** |  |  |  |
| **2.1** | **Firefighting Equipment** |  |  |  |
| 2.1.1 | Main Pump | Yes/No |  |  |
| 2.1.2 | Jockey Pump | Yes/No |  |  |
| 2.1.3 | Stand by pump | Yes/No |  |  |
| 2.1.4 | Booster pump | Yes/No |  |  |
| 2.1.5 | Electric Motor | Yes/No |  |  |
| 2.1.6 | Diesel Engine | Yes/No |  |  |
| 2.1.7 | Control panel (Instrumentation & Control System) | Yes/No |  |  |
| 2.1.8 | Pressure Gauge and Switches | Yes/No |  |  |
| 2.1.9 | Pipes, Nozzles, Fittings and Accessories | Yes/No |  |  |
| 2.1.10 | Pressure Tank | Yes/No |  |  |
| 2.1.11 | Suction Line | Yes/No |  |  |
| 2.1.12 | Common Fabricated steel base frame | Yes/No |  |  |
| 2.1.13 | Fire Detection and Alarm System | Yes/No |  |  |
| 2.1.14 | Sprinkler System | Yes/No |  |  |
| 2.1.15 | Hydrant Valves | Yes/No |  |  |
| 2.1.16 | Firefighting box (containing hose and fire extinguisher) | Yes/No |  |  |
| **2.2** | **Firefighting Package (Fire Pump Package)** |  |  |  |
| **2.2.1** | **General information** |  |  |  |
| 2.2.1.1 | Manufacturer |  |  |  |
| 2.2.1.2 | Country of manufacturing |  |  |  |
| 2.2.1.3 | Year of manufacturing |  |  |  |
| 2.2.1.4 | System type |  |  |  |
| 2.2.1.5 | System model |  |  |  |
| 2.2.1.6 | Applicable standards |  |  |  |
| 2.2.1.7 | Certification |  |  |  |
| 2.2.1.8 | Pressure vessel |  |  |  |
| 2.2.1.9 | No. of pumps |  |  |  |
| 2.2.1.10 | No. of Electric motors |  |  |  |
| 2.2.1.11 | Motor pump | Yes/No |  |  |
| 2.2.1.12 | Diesel pump | Yes/No |  |  |
| 2.2.1.13 | Control panel (Instrumentation & Control System) |  |  |  |
| 2.2.1.14 | Annunciation System |  |  |  |
| 2.2.1.15 | Power Supply for control system |  |  |  |
| 2.2.1.16 | Power supply for service/lighting |  |  |  |
| **2.2.2** | **Main pump** |  |  |  |
| 2.2.2.1 | Standby Pump | Yes/No |  |  |
| 2.2.2.2 | Manufacturer |  |  |  |
| 2.2.2.3 | Country of manufacturing |  |  |  |
| 2.2.2.4 | Year of manufacturing |  |  |  |
| 2.2.2.5 | Applicable standard |  |  |  |
| 2.2.2.6 | Certification |  |  |  |
| 2.2.2.7 | Listed | Yes/No |  |  |
| 2.2.2.8 | Type |  |  |  |
| 2.2.2.9 | Model |  |  |  |
| 2.2.2.10 | Size |  |  |  |
| 2.2.2.11 | Dimensions |  |  |  |
| 2.2.2.12 | Dry Weight | kg |  |  |
| 2.2.2.13 | Flow (Capacity) | GPM |  |  |
| 2.2.2.14 | Head | m |  |  |
| 2.2.2.15 | Discharge pressure | bar |  |  |
| 2.2.2.16 | Speed | rpm |  |  |
| 2.2.2.17 | Mounting |  |  |  |
| 2.2.2.18 | Casing material |  |  |  |
| 2.2.2.19 | Impeller material |  |  |  |
| 2.2.2.20 | Shaft material |  |  |  |
| 2.2.2.21 | Wearing rings material |  |  |  |
| 2.2.2.22 | Mechanical seal material |  |  |  |
| 2.2.2.23 | Bearing lubrication |  |  |  |
| 2.2.2.24 | Operating temperature |  |  |  |
| 2.2.2.25 | Suction x delivery dia. | mm x mm |  |  |
| 2.2.2.26 | Painting |  |  |  |
| 2.2.2.27 | Required electric motor power | HP |  |  |
|  | * Electric motor manufacturer |  |  |  |
|  | * Country of manufacturing |  |  |  |
|  | * Year of manufacturing |  |  |  |
|  | * Model name |  |  |  |
|  | * Certification |  |  |  |
|  | * Rated power | HP |  |  |
|  | * Applicable standard |  |  |  |
|  | * Voltage | V |  |  |
|  | * Frequency |  |  |  |
|  | * Speed | RPM |  |  |
|  | * Current | A |  |  |
|  | * Service factor |  |  |  |
|  | * Service duty |  |  |  |
|  | * Starting | DOL/Soft starter/VFD |  |  |
|  | * Enclosure |  |  |  |
|  | * Ingress protection |  |  |  |
|  | * Insulation class |  |  |  |
|  | * Design temperature | °C |  |  |
|  | * Design altitude (above sea level) | m |  |  |
|  | * Temperature rise |  |  |  |
|  | * Efficiency class |  |  |  |
|  | * Frame size |  |  |  |
|  | * Mounting |  |  |  |
|  | * Direction of rotation (view from drive end) |  |  |  |
|  | * Painting |  |  |  |
| **2.2.3** | **Jockey pump** |  |  |  |
| 2.2.3.1 | Manufacturer |  |  |  |
| 2.2.3.2 | Country of manufacturing |  |  |  |
| 2.2.3.3 | Year of manufacturing |  |  |  |
| 2.2.3.4 | Applicable standard |  |  |  |
| 2.2.3.5 | Certification |  |  |  |
| 2.2.3.6 | Listed | Yes/No |  |  |
| 2.2.3.7 | Type |  |  |  |
| 2.2.3.8 | Model |  |  |  |
| 2.2.3.9 | Size |  |  |  |
| 2.2.3.10 | Dimensions |  |  |  |
| 2.2.3.11 | Dry Weight | kg |  |  |
| 2.2.3.12 | Flow (Capacity) | GPM |  |  |
| 2.2.3.13 | Head | m |  |  |
| 2.2.3.14 | Discharge pressure | bar |  |  |
| 2.2.3.15 | Speed | rpm |  |  |
| 2.2.3.16 | Mounting |  |  |  |
| 2.2.3.17 | Casing material |  |  |  |
| 2.2.3.18 | Impeller material |  |  |  |
| 2.2.3.19 | Shaft material |  |  |  |
| 2.2.3.20 | Wearing rings material |  |  |  |
| 2.2.3.21 | Mechanical seal material |  |  |  |
| 2.2.3.22 | Bearing lubrication |  |  |  |
| 2.2.3.23 | Operating temperature |  |  |  |
| 2.2.3.24 | Suction x delivery dia. | mm x mm |  |  |
| 2.2.3.25 | Painting |  |  |  |
| 2.2.3.26 | Required electric motor power | HP |  |  |
|  | * Electric motor manufacturer |  |  |  |
|  | * Country of manufacturing |  |  |  |
|  | * Year of manufacturing |  |  |  |
|  | * Model name |  |  |  |
|  | * Certification |  |  |  |
|  | * Rated power | kW |  |  |
|  | * Applicable standard |  |  |  |
|  | * Voltage | V |  |  |
|  | * Frequency |  |  |  |
|  | * Speed | RPM |  |  |
|  | * Current | A |  |  |
|  | * Service factor |  |  |  |
|  | * Service duty |  |  |  |
|  | * Starting | DOL/Soft starter/VFD |  |  |
|  | * Enclosure |  |  |  |
|  | * Ingress protection |  |  |  |
|  | * Insulation class |  |  |  |
|  | * Design temperature | °C |  |  |
|  | * Design altitude (above sea level) | m |  |  |
|  | * Temperature rise |  |  |  |
|  | * Efficiency class |  |  |  |
|  | * Frame size |  |  |  |
|  | * Mounting |  |  |  |
|  | * Direction of rotation (view from drive end) |  |  |  |
|  | * Painting |  |  |  |
| **2.2.4** | **Booster pump** |  |  |  |
| 2.2.4.1 | Manufacturer |  |  |  |
| 2.2.4.2 | Country of manufacturing |  |  |  |
| 2.2.4.3 | Year of manufacturing |  |  |  |
| 2.2.4.4 | Applicable standard |  |  |  |
| 2.2.4.5 | Certification |  |  |  |
| 2.2.4.6 | Listed | Yes/No |  |  |
| 2.2.4.7 | Type |  |  |  |
| 2.2.4.8 | Model |  |  |  |
| 2.2.4.9 | Size |  |  |  |
| 2.2.4.10 | Dimensions |  |  |  |
| 2.2.4.11 | Dry Weight | kg |  |  |
| 2.2.4.12 | Flow (Capacity) | m3/h |  |  |
| 2.2.4.13 | Head | m |  |  |
| 2.2.4.14 | Discharge pressure | psi |  |  |
| 2.2.4.15 | Speed | rpm |  |  |
| 2.2.4.16 | Mounting |  |  |  |
| 2.2.4.17 | Casing material |  |  |  |
| 2.2.4.18 | Impeller material |  |  |  |
| 2.2.4.19 | Shaft material |  |  |  |
| 2.2.4.20 | Wearing rings material |  |  |  |
| 2.2.4.21 | Mechanical seal material |  |  |  |
| 2.2.4.22 | Bearing lubrication |  |  |  |
| 2.2.4.23 | Operating temperature |  |  |  |
| 2.2.4.24 | Suction x delivery dia. | mm x mm |  |  |
| 2.2.4.25 | Painting |  |  |  |
| 2.2.4.26 | Required electric motor power | HP |  |  |
|  | * Electric motor manufacturer |  |  |  |
|  | * Country of manufacturing |  |  |  |
|  | * Year of manufacturing |  |  |  |
|  | * Model name |  |  |  |
|  | * Certification |  |  |  |
|  | * Rated power | HP |  |  |
|  | * Applicable standard |  |  |  |
|  | * Voltage | V |  |  |
|  | * Frequency |  |  |  |
|  | * Speed | RPM |  |  |
|  | * Current | A |  |  |
|  | * Service factor |  |  |  |
|  | * Service duty |  |  |  |
|  | * Starting | DOL/Soft starter/VFD |  |  |
|  | * Enclosure |  |  |  |
|  | * Ingress protection |  |  |  |
|  | * Insulation class |  |  |  |
|  | * Design temperature | °C |  |  |
|  | * Design altitude (above sea level) | m |  |  |
|  | * Temperature rise |  |  |  |
|  | * Efficiency class |  |  |  |
|  | * Frame size |  |  |  |
|  | * Mounting |  |  |  |
|  | * Direction of rotation (view from drive end) |  |  |  |
|  | * Painting |  |  |  |
| **2.2.5** | **Engine** |  |  |  |
| 2.2.5.1 | Manufacturer |  |  |  |
| 2.2.5.2 | Country of manufacturing |  |  |  |
| 2.2.5.3 | Year of manufacturing |  |  |  |
| 2.2.5.4 | Applicable standards |  |  |  |
| 2.2.5.5 | Design temperature | °C |  |  |
| 2.2.5.6 | Design altitude (above sea level) | m |  |  |
| 2.2.5.7 | Air inlet temperature | °C |  |  |
| 2.2.5.8 | Fuel inlet temperature | °C |  |  |
| 2.2.5.9 | Power rating | HP |  |  |
| 2.2.5.10 | Speed | RPM |  |  |
| 2.2.5.11 | Min. and Max. rating | kW @ RPM |  |  |
| 2.2.5.12 | Min. and Max. torque | Nm @ RPM |  |  |
| 2.2.5.13 | Engine type |  |  |  |
| 2.2.5.14 | Injection Type |  |  |  |
| 2.2.5.15 | Model |  |  |  |
| 2.2.5.16 | Service | Indoor/ outdoor |  |  |
| 2.2.5.17 | Intake type |  |  |  |
| 2.2.5.18 | Starting type |  |  |  |
| 2.2.5.19 | No. of cylinders |  |  |  |
| 2.2.5.20 | Bore x Stroke | mm |  |  |
| 2.2.5.21 | Displacement | cm3 |  |  |
| 2.2.5.22 | Compression ratio |  |  |  |
| 2.2.5.23 | Emission certification |  |  |  |
| 2.2.5.24 | Max. Temp. rise between ambient air and Engine air inlet | °C |  |  |
| 2.2.5.25 | Air cleaner element |  |  |  |
| 2.2.5.26 | Exhaust temperature | °C |  |  |
| 2.2.5.27 | Exhaust gas flow | L/sec |  |  |
| 2.2.5.28 | Max. back pressure imposed by exhaust system | kPa |  |  |
| 2.2.5.29 | Exhaust pipe size | mm |  |  |
| 2.2.5.30 | Exhaust protection |  |  |  |
| 2.2.5.31 | Aspiration |  |  |  |
| 2.2.5.32 | Fuel type |  |  |  |
| 2.2.5.33 | Max. fuel temperature @ lift pump inlet | °C |  |  |
| 2.2.5.34 | Oil consumption | Kg/hr |  |  |
| 2.2.5.35 | Oil sump capacity | Liter |  |  |
| 2.2.5.36 | Dry weight | kg |  |  |
| 2.2.5.37 | Wet weight | kg |  |  |
| 2.2.5.38 | Lubrication type |  |  |  |
| 2.2.5.39 | Lubrication system oil pressure | psi |  |  |
| 2.2.5.40 | Lube oil filter |  |  |  |
| 2.2.5.41 | Oil capacity of pan (High-Low) | Liter |  |  |
| 2.2.5.42 | Lube oil cooler |  |  |  |
| 2.2.5.43 | Lube oil pump |  |  |  |
| 2.2.5.44 | Battery voltage | V DC |  |  |
| 2.2.5.45 | Battery capacity | Ah |  |  |
| 2.2.5.46 | Valves per cylinder: Intake / Exhaust |  |  |  |
| 2.2.5.47 | Gate valves |  |  |  |
| 2.2.5.48 | Check valves |  |  |  |
| 2.2.5.49 | Power take off flywheel |  |  |  |
| 2.2.5.50 | Flywheel size |  |  |  |
| 2.2.5.51 | Direction of rotation (view from power take-off side) |  |  |  |
| 2.2.5.52 | Cooling fan |  |  |  |
| 2.2.5.53 | Fitted water radiator (heat exchanger) |  |  |  |
| 2.2.5.54 | Raw water pressure at heat exchanger | psi |  |  |
| 2.2.5.55 | Coolant water capacity (engine side) | Liter |  |  |
| 2.2.5.56 | Water temperature switch |  |  |  |
| 2.2.5.57 | Engine heater | VAC, Watt |  |  |
| 2.2.5.58 | Centrifugal speed governor |  |  |  |
| 2.2.5.59 | Torque regulator |  |  |  |
| 2.2.5.60 | Manual start control |  |  |  |
| 2.2.5.61 | Overspeed control |  |  |  |
| 2.2.5.62 | Run-stop control |  |  |  |
| 2.2.5.63 | Run solenoid |  |  |  |
| 2.2.5.64 | Stop solenoid |  |  |  |
| 2.2.5.65 | Throttle control |  |  |  |
| 2.2.5.66 | Water pump type |  |  |  |
| 2.2.5.67 | Sound pressure level (front / side / exhaust) | dB(A) |  |  |
| 2.2.5.68 | Crankcase material |  |  |  |
| 2.2.5.69 | Painting |  |  |  |
| **2.2.6** | **Control panel** |  |  |  |
| 2.2.6.1 | Manufacturer |  |  |  |
| 2.2.6.2 | Country of manufacturing |  |  |  |
| 2.2.6.3 | Year of manufacturing |  |  |  |
| 2.2.6.4 | Applicable standards |  |  |  |
| 2.2.6.5 | Design temperature | °C |  |  |
| 2.2.6.6 | Enclosure IP |  |  |  |
| 2.2.6.7 | Main door lock disconnect switch |  |  |  |
| 2.2.6.8 | MCB |  |  |  |
| 2.2.6.9 | Fuses |  |  |  |
| 2.2.6.10 | No. of switching battery chargers |  |  |  |
| 2.2.6.11 | Control circuits relay |  |  |  |
| 2.2.6.12 | Thermal overload relay |  |  |  |
| 2.2.6.13 | Terminal board |  |  |  |
| 2.2.6.14 | Motor-Pump-Engine control unit |  |  |  |
| 2.2.6.15 | Multifunction instrument with display |  |  |  |
|  | * Voltmeter |  |  |  |
|  | * Ammeter |  |  |  |
|  | * Rev counter |  |  |  |
|  | * Duty hours counter |  |  |  |
|  | * Fuel level gauge |  |  |  |
|  | * Oil pressure gauge |  |  |  |
|  | Start and stop pushbuttons |  |  |  |
| 2.2.6.16 | Indicator lights |  |  |  |
| 2.2.6.17 | Test button for first start-up |  |  |  |
| 2.2.6.18 | AUT - 0 - MAN selector with key |  |  |  |
| 2.2.6.20 | Contacts on the terminal board to remote signals panel |  |  |  |
|  | * Pump running |  |  |  |
|  | * Selector not on AUT |  |  |  |
|  | * Failed starting |  |  |  |
|  | * Control panel and/or batteries fault |  |  |  |
| 2.2.6.21 | Automatic engine cranking system |  |  |  |
| 2.2.6.22 | Automatic battery charger |  |  |  |
| **2.2.7** | **Pipes and valves and fittings** |  |  |  |
| 2.2.7.1 | Pipe |  |  |  |
|  | * Manufacturer |  |  |  |
|  | * Country of manufacturing |  |  |  |
|  | * Year of manufacturing |  |  |  |
|  | * manufacturing standards |  |  |  |
|  | * OD | mm |  |  |
|  | * Thickness | mm |  |  |
|  | * Material |  |  |  |
| 2.2.7.2 | Valves |  |  |  |
|  | * Manufacturer |  |  |  |
|  | * Country of manufacturing |  |  |  |
|  | * Year of manufacturing |  |  |  |
|  | * Manufacturing standard |  |  |  |
|  | * Testing standard |  |  |  |
|  | * Type |  |  |  |
|  | * Model |  |  |  |
|  | * Size |  |  |  |
|  | * Quantity |  |  |  |
|  | * Service condition |  |  |  |
|  | * Construction |  |  |  |
|  | * End connections |  |  |  |
|  | * Rating |  |  |  |
|  | * Face to face |  |  |  |
|  | * Size |  |  |  |
|  | * M.O.C |  |  |  |
|  | * Body |  |  |  |
|  | * Adaptor |  |  |  |
|  | * Ball/ Disc material |  |  |  |
|  | * Gland |  |  |  |
|  | * Spindle |  |  |  |
|  | * Seat |  |  |  |
|  | * Seal |  |  |  |
|  | * Packing |  |  |  |
|  | * Fasteners |  |  |  |
|  | * Actuation |  |  |  |
|  | * Hydro Test pressure | Kg/cm2 |  |  |
|  | * Pneumatic Test pressure | Kg/cm2 |  |  |
| 2.2.7.3 | Fittings |  |  |  |
|  | * Manufacturer |  |  |  |
|  | * Country of manufacturing |  |  |  |
|  | * No. and type |  |  |  |
|  | * Material |  |  |  |
|  | * Applicable standard |  |  |  |
| **2.3** | **Fire hydrant system (only after full electrical isolation)** |  |  |  |
|  | Manufacturer |  |  |  |
|  | Country of manufacturing |  |  |  |
|  | Year of manufacturing |  |  |  |
|  | Fire hydrant No. |  |  |  |
|  | Fire hydrants locations |  |  |  |
|  | * Near buildings |  |  |  |
|  | * Transformers |  |  |  |
|  | * Reactors |  |  |  |
|  | Fire hydrant type |  |  |  |
|  | Fire hydrant dimensions |  |  |  |
|  | Fire hydrant class |  |  |  |
|  | Fire hydrant flow | GPM |  |  |
|  | Fire hydrant working pressure | psi |  |  |
|  | Fire hydrant hydrostatic test pressure | psi |  |  |
|  | Fire hydrant clearance | m |  |  |
|  | Size of nozzle | inch |  |  |
|  | Pumper nozzle size | inch |  |  |
|  | Fire hydrants installation |  |  |  |
|  | Applicable standard |  |  |  |
|  | Hydrants distance from substation buildings | m |  |  |
|  | Hydrants distance from each other | m |  |  |
|  | Water Supply |  |  |  |
|  | Hose Boxes |  |  |  |
|  | * Hose Pipe size and material |  |  |  |
|  | * Branch pipes size and material |  |  |  |
|  | * Nozzles size and material |  |  |  |
|  | Provision of Hose Reel and wet Riser in the buildings | Yes/No |  |  |
|  | Hydrant system design for farthest point of the switchyard considering the present scope & future bays | Yes/No |  |  |
|  | Warning plates | Yes/No |  |  |
| **2.4** | **Fire water tank** |  |  |  |
|  | Capacity |  |  |  |
|  | Construction type |  |  |  |
|  | Manufacturer |  |  |  |
|  | Country of origin |  |  |  |
|  | Model |  |  |  |
|  | International listing UL, FM, VdS or LPCB |  |  |  |
| **2.5** | **Main fire alarm & extinguishing control panel** |  |  |  |
|  | Manufacturer |  |  |  |
|  | country of origin |  |  |  |
|  | Model |  |  |  |
|  | Type |  |  |  |
|  | International listing UL, FM, VdS or LPCB |  |  |  |
|  | Number of loops |  |  |  |
|  | Display type |  |  |  |
|  | Enclosure |  |  |  |
|  | Mounting |  |  |  |
|  | Rack size |  |  |  |
|  | Dimension |  |  |  |
|  | Batteries for fire alarm panel |  |  |  |
|  | Type |  |  |  |
|  | Voltage | V DC |  |  |
|  | Backup | hr |  |  |
|  | Primary power supply voltage | V |  |  |
|  | Printer |  |  |  |
|  | Battery type |  |  |  |
|  | Secondary power supply from UPS | Yes/No |  |  |
|  | Mimic Panel | Yes/No |  |  |
|  | * Fascia material |  |  |  |
|  | * Size | mm |  |  |
|  | **Fire Extinguishers** |  |  |  |
| **3.1.** | **CO2 Wall Mounting Extinguisher** |  |  |  |
| 3.1.1 | Manufacturer |  |  |  |
| 3.1.2 | Country of manufacturing |  |  |  |
| 3.1.3 | Year of manufacturing |  |  |  |
| 3.1.4 | Dimensions |  |  |  |
| 3.1.5 | Weight | Kg |  |  |
| 3.1.6 | Type of dry powder |  |  |  |
| 3.1.7 | Test pressure | Bar g |  |  |
| 3.1.8 | Working pressure | Bar g |  |  |
| 3.1.9 | Applicable standards |  |  |  |
| 3.1.10 | International listing UL, FM, VdS or LPCB |  |  |  |
| **3.2.** | **Dry Powder Wall Mounting Extinguisher** |  |  |  |
| 3.2.1 | Manufacturer |  |  |  |
| 3.2.2 | Country of manufacturing |  |  |  |
| 3.2.3 | Year of manufacturing |  |  |  |
| 3.2.4 | Dimensions |  |  |  |
| 3.2.5 | Weight | Kg |  |  |
| 3.2.6 | Type of dry powder |  |  |  |
| 3.2.7 | Test pressure | Bar g |  |  |
| 3.2.8 | Working pressure | Bar g |  |  |
| 3.2.9 | Applicable standards |  |  |  |
| 3.2.10 | International listing UL, FM, VdS or LPCB |  |  |  |
| **3.3.** | **CO2 wheeled Extinguisher** |  |  |  |
| 3.3.1 | Manufacturer |  |  |  |
| 3.3.2 | Country of manufacturing |  |  |  |
| 3.3.3 | Year of manufacturing |  |  |  |
| 3.3.4 | Dimensions |  |  |  |
| 3.3.5 | Weight | Kg |  |  |
| 3.3.6 | Type of dry powder |  |  |  |
| 3.3.7 | Test pressure | Bar g |  |  |
| 3.3.8 | Working pressure | Bar g |  |  |
| 3.3.9 | Applicable standards |  |  |  |
| 3.3.10 | International listing UL, FM, VdS or LPCB |  |  |  |
|  | **Fire Blanket** |  |  |  |
| 4.1 | Manufacturer |  |  |  |
| 4.2 | Weight | Kg |  |  |
| 4.3 | Temperature Resistance | °C |  |  |
| 4.4 | Size | m |  |  |
| 4.5 | Material |  |  |  |
| 4.6 | Applicable standards |  | BS 7944,  BS EN 1869:1997 |  |

q) HEATING VENTIATION AND AIR CONDITIONING (HVAC)

| 1. HEATING VENTIATION AND AIR CONDITIONING (HVAC) | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
| 1. | MAIN HVAC CONTROL PANEL |  |  |  |
|  | Manufacturer / country of origin |  |  |  |
|  | Model |  |  |  |
|  | Applicable standards |  |  |  |
|  | Enclosure color code |  |  |  |
|  | HVAC CONTROL PANEL FIRE PUMP ROOM |  |  |  |
|  | Manufacturer / country of origin |  |  |  |
|  | Model (wall mounted) |  |  |  |
|  | Applicable standards |  |  |  |
|  | Enclosure color code |  |  |  |
| 2. | SPLIT UNITS |  |  |  |
|  | Manufacturer / country of origin |  |  |  |
|  | Quantity |  |  |  |
|  | Model |  |  |  |
|  | Applicable standards |  |  |  |
|  | Type |  |  |  |
|  | Power | kW |  |  |
|  | Condenser model |  |  |  |
| 3. | AIR COOLED CONDENSING UNITS |  |  |  |
|  | Manufacturer / country of origin |  |  |  |
|  | Quantity |  |  |  |
|  | Model |  |  |  |
|  | Applicable standards |  |  |  |
|  | Type of refrigerant |  |  |  |
|  | Cooling capacity | Btu/hr | 9000,12000,18000,24000 |  |
|  | Number of cooling circuit | No |  |  |
|  | Compressors per cooling circuit | No |  |  |
|  | Compressor model |  |  |  |
|  | Compressor type |  |  |  |
|  | Condenser coil |  |  |  |
|  | Fin material |  |  |  |
|  | Tube material |  |  |  |
| 4. | EXHAUST FANS |  |  |  |
|  | Manufacturer / country of origin |  |  |  |
|  | Quantity |  | 13 |  |
|  | Model |  |  |  |
|  | International approvals |  |  |  |
|  | Fan Speed | rpm |  |  |
|  | Fan impeller material |  |  |  |
|  | Fan Shaft Material |  |  |  |
|  | Voltage/Frequency | V/Hz |  |  |
|  | Capacity for Battery room, toilet, pantry,  basement | m3/hr |  |  |
|  | Capacity for gas cylinder room, staircase  pressurization fans, diesel pump exhaust |  |  |  |
|  | Gas flooded room fan type |  |  |  |
|  | Type |  |  |  |
|  | Basement extract fans |  |  |  |
|  | Battery room fan type |  | Suitable for hazardous area |  |
|  | Storage warehouse |  |  |  |
|  | DG house |  |  |  |
| 5. | EXHAUST AIR FLOW RATES |  |  |  |
| 5.1 | Control Building |  |  |  |
|  | Telecommunication room | m3/s |  |  |
|  | Battery room | m3/s |  |  |
|  | Relay room | m3/s |  |  |
|  | LVAC/DC room | m3/s |  |  |
|  | Cable basement | m3/s |  |  |
|  | Operator room | m3/s |  |  |
|  | Office | m3/s |  |  |
|  | Kitchen or pantry | m3/s |  |  |
|  | Store | m3/s |  |  |
|  | Toilet | m3/s |  |  |
| 5.2 | Guard House and Telecom Room | m3/s |  |  |
|  | Main equipment room | m3/s |  |  |
|  | Customer equipment room | m3/s |  |  |
|  | Battery room | m3/s |  |  |
|  | Guard room | m3/s |  |  |
|  | Kitchen | m3/s |  |  |
|  | Toilet | m3/s |  |  |
| 5.3 | Staff Housings | m3/s |  |  |
| 5.3.1 | Technical staff housing | m3/s |  |  |
|  | * Bedroom | m3/s |  |  |
|  | * Living room | m3/s |  |  |
|  | * Kitchen | m3/s |  |  |
|  | * Toilet | m3/s |  |  |
| 5.3.2 | Security staff housing | m3/s |  |  |
|  | * Bedroom | m3/s |  |  |
|  | * Living room | m3/s |  |  |
|  | * Kitchen | m3/s |  |  |
|  | * Toilet | m3/s |  |  |
| 5.4 | DG house | m3/s |  |  |
| 5.5 | Fire pump house | m3/s |  |  |
| 6. | SOUND ATTENUATORS |  |  |  |
| 6.1 | Manufacturer / country of origin |  |  |  |
| 6.2 | Model |  |  |  |
| 6.3 | International approvals |  |  |  |
| 6.4 | Main supply air |  |  |  |
| 6.5 | Main return air |  |  |  |
| 6.6 | Pressure drop across attenuators | Pa |  |  |
| 6.7 | Main supply air | Pa |  |  |
| 6.8 | Main return air | Pa |  |  |

r) LOW VOLTAGE CABLES

| 1. LOW VOLTAGE CABLES | | **UNIT** | **DATA** | | |
| --- | --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | | **OFFERED** |
| **1** | **Low Voltage Power Cable** |  |  |  | |
| 1.1 | Manufacturer |  |  |  | |
|  | Name |  |  |  | |
|  | Country |  |  |  | |
|  | Type designation |  |  |  | |
| 1.2 | Applicable standard |  |  |  | |
| 1.3 | Rated voltage | kV rms |  |  | |
| 1.4 | Number of cores / size |  |  |  | |
| 1.5 | Conductor material (Cu/Al) and its class acc. to IEC |  | High conductivity/plain annealed/copper |  | |
| 1.6 | Type of conductor |  | Stranded |  | |
| 1.7 | Min thickness & material of insulation | mm |  |  | |
| 1.8 | Type and thickness of inner sheath material | mm | Halogen free Material |  | |
| 1.9 | Whether shield is provided? (Yes/No) |  |  |  | |
| 1.10 | Type and material of armor (wire/tape & Steel/Al) |  | Galvanized steel wire |  | |
| 1.11 | Type and thickness of outer sheath material | mm | Halogen free Material |  | |
| 1.12 | High voltage test | kV |  |  | |
| 1.13 | Short circuit withstand current/time of conductor. | kA/Sec |  |  | |
| 1.14 | Minimum bending radius at minimum temperature |  |  |  | |
| 1.15 | Conductor DC resistance at 20°c | Ω/km |  |  | |
| 1.16 | Minimum temperature during installation | °C |  |  | |
| 1.17 | Minimum pulling tension | N |  |  | |
| 1.18 | Approx. weight of cable | kg/m |  |  | |
| 1.19 | Core identification required | Yes/No | yes |  | |
| 1.20 | Type and routine tests required | Yes/No | yes |  | |
| 1.21 | Distance between cables laid horizontally or in flat |  | equal to the outer diameter of cables |  | |
| **2** | **Control Cable** |  |  |  | |
| 2.1 | Manufacturer |  |  |  | |
|  | Name |  |  |  | |
|  | Country |  |  |  | |
|  | Type designation |  |  |  | |
| 2.2 | Applicable standard |  |  |  | |
| 2.3 | Rated voltage | kV rms |  |  | |
| 2.4 | Type and material of conductor |  | Stranded/ high conductivity plain annealed copper |  | |
| 2.5 | Diameter of each strand | mm |  |  | |
| 2.6 | Number and cross section of wires in each cable |  |  |  | |
|  | For CT cable |  | >=4 mm2 |  | |
|  | For CVT cable |  | >=4 mm2 |  | |
|  | For control cable |  | 2.5 mm2 |  | |
| 2.7 | Insulation material |  | X.L.P.E |  | |
| 2.8 | Material and thickness of inner sheath | mm | Halogen free Material |  | |
| 2.9 | Material and thickness of shield | mm | Lead or copper |  | |
| 2.10 | Material and thickness of bedding for armor | mm |  |  | |
| 2.11 | Material and thickness of armor | mm | Aluminium or galvanized steel |  | |
| 2.12 | Material and thickness of outer sheath | mm | Halogen free Material |  | |
| 2.13 | Type of sheath between shield and armor |  |  |  | |
| 2.14 | Short circuit withstand current/time of conductors | kA/Sec |  |  | |
| 2.15 | Minimum bending radius at minimum temperature |  |  |  | |
| 2.16 | Conductor DC resistance at 20°c | Ω/km |  |  | |
| 2.17 | Minimum temperature during installation | °C |  |  | |
| 2.18 | Minimum pulling tension | N |  |  | |
| 2.19 | Core identification required | Yes/No | yes |  | |
| 2.20 | Type and routine tests required | Yes/No | yes |  | |
| **3** | **Fiber Optic Cables** |  |  |  | |
| 3.1 | Manufacturer |  |  |  | |
| 3.2 | Type of optical fiber cable |  |  |  | |
| 3.3 | Number of cores |  |  |  | |
| 3.4 | Mode - field diameter at 1550 nm & | µm |  |  | |
|  | Mode - field diameter at 1310 nm |  |  |  | |
| 3.5 | Effective core area | µm2 |  |  | |
| 3.6 | Mode field concentricity error at 1550 nm & | ≤ µm |  |  | |
| 3.7 | Mode field concentricity error at 1310 nm |  |  |  | |
| 3.8 | Mode field non - circularity error |  |  |  | |
| 3.9 | Cut - off wavelength λCC |  |  |  | |
| 3.10 | Attenuation coefficient : in 1550 nm & | dB/Km |  |  | |
|  | Attenuation coefficient : in 1310 nm |  |  |  | |
| 3.11 | 1550 nm bend performance | ≤ db |  |  | |
| 3.12 | Non - zero dispersion region | nm |  |  | |
| 3.13 | Zero dispersion wavelength | < µm |  |  | |
| 3.14 | Cladding diameter | µm |  |  | |
| 3.15 | Cladding non - circularity | ≤ % |  |  | |
| 3.16 | Primary coating diameter | µm |  |  | |
| 3.17 | Primary coating concentricity error | ≤ µm |  |  | |
| 3.18 | Primary coating non- circularity error | ≤ % |  |  | |
| 3.19 | Fiber materials |  |  |  | |
| 3.20 | Fiber coating material |  |  |  | |
| 3.21 | Number of armor |  |  |  | |
| 3.22 | Material of outer jacket |  |  |  | |
| 3.23 | Color coding of fiber |  |  |  | |
| 3.24 | Normal drum length | m |  |  | |
| 3.25 | Proof stress level | ≥ Gpa |  |  | |
| **4** | **Cable Gland** |  |  |  | |
| 4.1 | Cable glands |  |  |  | |
|  | Manufacturer |  |  |  | |
|  | Material |  |  |  | |
|  | Type designation |  |  |  | |
| **5** | **Cable Tray, Ladder and Accessories** |  |  |  | |
| 5.1 | Manufacturer |  |  |  | |
|  | Name |  |  |  | |
|  | Country |  |  |  | |
|  | Type designation |  |  |  | |
| 5.2 | Material |  |  |  | |
| 5.3 | Galvanized thickness |  |  |  | |

s) DIESEL GENERATOR

| 1. DIESEL GENERATOR | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| **1** | **General** |  |  |  |
| 1.1 | Design Ambient Temperature | ̊C(min), ̊C(max) | According to General requirements document |  |
| 1.2 | Humidity | % | According to General requirements document |  |
| 1.3 | Installation |  | indoor |  |
| 1.4 | ELECTRICAL SYSTEM |  |  |  |
|  | ALTERNATOR |  |  |  |
|  | Model |  |  |  |
|  | AVR Model |  |  |  |
|  | Rated Cont. Power Output |  |  |  |
|  | Rated Voltage (no load) | V , % | 415 , ±5 |  |
|  | Alternator Matched to Engine Output |  | yes |  |
|  | Main Exciter(brushless) |  | yes |  |
|  | Earthing |  | Solidly grounded |  |
|  | Over Speed Rating | % | 120 |  |
| 1.5 | CONTROL INSTRUMENTS |  |  |  |
|  | Control Card | Yes/No | yes |  |
|  | Auto Start-up , Mains Failure | Yes/No | yes |  |
|  | Manual Start-up | Yes/No | yes |  |
|  | ALARMS |  |  |  |
|  | Start-up Failure | Yes/No | yes |  |
|  | Battery Change Failure | Yes/No | yes |  |
|  | Low Oil Pressure | Yes/No | yes |  |
|  | High Engine Water Temperature | Yes/No | yes |  |
|  | Low Fuel Level | Yes/No | yes |  |
|  | Low Radiator Water Level | Yes/No | yes |  |
|  | Emergency Stop | Yes/No | yes |  |
|  | Over speed | Yes/No | yes |  |
|  | PROTECTION DEVICE |  |  |  |
|  | Emergency Stop Button | Yes/No | yes |  |
|  | ATS (optional) |  |  |  |
| **2** | **A.C. Generator** |  |  |  |
| 2.1 | General |  |  |  |
|  | Manufacturer |  |  |  |
|  | country |  |  |  |
| 2.2 | Degree Of Protection For GEN |  | Ip23 |  |
| 2.3 | Degree Of Protection For Term Box |  | Ip55 |  |
| 2.4 | Type designation |  |  |  |
| 2.5 | Number of Poles |  |  |  |
| 2.6 | Class of insulation: |  |  |  |
|  | Stator |  |  |  |
|  | Rotor |  |  |  |
| 2.7 | Rated voltage | V rms | 415 , 3 , ±5 |  |
| 2.8 | Rated current | A rms |  |  |
| 2.9 | Rated out put | kVA | 250 |  |
| 2.10 | Rated Power Factor | lag | 0.8 |  |
| 2.11 | Total Harmonic Distortion | % | <3 |  |
| 2.12 | Over-load rating and time duration | kW.h |  |  |
| 2.13 | Short circuit withstand in 1 second (with submission of calculation) | kA (rms) |  |  |
| 2.14 | Rated frequency | HZ | 50 , ±2 |  |
| 2.15 | Emergency Standby Duty | Yes/No | yes |  |
| 2.16 | Time to Accept Full Load After Start up | % step load , sec | 100 / 10 |  |
| 2.17 | Load in % of Rated Continuous Power | % | 25,50,75,100,110 |  |
| 2.18 | Voltage stability equipment and range |  |  |  |
| 2.19 | frequency stability equipment and range |  |  |  |
| 2.20 | Connection of windings |  |  |  |
| 2.21 | Neutral grounding |  |  |  |
| 2.22 | Is generator brushless? |  |  |  |
| 2.23 | Number of Phases |  |  |  |
| 2.24 | Reactances: |  |  |  |
| 2.25 | Synchronous Xd | % |  |  |
| 2.26 | Transient X'd | % |  |  |
| 2.27 | Sub transient X''d | % |  |  |
| 2.28 | Type of cooling |  |  |  |
| 2.29 | Efficiency at rated voltage and frequency: |  |  |  |
| 2.30 | 75% rated load |  |  |  |
| 2.31 | 100% rated load |  |  |  |
| 2.32 | Exciter details: |  |  |  |
| 2.33 | Manufacturer |  |  |  |
| 2.34 | Power rating | kW |  |  |
| 2.35 | Voltage rating | V-DC |  |  |
| 2.36 | Max. instantaneous change in frequency for instantaneous load change from zero to full load |  |  |  |
| **3** | **Diesel Engine** |  |  |  |
| 3.1 | Manufacture |  |  |  |
| 3.2 | country |  |  |  |
| 3.3 | Type designation |  |  |  |
| 3.4 | Number of cylinders |  | 6 |  |
| 3.5 | Speed | r.p.m | 1500 |  |
| 3.6 | Type of cooling |  | Water cooled |  |
| 3.7 | Compression Ratio |  | By vendor |  |
| 3.8 | Coupling |  |  |  |
| 3.9 | Start-up time from initiation until circuit breaker closes | S |  |  |
| 3.10 | Number of strokes |  |  |  |
| 3.11 | Compression ratio |  |  |  |
| 3.12 | Efficiency at rated load | % |  |  |
| 3.13 | Fuel Type |  | HSD |  |
| 3.14 | Rated Overload Power(1hr in 24 hr) | % of Rated Load | 110 |  |
| 3.15 | Cylinders Wet or Dry |  | wet |  |
| 3.16 | Frame |  | cast |  |
| 3.17 | Starter Motor |  |  |  |
| 3.18 | Fuel Tank Capacity |  |  |  |
| 3.19 | Fuel injection system |  |  |  |
| 3.20 | Specific fuel consumption at:(Based on generation output) |  |  |  |
| 3.21 | Aspiration (Natural or supercharger) |  |  |  |
| 3.22 | ENGINE SAFETY SHUTDOWN WITH ALARM & INDICATION |  |  |  |
| 3.23 | Engine Over Speed | Yes/No | yes |  |
| 3.24 | Low lube Oil Pressure | Yes/No | yes |  |
| 3.25 | High Jacket Water Temperature | Yes/No | yes |  |
| 3.26 | Fuel Engine Leakage | Yes/No | yes |  |
| 3.27 | Flow of Air From Fan | m³/min |  |  |
| 3.28 | Water Jacket Heater | Yes/No | yes |  |
| 3.29 | LUBRICATION SYSTEM |  |  |  |
| 3.30 | Maximum Oil Consumption ( % Fuel Consumption) |  | 0.2 |  |
| **4** | **Governor** |  |  |  |
| 4.1 | Type | Electric/Hydraulic | Electronic |  |
| 4.2 | Manufacturer and country |  |  |  |
| **5** | **Starting system** |  |  |  |
| 5.1 | Type of the battery |  |  |  |
| 5.2 | Number of Batteries |  | 1 |  |
| 5.3 | ‍Capacity of the battery | Ah |  |  |
| 5.4 | Rated voltage of the battery | V DC | 24 |  |
| 5.5 | Type of starter |  |  |  |
| 5.6 | Type of charger |  |  |  |
| 5.7 | charger voltage supply |  |  |  |
| **6** | **‍Control and indication** |  |  |  |
| 6.1 | Type of control cubicle (local console or control panel) |  |  |  |
| 6.2 | Number and type of alarms |  |  |  |
| 6.3 | Number and type of alarms |  |  |  |
| 6.4 | Type of remote alarms |  |  |  |
| 6.5 | Metering equipment (manufacturer, type and range): |  |  |  |
|  | A.C. ammeter |  |  |  |
|  | A.C. voltmeter |  |  |  |
|  | Frequency-meter |  |  |  |
|  | Water temperature indicator |  |  |  |
|  | Oil pressure indicator |  |  |  |
|  | Running hour-meter |  |  |  |
| 6.6 | Control switches and knobs (manufacturer and type) |  |  |  |
| 6.7 | Protective relaying (manufacturer and type) |  |  |  |
| 6.8 | Circuit breaker (contactor): |  |  |  |
|  | Manufacturer and type |  |  |  |
|  | Current rating | A(rms) |  |  |
| **7** | **Weight and dimension** |  |  |  |
| 7.1 | Main fuel tank |  |  |  |

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| 1. UPS | | UNIT | Data Required | Data Offered |
| **CCTV - UPS** | |  |  |  |
| 1 | Manufacturer`s name and country |  |  |  |
| 2 | Manufacturer`s type and designation |  |  |  |
| 3 | Output Voltage |  | 240V, AC |  |
| 4 | Power rating | KVA | 10 |  |
| 5 | Transfer time | Sec | 0 |  |
| 6 | Overload capability | % | 125 |  |
| 7 | Regulation |  | Yes |  |
| 8 | Input Voltage | V | 240 |  |
| 9 | Maximum current | A | 5 |  |
| 10 | Power factor |  | 0.9 |  |
| 11 | Battery | AH |  |  |
| 12 | Manufacturer`s name and country |  |  |  |
| 13 | Manufacturer`s type and designation |  |  |
| 14 | Rating |  |  |  |
| 15 | Number of cells |  |  |
| 16 | Autonomy time | H | 8 |  |
| 17 | Recharge time | H | 10 |  |
| 18 | Communication |  |  |  |
| 19 | User interface |  | RS232 |  |
| 20 | Networks |  | Yes |  |

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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Mobile Camera** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Horizontal resolution  in color mode  in B/W mode | lines  lines |  |  |
| 4 | Vertical resolution lines |  |  |  |
| 5 | Minimum illumination  in color mode  in B/W mode | Lx |  |  |
| 6 | Zoom speed | Sec |  |  |
| 7 | Focus speed | Sec |  |  |
| 8 | Video out put |  |  |  |
| 9 | Panning range | Degree |  |  |
| 10 | Tilting range | Degree |  |  |
| 11 | Iris |  |  |  |
| 2 | Alarm in |  |  |  |
| 13 | Alarm out |  |  |  |
| 14 | Ambient operating temperature | Degree C |  |  |
| 15 | Ambient operating humidity |  |  |  |
| 16 | Heater | W | Yes |  |
| 17 | Power of heater | W |  |  |
| 18 | Weight | kg |  |  |
| 19 | Number of camera’s  IP protection |  | IP66/67/Ethernet type |  |

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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Fixed Camera** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Horizontal resolution  in color mode  in B/W mode | lines  lines |  |  |
| 4 | Vertical resolution | lines |  |  |
| 5 | Minimum illumination  in color mode  in B/W mode | Lx |  |  |
| 6 | Signal to noise ratio | dB |  |  |
| 7 | Lens mount |  |  |  |
| 8 | Video out put |  |  |  |
| 9 | Electronic shutter |  |  |  |
| 10 | Alarm out |  | Yes |  |
| 11 | Ambient operating temperature | Degree C | -40˚C to +85˚C |  |
| 12 | Ambient operating humidity |  | max (year):100  min(year):20 |  |
| 13 | Heater |  | yes |  |
| 14 | Power of heater | W | 40 |  |
| 15 | Weight | kg |  |  |
| 16 | Number of camera’s IP protection |  | IP66/67-Ethernet type |  |

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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Lens** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Manufacturer’s model number |  |  |  |
| 4 | Focal length | mm |  |  |
| 5 | Aperture |  |  |  |
| 6 | Mount |  |  |  |
| 7 | Image format |  |  |  |
| 8 | Dimension |  |  |  |

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| **UPS** | | UNIT | Data Required | Data Offered | |
|  | **CCTV – Power cable** |  |  |  | |
| 1 | General |  |  |  | |
| 2 | Manufacturer’s name and country |  |  |  | |
| 3 | Applicable technical standard |  |  |  | |
| 4 | Voltage rating | kV |  |  | |
| 5 | Conductor material |  |  |  | |
| 6 | Type of conductor (stranded or solid) |  |  |  | |
| 7 | Conductor insulation material |  |  |  | |
| 8 | Insulation resistance at 20oC | mΩ /Km |  |  | |
| 9 | Sheath material |  |  |  | |
| 10 | Composition of sheath: |  | Yes |  | |
| 11 | Composition of sheath:  a) Lead sheath  lead  Tin  Cadmium  Antimony  b) Other sheath | %  %  %  % | -40˚C to +85˚C |  | |
| 12 | Armouring material |  | Galvanized steel |  | |
| 13 | Number of layers of steel tapes |  | 2-tape |  | |
| 14 | Type of outer sheath and color |  | P.V.C/Black/Blue |  | |
| 15 | Minimum bending radius x (O.D.) |  | 12\*(O.D.) for multi-core & 15\*(O.D.) for single core |  | |
| 16 | Test voltage levels | kV | 3.5KVAC |  | |
|  |  |  | | Data offered |
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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – POWER CABLE** |  |  |  |
| 1 | Special for each type |  |  |  |
| 2 | Manufacture’s type and designation |  | NYRY |  |
| 3 | No. of cores and core cross section area | mm2 | At design stage |  |
| 4 | Normal current carrying capacity (in air), at 30 °C Ambient |  | At design stage |  |
| 5 | Thickness of core insulation | mm | ≥0.8 |  |
| 6 | Color code or numbering code of cores |  | At design stage |  |
| 7 | Thickness of sheath | mm | ≥1.8 |  |
| 8 | Minimum thickness of insulation between core and sheath | mm | ≥1.0 |  |
| 9 | Armoring thickness | mm |  |  |
| 10 | External diameter of completed cable | mm |  |  |
| 11 | Weight per meter of completed cable | Kg |  |  |
| 12 | Estimated length which will be provided per drum | m |  |  |
| 13 | Estimated length of cable to be supplied | m | As Req. |  |
| 14 | Max. current in inter shield (amors or shield) under line ground fault condition - A |  |  |  |
| 15 | Resistance of each core per km at 20°C | Ω |  |  |
| 16 | Mean electro - static capacitance of each conductor to earth per km of complete cable |  |  |  |
| 17 | Estimated length for control & protection cables | m | As Req. |  |

| **UPS** | | UNIT | Data Required | Data Offered |
| --- | --- | --- | --- | --- |
|  | **CCTV – Data Cable/Ethernet cable** |  |  |  |
| 1 | General |  | Should comply to outdoor STP ANSI/TIA 568C |  |
| 2 | Manufacturer’s name and country |  | Specified by bidder |  |
| 3 | Applicable technical standard |  | BS 6500(1990) similar to IEC (227) (53) |  |
| 4 | Voltage rating | kV | 0.3/0.5 |  |
| 5 | Conductor material |  | Cu |  |
| 6 | Type of conductor (stranded or solid) |  | stranded |  |
| 7 | Conductor insulation material |  | PVC |  |
| 8 | Insulation resistance at 20°C | mΩ /Km | 1000 |  |
| 9 | Sheath material |  | PVC |  |
| 10 | Composition of sheath: |  |  |  |
| 11 | Lead sheath  Tin  Cadmium  Antimony | %  %  % |  |  |
| 12 | b) Other sheath |  |  |  |
| 13 | Armoring material |  |  |  |
| 14 | Number of layers of steel tapes |  |  |  |
| 15 | Type of outer sheath and color |  | PVC / White |  |
| 16 | Minimum bending radius x (O.D.) |  | 7xO.D ~ 7 Cm |  |
| 17 | Test voltage levels | kV |  |  |
| 18 | Special for each type |  |  |  |
| 19 | Manufacture’s type and designation |  |  |  |
| 20 | No. of cores and core cross section area | mm² |  |
| 21 | Normal current carrying capacity (in air), at 30 °C Ambient |  |  |  |
| 22 | Thickness of core insulation | mm |  |  |
| 23 | Color code or numbering code of cores |  | At design stage |  |
| 24 | Thickness of sheath | mm | Acc. To IEC… |  |
| 25 | Minimum thickness of insulation between core and sheath | mm | Acc. To IEC… |  |
| 26 | Armoring thickness | mm |  |  |
| 27 | External diameter of completed cable | mm |  |  |
| 28 | Weight per meter of completed cable | Kg |  |  |
| 29 | Estimated length which will be provided per drum | m |  |  |
| 30 | Estimated length of cable to be supplied | m |  |  |
| 31 | Max. current in inter shield (armors or shield) under line ground fault condition | A |  |  |
| 32 | Resistance of each core per km at 20 °C Ω | Ω |  |  |
| 33 | Mean electro - static capacitance of each conductor to earth per km of complete cable |  |  |  |
| 34 | Estimated length for control & protection cables | m | As Req. |  |

| **UPS** | | | UNIT | Data Required | Data Offered |
| --- | --- | --- | --- | --- | --- |
|  | | **CCTV – Housing** |  |  |  |
| 1 | | Manufacture’s name and country |  |  |  |
| 2 | | Type of fixture |  | Telescopic |  |
| 3 | | Fixture mounting height | m | 5 ~ 7 |  |
| 4 | | Number of fixtures |  | As Req. |  |
| 5 | | Minimum length of horizontal bracket |  | At design stage |  |
| 6 | | Type of bracket for movable camera |  | At design stage |  |
| 7 | | Heater | yes/no | in Housing |  |
| 8 | | Power of heater | W | 40 |  |
| 9 | | Manufacturer’s name and country |  |  |  |
| 10 | | Manufacturer’s type and designation |  |  |  |
| 11 | | Material of cabinet |  |  |  |
| 12 | | Material of glass |  | Nano Type |  |
| 13 | | Dimension  Length  Width  Hight | mm  mm  mm |  |  |
| 14 | | No. of housing for fixed camera |  | As Req. |  |
| 15 | | No. of housing for movable camera |  | As Req. |  |
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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Controller** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Ambient operating temperature |  | +10°C-+40°C |  |
| 4 | Ambient operating humidity |  | 90% |  |
| 5 | Power Source AC/DC  Voltage  Current | AC/DC  V  mA | 230VAC-9VDC |  |
| 6 | Controller number |  | 4 |  |
| 7 | Camera number selection |  | ≥24 |  |
| 8 | All of lens functions |  | Yes |  |
| 9 | System operation |  |  |  |
| 10 | Pan/Tilt |  |  |  |
| 11 | Switching functions |  |  |  |
| 12 | Type of output data/input data |  | RS485-P.S-Data |  |
| 13 | Type of prot. for PC |  | Via matrix |  |
| 14 | Accessories |  |  |  |

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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Video Switchers** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Type of camera inputs |  | 32 |  |
| 4 | Type of camera outputs |  | 1600% |  |
| 5 | Frequency response | MHz | >6 |  |
| 6 | Time of switching interval | Sec | Variable/as setup |  |
| 7 | Ext. time input |  | Yes |  |
| 8 | Ext. time output |  | Yes |  |
| 9 | Alarm input |  | Yes |  |
| 10 | Number of alarm input |  | ≥8 |  |
| 11 | Alarm buzzer |  | Yes |  |
| 12 | Power source |  | AC/22-230V |  |
| 13 | Three – position - lever switchers |  | Yes |  |

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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Multiplexer** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Picture in picture function |  | Yes |  |
| 4 | Picture out picture function |  | Yes |  |
| 5 | Zoom function |  | Yes |  |

| **UPS** | | UNIT | Data Required | Data Offered |
| --- | --- | --- | --- | --- |
|  | **CCTV – DVR – TELE EYE** |  |  |  |
| 1 | Manufacturer’s name and country |  |  |  |
| 2 | Manufacturer’s type and designation |  |  |  |
| 3 | Video input |  |  |  |
| 4 | Standard  Pal/CCIR, lines, field per second  NTSC/EIA, Lines, field per second |  |  |  |
| 5 | No. of channel | Nos | 32 |  |
| 6 | Resolution  In quality mode  in speed mode |  | Min:  25Im/sec 720x576 PAL  100Im/sec 360x288 PAL |  |
| 7 | Video output |  | Min: BNC out/ monitor out RGB/ S video/ RCA |  |
| 8 | Standard  One) Pal/CCIR, lines, field per second  Two) NTSC/EIA, Lines, field per second |  |  |  |
| 9 | No. of channels |  | Min: 2xBNC/ 1XRGB/ S video |  |
| 10 | Type of standalone operation |  | To be specified by Bidder |  |
| 11 | Communication |  | RS485/RS232/RS 985 ,RJ11 |  |
| 12 | Network |  | 10/100 RJ45 |  |
| 13 | Concurrent users |  | To be specified by Bidder |  |
| 14 | Web server |  | Yes |  |
| 15 | Sure link |  | Yes |  |
| 16 | Modem port |  | RS 45 |  |
| 17 | Port |  | RS 105 |  |
| 18 | Data bits |  | RS 232 |  |
| 19 | Stop bit |  | 100 mbps over Ethernet |  |
| 20 | Connection speed | kbps | 32 ~ unlimited |  |
| 21 | Parity | yes/no | Yes |  |
| 22 | Aux port |  |  |  |
| 23 | Recording |  |  |  |
| 24 | Mode |  |  |  |
| 25 | HD type |  |  |
| 26 | HD size |  |  |
| 27 | Max. recording rate | fps | Min: 100 fps per channel Depend on storage EXT.(To 7.5TB) |  |
| 28 | Event handling |  |  |  |
| 29 | Event type |  | To be specified by Bidder |  |
| 30 | Action type |  |  |
| 31 | External input |  |  |
| 32 | Relay switch |  |  |  |
| 33 | No. of channels |  | Min: 32CH=16CHx2 |  |
| 34 | Max. rating |  | To be specified by Bidder |  |
| 35 | Power |  |  |  |
| 36 | Voltage | V | 240VAC |  |
| 37 | Max. current | mA |  |  |
| 38 | Operating environment |  |  |  |
| 39 | Ambient temperature | °C | +10° to +40° |  |
| 40 | Relative humidity |  | Less than 90% |  |

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| **UPS** | | UNIT | Data Required | Data Offered |
|  | **CCTV – Other Requirements** |  |  |  |
| .1 | Computer |  | Industrial |  |
| 2 | Mother board |  |  |  |
| 3 | CPU | MHz | Corei5 |  |
| 4 | Type of RAM |  | DDR3 |  |
| 5 | Size of RAM | MB | 4 GB |  |
| 6 | H.D.D  Type  Size  Size of buffer  Head size  Caption | GB  MB | SSD  2x60GB  120  3.5"  (8Gb/S) |  |
| 7 | Display adapter |  | Yes |  |
| 8 | DVD ROM |  | Yes |  |
| 9 | DVD writer |  | Yes |  |
| .10 | Monitor to beam the footages |  | 2\*LCD 42" |  |
| 11 | Sound card |  | Yes |  |
| 12 | Power of case |  | Yes , industrial |  |
| 13 | Speaker |  | Yes |  |
| 14 | Keyboard |  | Yes |  |
| 15 | Mouse |  | Yes |  |
| 16 | F.D.D |  | no |  |
| 17 | Operating system |  | To be specified by Bidder |  |