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a) SITE CONDITIONS

| 1. SITE CONDITIONS | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **Required** | **Offered** |
|  | **General Requirement** |  |  |  |
| 1 | Climate |  | Arid |  |
| 2 | Pollution |  | Very Heavy |  |
| 2.1 | Creepage distance (based on Um) | mm/kV | 31 |  |
| 3 | Isokeraunic Level | thunderstorm days/year | 80 |  |
| 4 | Altitude of Area | m | 1850 |  |
| 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 | 50 |  |
| 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 | Ave. annual sum of direct normal irradiation | kWh/m2 | 1200 |  |
| 12 | Thickness of ice | mm | 5 |  |
| 13 | Average annual rainfall | mm | 1000 |  |
| 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) 400 kV OPEN TERMINAL SWITCHGEAR

| 1. 400 kV OPEN TERMINAL SWITCHGEAR | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **Required** | **Offered** |
|  | **400KV Circuit Breaker** |  |  |  |
|  | **General** |  |  |  |
| 1.1 | Manufacturer |  | Based on bidder’s offer |  |
| 1.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 1.3 | Type designation for breaker |  | Based on bidder’s offer |  |
| 1.4 | Type designation for operating mechanism |  | Based on bidder’s offer |  |
| 1.5 | Type of operation mechanism |  | Spring Charge  motor operated |  |
| 1.6 | Type of interrupting chamber |  | Based on bidder’s offer |  |
| 1.7 | Applicable standard |  | IEC 62271-100, 62271-101, 62271-110, 62271-302, 60376, 60480 |  |
| 1.8 | Rated voltage | kV | 420 |  |
| 1.9 | System Voltage | kV | 400 |  |
| 1.10 | Rated current at maximum site temperature | A |  |  |
| 1.10.1 | For line feeder |  | 4000 |  |
| 1.10.2 | For Transformer feeder |  | 4000 |  |
| 1.10.3 | For Diameters |  | 4000 |  |
| 1.11 | Rated frequency | Hz | 50 |  |
| 1.12 | Media of breaking chamber |  | SF6 |  |
| 1.13 | Single pressure, low pressure or others |  | Based on bidder’s offer |  |
| 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 |  | 1 pole operated |  |
| 1.16.2 | For Transformer feeder |  | 1 pole operated |  |
| 1.16.3 | For Diameter |  | 1 pole operated |  |
| Note | All 400 kV circuit breakers should be capable of both Single pole and three pole operation | | | |
| 1.17 | Number of interrupting chambers per pole |  | One/Two |  |
| 1.18 | Class (indoor / outdoor) |  | Outdoor |  |
| 1.19 | Circuit breaker type (live tank / dead tank) |  | Live tank |  |
| 1.20 | Type of system earthing |  | Effective |  |
| 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) |  | 1425 |  |
| 1.27.2 | Across the isolating distance |  | 1425+240 |  |
| 1.28 | One minute power frequency withstand voltage (at IEC condition) | kV rms |  |  |
| 1.28.1 | Common value (Phase-phase, Phase-ground) |  | 520 |  |
| 1.28.2 | Across isolating distance |  | 610 |  |
| 1.29 | Switching Impulse Withstand Voltage at IEC conditions | kV peak |  |  |
| 1.29.1 | Phase to ground and across open switching device |  | 1050 |  |
| 1.29.2 | Phase to phase |  | 1575 |  |
| 1.29.3 | Across isolating distance |  | 900+345 |  |
| 1.30 | Rated transient recovery voltage for terminal faults | kV peak | 624 |  |
| 1.31 | Rated recovery voltage | kV peak |  |  |
| 1.31.1 | Amplitude factor |  | Based on bidder’s offer |  |
| 1.31.2 | Rate of rise | kV/µs | Based on bidder’s offer |  |
| 1.32 | Rate of rise of restriking voltage |  |  |  |
| 1.32.1 | For 30% breaking capacity | kV/µs | Based on bidder’s offer |  |
| 1.32.2 | For 60% breaking capacity | kV/µs | Based on bidder’s offer |  |
| 1.32.3 | For 100% breaking capacity | kV/µs | Based on bidder’s offer |  |
| 1.33 | Maximum recovery voltage on breaking a synchronous system | kV | Based on bidder’s offer |  |
| 1.34 | Rated characteristics for short line faults | kV rms | Based on bidder’s offer |  |
| 1.35 | First pole to clear factor |  | 1.3 |  |
| 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 | 60 |  |
|  | **Current Ratings** |  |  |  |
| 1.41 | Rated short time withstand current & duration | kA rms/sec | 40/1 |  |
| 1.42 | Rated short circuit making current | kA peak | 2.5\*40 |  |
| 1.43 | Rated out of phase breaking current | kA rms | 12.5 |  |
| 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 | 40 |  |
| 1.46.2 | DC component | % | Acc. To IEC |  |
| 1.47 | Maximum current on breaking asynchronous system | kA peak | Based on bidder’s offer |  |
| 1.48 | 180° out of phase switching duty as a percentage of rated  breaking current | % | Based on bidder’s offer |  |
|  | **Other Characteristics** |  |  |  |
| 1.49 | Voltage drop across HV terminals of one pole at 100 A dc | mV | Based on bidder’s offer |  |
| 1.50 | Maximum temperature rise at normal current over maximum  ambient temperature | °C | Based on bidder’s offer |  |
| 1.51 | Opening time (from trip contact closing to the primary contacts separation in all poles) |  |  |  |
| 1.51.1 | Without current | ms | Based on bidder’s offer |  |
| 1.51.2 | With 100% rated breaking current | ms | Based on bidder’s offer |  |
| 1.52 | Opening time from trip contact closing to primary contact separation | ms | ≤25 |  |
| 1.53 | Closing time (from energization of close coil to latching of circuit breaker in fully closed position) | ms | ≤75 |  |
| 1.54 | Rated break or interrupting time (opening time plus arcing time) | ms | Based on bidder’s offer |  |
| 1.55 | Making time (energization of close coil to contact touch) |  |  |  |
| 1.55.1 | Without current | ms | Based on bidder’s offer |  |
| 1.55.2 | 100% making current | ms | Based on bidder’s offer |  |
| 1.56 | Maximum break time | ms | 40 |  |
| 1.57 | Maximum close time | ms | < 70 |  |
| 1.58 | Dead time (during auto-reclosing) | ms | Based on bidder’s offer |  |
| 1.59 | Reclosing | ms | Based on bidder’s offer |  |
| 1.60 | Arcing time | ms | Based on bidder’s offer |  |
| 1.61 | Maximum time interval between opening of first and last phase of three phase circuit breakers | ms | 3.3 |  |
| 1.62 | Maximum time interval between opening of interrupters of one phase | µs | Based on bidder’s offer |  |
| 1.63 | Maximum time interval between closure of interrupters of one phase | µs | Based on bidder’s offer |  |
| 1.64 | Minimum time from extinction of main arc to contact make during auto-reclosing duty | ms | Based on bidder’s offer |  |
| 1.65 | Closing time from energisation of close coil to latching of circuit breaker in fully closed position | ms | Based on bidder’s offer |  |
| 1.66 | Making time (energisation of close coil to contact touch) |  |  |  |
| 1.66.1 | Without current | ms | Based on bidder’s offer |  |
| 1.66.2 | 100% making current | ms | Based on bidder’s offer |  |
|  | **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 | Based on bidder’s offer |  |
| 1.69.3 | Full-load current | A | Based on bidder’s offer |  |
| 1.69.4 | Maximum starting current | A | Based on bidder’s offer |  |
| 1.69.5 | Speed | rpm | Based on bidder’s offer |  |
| 1.69.6 | Required time by motor to charge the spring completely | s | Based on bidder’s offer |  |
| 1.69.7 | Type of protection of motor |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 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 |  | 18NO+18NC |  |
| 1.79 | Opening and closing nominal control voltage | V dc | 110 |  |
| 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 |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.81.4 | Closing coil current | A, DC | Based on bidder’s offer |  |
| 1.81.5 | Rated power of trip coil | W | Based on bidder’s offer |  |
| 1.81.6 | Rated power of close coil | W | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 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 | N/A |  |
| 1.87.2 | Insertion time | ms | Based on bidder’s offer |  |
| 1.88 | Whether Switching Control Relay or point on wave (POW switching) is provided? | Yes/No | Yes |  |
| 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 | Based on bidder’s offer |  |
| 1.92 | Limits of gas pressure for correct operation of breaker | Absolute  bar | Based on bidder’s offer |  |
| 1.93 | Signal loss of SF6 at 20°C | Absolute  bar | Based on bidder’s offer |  |
| 1.94 | General lockout at 20°C | Absolute  bar | Based on bidder’s offer |  |
| 1.95 | Leakage rate of SF6 at rated pressure per annum | % | < 0.5 |  |
| 1.96 | Type and material of gasket used to gas tightening the joints |  |  |  |
| 1.96.1 | Metal to metal joints |  | Based on bidder’s offer |  |
| 1.96.2 | Metal to porcelain joints |  | Based on bidder’s offer |  |
| 1.97 | Supplier of SF6 gas |  | Based on bidder’s offer |  |
| 1.98 | Supplier of Density meter |  | Based on bidder’s offer |  |
| 1.99 | Toxicological test |  | Based on bidder’s offer |  |
| 1.100 | Storage capacity of each gas cylinder | m³ | Based on bidder’s offer |  |
| 1.101 | Whether sufficient gas plus 20% supplied for first filling? | Yes / No | Yes |  |
| 1.102 | Mass of gas stored cylinder | kg | Based on bidder’s offer |  |
| 1.103 | Time required to fill the circuit breaker with SF6 gas ready  for operation | hour | Based on bidder’s offer |  |
| 1.104 | Time required to empty gas of the circuit breaker | hour | Based on bidder’s offer |  |
| 1.105 | Total mass of transportable gas handling equipment | kg | Based on bidder’s offer |  |
| 1.106 | Whether SF6 is stored as gas or liquid? |  | Gas |  |
|  | **Insulator Columns** |  |  |  |
| 1.107 | Manufacturer |  | Based on bidder’s offer |  |
| 1.108 | Type |  | Based on bidder’s offer |  |
| 1.109 | Color |  | Based on bidder’s offer |  |
| 1.110 | Creepage distance phase to ground | mm | 13020 |  |
| 1.111 | Creepage distance between terminals of one pole | mm | 31mm/kV |  |
| 1.112 | Protected creepage distance (90° shadow) | mm | 31mm/kV |  |
| 1.113 | Clearance (phase to phase ) | mm | Acc to IEC |  |
| 1.114 | External striking distance |  |  |  |
| 1.114.1 | Phase to ground | mm | Acc to IEC |  |
| 1.114.2 | Phase to phase | mm | Acc to IEC |  |
| 1.115 | Ultimate strength of columns |  |  |  |
| 1.115.1 | Cantilever | N | Based on bidder’s offer |  |
| 1.115.2 | Tension | N | Based on bidder’s offer |  |
| 1.115.3 | Torsion | N.m | Based on bidder’s offer |  |
| 1.115.4 | Compression | N | Based on bidder’s offer |  |
| 1.116 | Permissible force at HV terminals |  |  |  |
| 1.116.1 | Static at any direction | N | Based on bidder’s offer |  |
| 1.116.2 | Dynamic at any direction | N | Based on bidder’s offer |  |
| 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 | 15 to 20 |  |
| 1.119.3 | Cumulative ampere rating | time | Acc to IEC |  |
| 1.120 | Whether a lock out device for preventing circuit breaker to close is provided? | Yes / No | Yes |  |
| 1.121 | Whether Switching Control Relay is provided? | Yes/No | Yes |  |
| 1.122 | Number and type of free auxiliary contacts for main contact monitoring |  | 18NO and 18NC |  |
| 1.123 | Number and type of free auxiliary contacts for SF6 gas pressure monitoring |  | 4 |  |
| 1.124 | Number and type of free auxiliary contacts for local/remote selector switch monitoring |  | 6 |  |
| 1.125 | Whether circuit breaker is equipped with rings? | Yes/No | Based on bidder’s offer |  |
| 1.126 | Whether circuit breaker is equipped with grading capacitors? | (Yes/ No) | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.135.2 | Total weight of complete circuit breaker | kg | Based on bidder’s offer |  |
| 1.135.3 | Maximum weight of package ready for shipment | kg | Based on bidder’s offer |  |
| 1.136 | CB main dimensions |  |  |  |
| 1.136.1 | Overall height of assembled circuit breaker | mm | Based on bidder’s offer |  |
| 1.136.2 | Phase spacing | mm | Based on bidder’s offer |  |
| 1.136.3 | Minimum vertical distance between upper and lower terminal of the circuit breaker | mm | Based on bidder’s offer |  |
| 1.136.4 | Minimum vertical distance between lower side of the circuit breaker and metallic support | mm | Based on bidder’s offer |  |
| 1.137 | Mechanical endurance class |  | M2 |  |
| 1.138 | Electrical endurance class |  | E2 |  |
| 1.139 | Restrike probability class due to capacitive current breaking |  | C2 |  |
|  | **400KV ISOLATOR** |  |  |  |
|  | **General** |  |  |  |
| 2.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 2.3 | Type designation for Isolator |  | Based on bidder’s offer |  |
| 2.4 | Type designation for grounding switch |  | Based on bidder’s offer |  |
| 2.5 | Type of Isolator |  | Horizontal Double Break/Centre break |  |
| 2.6 | Applicable standard |  | IEC 62271-102 |  |
| 2.7 | Quantity of poles |  | 3 poles.  3 Poles simultaneous operation |  |
| 2.8 | Rated voltage | kV | 420 |  |
| 2.9 | Rated current | A |  |  |
| 2.9.1 | At maximum site temperature |  |  |  |
| 2.9.1.1 | For line feeder |  | 4000 |  |
| 2.9.1.2 | For Transformer feeder |  | 4000 |  |
| 2.9.1.3 | For Diameter |  | 4000 |  |
| 2.9.2 | At IEC condition |  |  |  |
| 2.9.2.1 | For line feeder |  | 4000 |  |
| 2.9.2.2 | For Transformer feeder |  | 4000 |  |
| 2.9.2.3 | For Diameter |  | 4000 |  |
| 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 |  | Yes |  |
| 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 | 1425 |  |
| 2.19.2 | Across the isolating distance | kV peak | 1425+240 |  |
| 2.20 | One minute power frequency withstand voltage (at site condition) |  |  |  |
| 2.20.1 | Common value | kV rms | 520 |  |
| 2.20.2 | Across the isolating distance | kV rms | 610 |  |
| 2.21 | Switching impulse withstand voltage (at site condition) |  |  |  |
| 2.21.1 | Common value | kV peak | 1050 |  |
| 2.21.2 | Across the isolating distance | kV peak | 900+345 |  |
| 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 | 40/1 |  |
| 2.23.2 | For grounding switch | kA rms/sec | 40/1 |  |
| 2.24 | Rated short circuit making current for grounding switches | kA rms | 2.5\*40 |  |
| 2.25 | Rated peak short circuit withstand current | kA peak | Based on bidder’s offer |  |
| 2.26 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | kVA | Based on bidder’s offer |  |
| 2.27 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | kVA | Based on bidder’s offer |  |
|  | **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 | Based on bidder’s offer |  |
| 2.30 | Maximum temperature rise at normal current over Maximum ambient temperature | °C | Based on bidder’s offer |  |
| 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 and Manual |  |
| 2.33.2 | For grounding switch |  | DC Motor and Manual |  |
| 2.34 | Motor type |  | Based on bidder’s offer |  |
| 2.35 | Motor |  |  |  |
| 2.35.1 | Rated voltage | V | 110 VDC |  |
| 2.35.2 | Power demand | W | Based on bidder’s offer |  |
| 2.35.3 | Full load current | A | Based on bidder’s offer |  |
| 2.35.4 | Speed | rpm | Based on bidder’s offer |  |
| 2.36 | Type of motor protection |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 2.39 | Total time from initiation of opening operation to time when Isolator gap can withstand phase voltage |  | Based on bidder’s offer |  |
| 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 | No | Based on bidder’s offer |  |
| 2.42 | Maximum required force for hand operation with supplied handle |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 2.46.2 | Nominal Voltage | V | 240 AC |  |
| 2.47 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | Yes / No | Yes |  |
| 2.48 | Whether open/neutral /close control switch is provided? ( Yes / No) | Yes / No | Yes |  |
| 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 | Based on bidder’s offer |  |
| 2.52 | Total load of heaters for Isolator | W | Based on bidder’s offer |  |
|  | **Insulators** |  |  |  |
| 2.53 | Manufacturer |  | Based on bidder’s offer |  |
| 2.54 | Place of manufacturing |  | Based on bidder’s offer |  |
| 2.55 | Type (porcelain /composite) |  | porcelain |  |
| 2.56 | Color |  | Based on bidder’s offer |  |
| 2.57 | Creepage distance | mm | 13020 |  |
| 2.58 | Protected creepage distance | mm | Based on bidder’s offer |  |
| 2.59 | Permissible cantilever working load | N | C12 |  |
| 2.60 | Operating handle or lever mounting height above ground | m | 1.2 |  |
| 2.61 | Permissible tensional strength | N.m | Based on bidder’s offer |  |
| 2.62 | Minimum clearance | mm |  |  |
| 2.62.1 | Between poles when Isolator is closed |  | Based on bidder’s offer |  |
| 2.62.2 | Between poles when Isolator is open |  | Based on bidder’s offer |  |
| 2.62.3 | Between phase and ground |  | Based on bidder’s offer |  |
| 2.62.4 | Between one pole terminals at open condition |  | Based on bidder’s offer |  |
|  | **Interlocks** |  |  |  |
| 2.63 | Type of interlock between Isolator and associated ground switch |  | Electrical and Mechanical |  |
| 2.64 | Type of interlock between ground switch and related circuit breakers |  | Electrical |  |
| 2.65 | Type of interlock between Isolator and related circuit breaker |  | Electrical |  |
| 2.66 | Locking arrangement in on/off position | Yes / No | Yes |  |
| 2.67 | Automatic isolation of control supplies when lock off | Yes / No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 2.68 | Type of main contacts |  |  |  |
| 2.68.1 | For Isolator |  | Based on bidder’s offer |  |
| 2.68.2 | For grounding switch |  | Based on bidder’s offer |  |
| 2.69 | Material of main contacts |  |  |  |
| 2.69.1 | For Isolator |  | Copper |  |
| 2.69.2 | For grounding switch |  | Copper |  |
| 2.70 | Material of blades |  |  |  |
| 2.70.1 | For Isolator |  | Based on bidder’s offer |  |
| 2.70.2 | For grounding switch |  | Based on bidder’s offer |  |
| 2.71 | Whether main contacts are silver plated? |  |  |  |
| 2.71.1 | For Isolators. |  | Yes |  |
| 2.71.2 | For grounding switches |  | Yes |  |
| 2.72 | Quantity and type of free auxiliary contacts |  |  |  |
| 2.72.1 | For Isolators |  | 10NO+10NC |  |
| 2.72.2 | For grounding switches |  | 10NO+10NC |  |
| 2.73 | Permissible force on HV terminals |  |  |  |
| 2.73.1 | Static in any direction | N | Based on bidder’s offer |  |
| 2.73.2 | Dynamic in any direction | N | Based on bidder’s offer |  |
| 2.74 | Weight of maximum package ready for shipment | kg | Based on bidder’s offer |  |
| 2.75 | Weight of complete |  |  |  |
| 2.75.1 | Isolator | kg | Based on bidder’s offer |  |
| 2.75.2 | Isolator with associated grounding switch | kg | Based on bidder’s offer |  |
| 2.75.3 | Single phase | kg | Based on bidder’s offer |  |
| 2.76 | Cubicle Light (Compact LED) | Yes / No | Yes |  |
| 2.77 | 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 | | | | |
|  | **400KV ,**  **EARTHING SWITCH** |  |  |  |
|  | **General** |  |  |  |
| 3.1 | Manufacturer |  | Based on bidder’s offer |  |
| 3.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 3.3 | Type designation |  | Out door |  |
| 3.4 | Type of operating mechanism |  | DC Motor |  |
| 3.5 | Applicable standard |  | IEC 62271-102 |  |
| 3.6 | Rated voltage | kV | 420 |  |
| 3.7 | Rated current | A | 4000 |  |
| 3.8 | At maximum site temperature |  | 4000 |  |
| 3.9 | At IEC condition |  | 4000 |  |
| 3.9.1 | Rated frequency | Hz | 50 |  |
| 3.9.2 | Class (outdoor / indoor) |  | Outdoor |  |
| 3.10 | Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No) | Yes / No | Yes |  |
| 3.11 | Hand operating facility is provided? ( Yes / No) | Yes / No | Yes |  |
| 3.12 | Accessibility to operating mechanism from ground level | Yes / No | Yes |  |
| 3.13 | Manufacturer quality system in accordance with ISO 9000 | Yes / No | Yes |  |
| 3.14 | Date of issue |  | Latest |  |
| 3.15 | Validity |  | Yes |  |
| 3.16 | Certificate attached to the offer | Yes / No | Yes |  |
| 3.17 | Type test certificate to be issued by independent laboratory or independently witnessed type test | Yes / No | Yes |  |
| 3.17.1 | Certificate to be attached to the offer |  | Yes |  |
| 3.17.2 | Report to be attached to the offer |  | Yes |  |
|  | **Insulation Rating** |  |  |  |
| 3.18 | Basic Insulation level (at site condition) |  |  |  |
| 3.18.1 | Common value | kV peak | 1425 |  |
| 3.18.2 | Across the isolating distance | kV peak | 1425+240 |  |
| 3.19 | One minute power frequency withstand voltage (at site condition) |  |  |  |
| 3.19.1 | Common value | kV rms | 520 |  |
| 3.19.2 | Across the isolating distance | kV rms | 610 |  |
| 3.20 | Switching impulse withstand voltage (at site condition) |  |  |  |
| 3.20.1 | Common value | kV peak | 1050 |  |
| 3.20.2 | Across the isolating distance | kV peak | 900+345 |  |
| 3.21 | Type of Insulation(porcelain/silicon rubber) |  | porcelain |  |
|  | **Current Rating** |  |  |  |
| 3.22 | Rated short time withstand current |  |  |  |
| 3.22.1 | For grounding switch | kA rms/sec | 40/1 |  |
| 3.22.2 | Rated short circuit making current for grounding switches | kA rms | 2.5\*40 |  |
| 3.23 | Rated peak short circuit withstand current | kA peak | Based on bidder’s offer |  |
| 3.24 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | kVA | Based on bidder’s offer |  |
| 3.25 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | kVA | Based on bidder’s offer |  |
|  | **Other Characteristic** |  |  |  |
| 3.26 | Rated Supply Voltage |  |  |  |
| 3.26.1 | For motor, control and interlock | Vdc | 110 |  |
| 3.26.2 | For AC auxiliaries | Vac | 240 |  |
| 3.27 | Voltage drop across terminals of one pole at 100 A.dc for ground switches | mV | Based on bidder’s offer |  |
| 3.28 | Maximum temperature rise at normal current over Maximum ambient temperature | °C | Based on bidder’s offer |  |
| 3.29 | Maximum and minimum ambient temperature for design | °C | Acc. to section 1 |  |
| 3.30 | Altitude above sea level | m | Acc. to section 1 |  |
|  | **Operating Mechanism** |  |  |  |
| 3.31 | Type of operating mechanism |  | DC Motor |  |
| 3.31.1 | Motor type |  | Based on bidder’s offer |  |
| 3.31.2 | Motor |  |  |  |
| 3.32 | Rated voltage | V | 110V DC |  |
| 3.33 | Power demand | W | Based on bidder’s offer |  |
| 3.33.1 | Full load current | A | Based on bidder’s offer |  |
| 3.33.2 | Speed | rpm | Based on bidder’s offer |  |
| 3.34 | Type of motor protection |  | Based on bidder’s offer |  |
| 3.35 | Total time from initiation of opening operation in fully open position | sec | ≤15 |  |
| 3.36 | Breaking and closing of: |  |  |  |
| 3.36.1 | Magnetizing current of power transformers | Yes / No | Yes |  |
| 3.36.2 | Mutual inductive/capacitive current of parallel circuit in double circuit line | Yes / No | Yes |  |
| 3.36.3 | Charging current of unloaded lines and/or cables | Yes / No | Yes |  |
| 3.37 | Minimum guaranteed no. of operations for grounding switches before maintenance | N | Based on bidder’s offer |  |
| 3.38 | Maximum required force for hand operation with supplied handle |  | Based on bidder’s offer |  |
| 3.39 | Thickness of steel control cabinet | mm | Min (2) |  |
| 3.40 | Degree of protection (IP) of mechanism housing |  | IP55 |  |
| 3.41 | Cubicle space heaters (thermostat Controlled) | Yes / No | Yes |  |
| 3.42 | Cabinet heater |  |  |  |
| 3.42.1 | Power | W | Based on bidder’s offer |  |
| 3.42.2 | Nominal Voltage | V | 240 AC |  |
| 3.43 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | Yes / No | Yes |  |
| 3.44 | Whether open/neutral /close control switch is provided? ( Yes / No) | Yes / No | Yes |  |
| 3.45 | Whether under voltage relay is provided for motor supply? | Yes / No | Yes |  |
| 3.46 | Whether all of the heaters are equipped with a M.C.B ? | Yes / No | Yes |  |
| 3.47 | Rated power of operation coil | W | Based on bidder’s offer |  |
| 3.48 | Total load of heaters | W | Based on bidder’s offer |  |
|  | **Insulators** |  |  |  |
| 3.49 | Manufacturer |  | Based on bidder’s offer |  |
| 3.50 | Place of manufacturing |  | Based on bidder’s offer |  |
| 3.51 | Type (porcelain /composite) |  | porcelain |  |
| 3.52 | Colour |  | Based on bidder’s offer |  |
| 3.53 | Creepage distance | mm | 13020 |  |
| 3.54 | Protected creepage distance | mm | Based on bidder’s offer |  |
| 3.55 | Permissible cantilever working load | N | C12 |  |
| 3.56 | Operating handle or lever mounting height above ground | m | 1.2 |  |
| 3.57 | Permissible tensional strength | N.m | Based on bidder’s offer |  |
| 3.58 | Minimum clearance | mm |  |  |
| 3.58.1 | Between poles when earth switch is closed |  | Based on bidder’s offer |  |
| 3.58.2 | Between poles when earth switch is open |  | Based on bidder’s offer |  |
| 3.58.3 | Between phase and ground |  | Based on bidder’s offer |  |
| 3.58.4 | Between one pole terminals at open condition |  | Based on bidder’s offer |  |
|  | **Interlocks** |  |  |  |
| 3.59 | Type of interlocking |  | Electrical and Mechanical |  |
| 3.60 | Locking arrangement in on/off position | Yes / No | Yes |  |
| 3.61 | Automatic isolation of control supplies when lock off | Yes / No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 3.62 | Type of main contacts |  | Based on bidder’s offer |  |
| 3.63 | For grounding switch |  | Based on bidder’s offer |  |
| 3.64 | Material of main contacts |  |  |  |
| 3.64.1 | For grounding switch |  | Based on bidder’s offer |  |
| 3.65 | Material of blades |  |  |  |
| 3.65.1 | For grounding switch |  | Based on bidder’s offer |  |
| 3.66 | Whether main contacts are silver plated |  |  |  |
| 3.66.1 | For grounding switches |  | Yes |  |
| 3.67 | Quantity and type of free auxiliary contacts |  |  |  |
| 3.67.1 | For grounding switches |  | 10NO+10NC |  |
| 3.68 | Permissible force on HV terminals |  |  |  |
| 3.68.1 | Static in any direction | N | Based on bidder’s offer |  |
| 3.68.2 | Dynamic in any direction | N | Based on bidder’s offer |  |
| 3.69 | Weight of maximum package ready for shipment | kg | Based on bidder’s offer |  |
| 3.70 | Weight of complete earth switch | kg | Based on bidder’s offer |  |
| 3.71 | Cubicle Light (Compact LED) | Yes / No | Yes |  |
|  | 400kV CURRENT TRANSFORMERS |  |  |  |
|  | **General** |  |  |  |
| 4.1 | Manufacturer |  | Based on bidder’s offer |  |
| 4.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 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 | 420 |  |
| 4.11 | Rated current at max. site temperature : | A |  |  |
| 4.11.1 | For line feeders |  | 4000 |  |
| 4.11.2 | For transformer feeders |  | 4000 |  |
| 4.11.3 | For Diameters |  | 4000 |  |
| 4.11.4 | Power transformer neutral |  | 500 |  |
| 4.12 | Rated frequency | Hz | 50 |  |
| 4.13 | Max. and min. ambient temperatures used for design | °C | Acc. to section1 |  |
| 4.14 | Rated short time withstand current | kA rms | 40/1sec |  |
| 4.15 | Rated short time dynamic current | kA peak | 2.5\*40 |  |
| 4.16 | Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No) | (Yes / No) | Yes |  |
| 4.17 | Altitude above sea level | m | Acc. to section1 |  |
| 4.18 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 4.18.1 | Date of issue |  | Latest |  |
| 4.18.2 | Validity |  |  |  |
| 4.18.3 | Certificate attached to the offer | Yes/No | Yes |  |
| 4.19 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | Yes/No | Yes |  |
| 4.19.1 | Certificate to be attached to the offer | Yes/No | Yes |  |
| 4.19.2 | Report to be attached to the offer | Yes/No | Yes |  |
|  | **Insulation** |  |  |  |
| 4.20 | Maximum continuous line to line operating voltage | kV rms | 420 |  |
| 4.21 | Basic Insulation level (at site condition) | kV peak | 1425 |  |
| 4.22 | Switching impulse withstand level (at site condition ) | kV peak | 1050 |  |
| 4.23 | One minute power frequency withstand voltage (at site condition) | kV rms |  |  |
| 4.23.1 | Dry |  | 520 |  |
| 4.23.2 | Wet |  | Based on bidder’s offer |  |
| 4.24 | One minute power frequency withstand voltage for secondary winding | kV rms | Based on bidder’s offer |  |
| 4.25 | Highest value of partial discharge when tested acc. to IEC | pc | 5 |  |
| 4.26 | Voltage at secondary winding terminals with normal primary load current , and secondary open circuit | kV | Based on bidder’s offer |  |
| 4.27 | Time permitted with open circuit secondary | sec | Based on bidder’s offer |  |
| 4.28 | Dielectric dissipation factor |  | Based on bidder’s offer |  |
|  | **Ratings and Accuracies** |  |  |  |
| 4.29 | Rated primary current | A |  |  |
| 4.29.1 | Line feeder |  | 2000/1000 |  |
| 4.29.2 | diameter |  | 4000/2000 |  |
| 4.30 | Rated continous primary current |  | 120% |  |
| 4.31 | Rated secondary current | A | 1 |  |
| 4.32 | Change of CT ratio shall be possible at the secondary circuit only | Yes/No | Yes |  |
| 4.33 | specification of CTs on:  Line feeders, Auxiliary transformer,  Power transformer neutral,  Core balance |  |  |  |
| 4.33.1 | Number of cores |  | Acc. to PSLD |  |
| 4.33.2 | Ratio (TR – turns ratio) | A | Acc. to PSLD |  |
| 4.33.3 | Class |  | Acc. to PSLD |  |
| 4.33.4 | Knee point voltage (Ek) | V | Based on bidder’s offer |  |
| 4.33.5 | Exciting current (IE) at Ek | mA | Based on bidder’s offer |  |
| 4.33.6 | Rated output (burden to be 25-100% rated burden) | VA | Acc. to PSLD |  |
|  | **External Insulation** |  |  |  |
| 4.34 | Material |  | Based on bidder’s offer |  |
| 4.35 | Manufacturer |  | Based on bidder’s offer |  |
| 4.36 | Place of manufacturing |  | Based on bidder’s offer |  |
| 4.37 | Type designation |  | Based on bidder’s offer |  |
| 4.38 | Minimum creepage distance | mm | 13020 |  |
| 4.39 | Color |  | Brown |  |
| 4.40 | Protected creepage distance (90 shadow) | mm | Based on bidder’s offer |  |
| 4.41 | Shortest flash-over distance | mm | Based on bidder’s offer |  |
| 4.42 | Whether washable in service ? (Yes / No) | (Yes / No) | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 4.43 | Maximum R.I.V. level at 1.2 max. rated voltage at 1 MHz according to NEMA 107 | μv | 2500 |  |
| 4.44 | Whether oil level indicator/oil sampling valve/oil filling valve are provided? (Yes / No) |  | Yes |  |
| 4.45 | Means for compensation of oil expansion |  | Based on bidder’s offer |  |
| 4.46 | Temperature rise at rated continuous thermal current | °C |  |  |
| 4.47 | Rated continuous thermal current (% of rated primary current ) |  | Rated extended primary current |  |
| 4.48 | Electrostatic capacity of complete current transformer. PF |  | Based on bidder’s offer |  |
| 4.49 | Loss angle at rated voltage |  | Based on bidder’s offer |  |
| 4.50 | Permissible force at HV terminals |  | Based on bidder’s offer |  |
| 4.50.1 | Static at any direction | N | 3000 |  |
| 4.50.2 | Dynamic at any direction | N | 5000 |  |
| 4.51 | Type , grade and manufacturer of oil |  | Based on bidder’s offer |  |
| 4.52 | Weight of oil | kg | Based on bidder’s offer |  |
| 4.53 | Primary conductor material |  | Based on bidder’s offer |  |
| 4.54 | Secondary conductor material |  | Based on bidder’s offer |  |
| 4.55 | Overall height | mm | Based on bidder’s offer |  |
| 4.56 | Overall width | mm | Based on bidder’s offer |  |
| 4.57 | Overall length | mm | Based on bidder’s offer |  |
| 4.58 | Total weight of complete current transformer | Kg | Based on bidder’s offer |  |
| 4.59 | Max. package weight ready for shipment | Kg | Based on bidder’s offer |  |
| 4.60 | Whether lugs for lifting up of CT are provided ? (Yes / No) |  | Yes |  |
| 4.61 | Permitted inclination refer to vertical axis during transport or storage | Degree | Based on bidder’s offer |  |
| 4.62 | Degree protection of Terminal box |  | IP55 |  |
|  | 400kV CAPACITIVE VOLTAGE TRANSFORMERS |  |  |  |
|  | **General** |  |  |  |
| 5.1 | Manufacturer |  | Based on bidder’s offer |  |
| 5.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 5.3 | Type of CVT |  | Single-phase/self cooled |  |
| 5.4 | Applicable standard |  | IEC 61869-1/-5 |  |
| 5.5 | Rated voltage | kV rms | 420 |  |
| 5.6 | Rated frequency | Hz | 50 |  |
| 5.7 | Max. and min. ambient temperatures used for design | °C | Acc. to Section1 |  |
| 5.8 | Class (indoor/ outdoor ) |  | Outdoor |  |
| 5.9 | Type (Oil-immersed / dry) |  | Oil-immersed/ Oil-impregnated paper |  |
| 5.8 | Maximum permissible partial discharge level at Um | pC | 10 |  |
| 5.9 | Maximum permissible partial discharge level at 1.2Um /Ö3 | pC | 5 |  |
| 5.10 | Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No) | (Yes / No) | Yes |  |
| 5.11 | Altitude above sea level | m | Acc. to Section1 |  |
| 5.12 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 5.12.1 | Date of issue |  | Latest |  |
| 5.12.2 | Validity |  |  |  |
| 5.12.3 | Certificate attached to the offer | Yes/No | Yes |  |
|  | **Insulation ratings** |  |  |  |
| 5.13 | Basic insulation level (at site condition) | kV peak | 1425 |  |
| 5.14 | Switching impulse withstand voltage (at site condition ) | kV peak | 1050 |  |
| 5.15 | One minute power frequency withstand voltage (at site condition ) | kV rms | 520 |  |
| 5.16 | Power frequency withstand voltage between secondaries and secondary to earth | kV rms | Based on bidder’s offer |  |
| 5.17 | Rated voltage factor |  |  |  |
| 5.17.1 | Continuous |  | 1.2 |  |
| 5.17.2 | 30 seconds |  | 1.5 |  |
| 5.18 | Minimum HV terminal withstand |  |  |  |
| 5.18.1 | Static terminal load | N | 2000 |  |
| 5.18.2 | Dynamic terminal load | N | 3000 |  |
| 5.19 | Max. RIV measured at 1.2 highest system voltage , 1 Mega-Hz acc. to CISPR | μV | Based on bidder’s offer |  |
|  | **Burdens and accuracies** |  |  |  |
|  | * **3-Winding CVT** |  |  |  |
| 5.20 | Number of secondary windings |  | 3 |  |
| 5.21 | Accuracy class for |  |  |  |
| 5.21.1 | Winding 1 |  | Acc. to PSLD |  |
| 5.21.2 | Winding 2 |  | Acc. to PSLD |  |
| 5.21.3 | Winding 3 |  | Acc. to PSLD |  |
| 5.22 | Rated primary voltage | KVrms | 400/√3 |  |
| 5.23 | Rated secondary voltage | KVrms | 0.110/√3 |  |
| 5.24 | Rated burden for |  |  |  |
| 5.24.1 | Winding 1 | VA | Acc. to PSLD |  |
| 5.24.2 | Winding 2 | VA | Acc. to PSLD |  |
| 5.24.3 | Winding 3 | VA | Acc. to PSLD |  |
| 5.25 | Continuous thermal burden of |  |  |  |
| 5.25.1 | Winding 1 alone | VA | Based on bidder’s offer |  |
| 5.25.2 | Winding 2 alone | VA | Based on bidder’s offer |  |
|  | * **2-Winding CVT** |  |  |  |
| 5.26 | Number of secondary windings |  | 2 |  |
| 5.27 | Accuracy class for |  |  |  |
| 5.27.1 | Winding 1 |  | Acc. to PSLD |  |
| 5.27.2 | Winding 2 |  | Acc. to PSLD |  |
| 5.28 | Rated primary voltage | KVrms | 400/√3 |  |
| 5.29 | Rated secondary voltage | KVrms | 0.110/√3 |  |
| 5.30 | Rated burden for |  |  |  |
| 5.30.1 | Winding 1 | VA | Acc. to PSLD |  |
| 5.30.2 | Winding 2 | VA | Acc. to PSLD |  |
| 5.31 | Continuous thermal burden of |  |  |  |
| 5.31.1 | Winding 1 alone | VA | Based on bidder’s offer |  |
| 5.31.2 | Winding 2 alone | VA | Based on bidder’s offer |  |
| 5.32 | Type of system grounding |  | Effective |  |
| 5.33 | Type of connection |  | phase to ground |  |
| 5.34 | Connections |  |  |  |
| 5.34.1 | Primary |  | Stud type |  |
| 5.34.2 | Secondary |  | Standard terminal block (screw and bolt) |  |
| 5.35 | Type of protection device in secondary side |  | MCB with auxiliary contact |  |
| 5.36 | Total continuous thermal burden of secondary windings | VA |  |  |
| 5.36.1 | Primary |  | Based on bidder’s offer |  |
| 5.36.2 | Secondary |  | Based on bidder’s offer |  |
|  | **Other Characteristics** |  |  |  |
| 5.37 | Temperature rise at rated burden and at 1.2 times rated primary voltage and ambient temperature | K | 60K Wind. 50K Oil |  |
| 5.38 | Permissible secondary short circuit time with rated primary voltage | sec | 1 |  |
| 5.39 | Short circuit impedance | Ohm | Max(0.25) |  |
| 5.40 | Method of suppressing for ferro resonance |  | RLC Dumping |  |
| 5.41 | Available ranges of high voltage capacitor | pF | Based on bidder’s offer |  |
| 5.42 | Coupling capacitor \* | pF | Max (10000) |  |
| 5.43 | Loss angle at rated voltage |  | 35\*10-4 |  |
| 5.44 | Frequency range for PLC use | KHz | Based on bidder’s offer |  |
| 5.45 | Equipment series resistance for 35-450 KHz | Ohm | Max(40) |  |
| 5.46 | Natural frequency | MHz | Based on bidder’s offer |  |
| 5.47 | Intermediate stage voltage | kV | Based on bidder’s offer |  |
| 5.48 | Attenuation of intermediate voltage transformer within 35-450 KHz | dB | Based on bidder’s offer |  |
| 5.49 | Max. insertion loss when used for PLC | dB | Based on bidder’s offer |  |
| 5.50 | Whether intermediate tap is brought out? (Yes / No) |  | Based on bidder’s offer |  |
| \* Min. coupling capacitance of CVT could be changed by manufacture | | | | |
|  | **Insulator columns** |  |  |  |
| 5.51 | Manufacturer |  | Based on bidder’s offer |  |
| 5.52 | Place of manufacturing |  | Based on bidder’s offer |  |
| 5.53 | Type designation |  | Based on bidder’s offer |  |
| 5.54 | Material |  | Based on bidder’s offer |  |
| 5.55 | Min. creepage distance | mm | 13020 |  |
| 5.56 | Protected creepage distance | mm |  |  |
| 5.57 | Color |  | Brown |  |
|  | **Miscellaneous** |  |  |  |
| 5.58 | Type and manufacturer of oil for capacitor section |  | Based on bidder’s offer |  |
| 5.59 | Type and manufacturer of oil for intermediate section |  | Based on bidder’s offer |  |
| 5.60 | Whether oil level indicator is provided? (Yes / No) | (Yes / No) | YES |  |
| 5.61 | Class and grade of insulation material used in capacitors |  | Based on bidder’s offer |  |
| 5.62 | Permitted inclination during transport/ storage | Degree | Based on bidder’s offer |  |
| 5.63 | Material of windings |  | Based on bidder’s offer |  |
| 5.64 | Whether CVT is designed to mount line trap on top? (Yes / No) |  | NO |  |
| 5.65 | Permissible force at HV terminals |  |  |  |
| 5.65.1 | Static at any direction | N | Based on bidder’s offer |  |
| 5.65.2 | Dynamic at any direction | N | Based on bidder’s offer |  |
| 5.66 | Total weight | kg | Based on bidder’s offer |  |
| 5.67 | Total oil weight | kg | Based on bidder’s offer |  |
| 5.68 | Overall height | mm | Based on bidder’s offer |  |
| 5.69 | Overall width | mm | Based on bidder’s offer |  |
| 5.70 | Max. package dimensions ready for shipment | m3 | Based on bidder’s offer |  |
| 5.71 | Washable in service? (Yes / No) |  | Based on bidder’s offer |  |
|  | **400kV Conductors** |  |  |  |
|  | **General** |  |  |  |
| 6.1 | Rated current | A |  |  |
| 6.1.1 | Line feeders |  | 4000 |  |
| 6.1.2 | Trans feeders |  | 4000 |  |
| 6.1.3 | Busbars |  | 4000 |  |
| 6.1.4 | Rated frequency | Hz | 50 |  |
| 6.2 | Rated voltage | kV | 420 |  |
| 6.2.1 | Basic insulation level of equipment at site condition | kV peak | 1425 |  |
| 6.2.2 | Rated one minute power frequency withstand voltage at site condition | kV rms | 520 |  |
| 6.2.3 | Rated short circuit withstand current and its duration | kA/sec | 40kA/3sec |  |
| 6.3 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No) | (Yes / No) | Yes |  |
| 6.4 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | °C | 80 |  |
| 6.5 | Minimum assumed tension for each stranded conductor at E.D.S condition | % of UTS | 3 |  |
| 6.6 | Minimum assumed tension for each stranded conductor of incoming and outgoing overhead lines (per phase ) | % of UTS | 20 |  |
| 6.7 | Minimum tension of incoming and outgoing shield wires | % of UTS | 10 |  |
| 6.8 | Maximum permissible surface gradient | kV/cm | 16 |  |
| 6.9 | Maximum permissible angle for incoming and outgoing overhead lines |  | ±30 |  |
| 6.10 | Ambient condition |  |  |  |
| 6.10.1 | Minimum ambient temperature |  | Acc. to section 1 |  |
| 6.10.2 | Maximum ambient temperature |  | Acc. to section 1 |  |
| 6.10.3 | Solar radiation |  | Acc. to section 1 |  |
| 6.10.4 | Seismic acceleration |  | Acc. to section 1 |  |
| 6.10.5 | Wind speed |  | Acc. to section 1 |  |
| 6.10.6 | Ice thickness |  | Acc. to section 1 |  |
| 6.11 | Solar radiation absorption coefficient (ϒ) |  | Acc. to section 1 |  |
| 6.12 | Emissivity coefficient in respect to black body (Ke) |  | 0.5 |  |
| 6.13 | Altitude above sea level | m | Acc. to section 1 |  |
|  | **Stranded Conductors** |  |  |  |
| 6.14 | Manufacturer |  | Based on bidder’s offer |  |
| 6.15 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.16 | Material and alloy type |  | AAAC/AAC |  |
| 6.17 | Nominal cross section | mm² | Based on bidder’s offer |  |
| 6.18 | Number of strands |  | Based on bidder’s offer |  |
| 6.19 | Overall diameter of conductor | mm | Based on bidder’s offer |  |
| 6.20 | Ultimate strength of conductor | kN | Based on bidder’s offer |  |
| 6.21 | Continuous current rating of conductor at max. ambient temperature and 80° conductor Temperature | A | Based on bidder’s offer |  |
|  | **Note:** The stranded conductor size adequacy shall be determined by calculation. |  |  |  |
|  |  |  |  |  |
|  | **Tubular Conductors** |  |  |  |
| 6.22 | Manufacturer |  | Based on bidder’s offer |  |
| 6.23 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.24 | Material and alloy type |  | Aluminum alloy |  |
| 6.25 | Outside diameter | mm | For main busbar:250  For bay busbar:160  For Aframe :120 |  |
| 6.26 | Thickness | mm | For main busbar:6  For bay busbar:6  For Aframe : 6 |  |
| 6.27 | Weight | kg/m | Based on bidder’s offer |  |
| 6.28 | Max. deflection after installation | mm | Based on bidder’s offer |  |
| 6.29 | Continuous current rating of conductor at max. ambient temperature at and tube Temperature 80 °C | A | Based on bidder’s offer |  |
| 6.30 | Moment of inertia | cm | Based on bidder’s offer |  |
| 6.31 | Minimum yield strength | kg/cm² | Based on bidder’s offer |  |
|  | **Note:** The tubular conductor size adequacy shall be determined by calculation. |  |  |  |
|  | **Shield wires** |  |  |  |
| 6.32 | Manufacturer |  | Based on bidder’s offer |  |
| 6.33 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.34 | Material |  | Al. clad steel |  |
| 6.35 | Cross section | mm² | 58.56 |  |
| 6.36 | Diameter | mm | 9.78 |  |
| 6.37 | Number of strands |  | 7 no.8 |  |
| 6.38 | Resistance (at 20 °C) | ohm/km | 1.463 |  |
| 6.39 | Ultimate strength | kN | 70.76 |  |
| 6.40 | Modulus of elasticity | kg/mm2 | 16000 |  |
| 6.41 | Coefficient of linear expansion | 1/°C | 13\* 10^(−6) |  |
| 6.42 | Aluminium coating thickness | μm | Based on bidder’s offer |  |
|  | **Connectors and Hardware** |  |  |  |
| 6.43 | Manufacturer |  | Based on bidder’s offer |  |
| 6.44 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.45 | Material of connectors |  | Based on bidder’s offer |  |
| 6.46 | Material of bolts and nuts |  | Based on bidder’s offer |  |
| 6.47 | Material of washers |  | Based on bidder’s offer |  |
| 6.48 | Applicable standard for connectors |  | Based on bidder’s offer |  |
| 6.49 | Type of contact paste |  | Based on bidder’s offer |  |
|  | **Minimum Clearances** (Not applicable for equipment subject to impulse voltage tests ) |  |  |  |
| 6.50 | Clearance between live parts and ground (Basic value ) | mm | 5730 |  |
| 6.51 | Clearance between different phases in bays | mm | 6500 |  |
| 6.52 | Minimum Spacing between phases of rigid buses | mm | 6500 |  |
| 6.53 | Minimum height of energized parts above ground | mm | 6000 |  |
| 6.54 | Height of energized parts above access roads | mm | 13000 |  |
| 6.55 | Minimum Distance between over-span phases | mm | 7500 |  |
| 6.56 | Shield wire clearance over bus conductors | mm | 7000 |  |
|  | **Insulators** |  |  |  |
|  | **General** |  |  |  |
| 7.1 | Rated current | A |  |  |
| 7.1.1 | Line feeders |  | 4000 |  |
| 7.1.2 | Trans feeders |  | 4000 |  |
| 7.1.3 | Busbars |  | 4000 |  |
| 7.1.4 | Rated frequency | Hz | 50 |  |
| 7.2 | Rated voltage | kV | 420 |  |
| 7.2.1 | Basic insulation level of equipment at site condition | kV peak | 1425 |  |
| 7.2.2 | Rated one minute power frequency withstand voltage at site condition | kV rms | 520 |  |
| 7.2.3 | Rated short circuit withstand current and its duration | kA/sec | 40/3 |  |
| 7.3 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? ( Yes / No) | ( Yes / No) | Yes |  |
| 7.4 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | °C | 80 |  |
| 7.5 | Maximum permissible surface gradient | kV/cm | 16 |  |
| 7.6 | Maximum permissible angle for incoming and outgoing overhead lines |  | ±30 |  |
| 7.7 | Ambient condition |  |  |  |
| 7.7.1 | Minimum ambient temperature |  | Acc. to section 1 |  |
| 7.7.2 | Maximum ambient temperature |  | Acc. to section 1 |  |
| 7.7.3 | Solar radiation |  | Acc. to section 1 |  |
| 7.7.4 | Seismic acceleration |  | Acc. to section 1 |  |
| 7.7.5 | Wind speed |  | Acc. to section 1 |  |
| 7.7.6 | Ice thickness |  | Acc. to section 1 |  |
| 7.7 | Solar radiation absorption coefficient (ϒ) |  | Acc. to section 1 |  |
| 7.8 | 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 |  | Based on bidder’s offer |  |
| 7.13 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.14 | Type designation |  | ball & socket |  |
| 7.15 | Applicable standard |  | IEC |  |
| 7.16 | Insulator material |  | Glazed porcelain |  |
| 7.17 | Color |  | Based on bidder’s offer |  |
| 7.18 | Wet power frequency withstand voltage of each unit | kV | 47 |  |
| 7.19 | Lightning impulse withstand voltage of each unit | kV | 125 |  |
| 7.20 | Electromechanical failing load of each unit | kN | 160 |  |
| 7.21 | Puncture voltage of each unit | kV | 130 |  |
| 7.22 | Minimum creepage distance of each unit | mm | 370 |  |
| 7.23 | Total creepage distance of string | mm | 13020 |  |
| 7.24 | Nominal spacing | mm | 170 |  |
| 7.25 | Protected ( 90 ) creepage distance | mm | Based on bidder’s offer |  |
| 7.26 | Size of ball and socket | mm | Based on bidder’s offer |  |
| 7.27 | IEC coupling ball |  | Based on bidder’s offer |  |
| 7.28 | Material of fittings |  | Based on bidder’s offer |  |
| 7.29 | Minimum quantity of disks per string |  | 35 |  |
| 7.30 | Power frequency withstand voltage of complete String | kV rms |  |  |
| 7.30.1 | Dry |  | 520 |  |
| 7.30.2 | Wet |  | Based on bidder’s offer |  |
| 7.31 | Basic Insulation level of complete string | KV peak |  |  |
| 7.31.1 | Positive |  | 1425 |  |
| 7.31.2 | Negative |  | Based on bidder’s offer |  |
| 7.32 | Max. R.I.V. at 1MHz as per CISPR no.1 | μ V | Based on bidder’s offer |  |
| 7.33 | Overall length of string with accessories | mm | Based on bidder’s offer |  |
| 7.34 | Ultimate tensile strength of string | kN | Based on bidder’s offer |  |
| 7.35 | Total weight of string | kg | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 7.41 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.42 | Material |  | Based on bidder’s offer |  |
| 7.43 | Applicable standard |  | IEC 60305  IEC 60383-1  IEC 60383-2 |  |
| 7.44 | Rated ultimate tensile strength | kN | 160 |  |
|  | **Post Insulators** |  |  |  |
| 7.45 | Manufacturer |  | Based on bidder’s offer |  |
| 7.46 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.47 | Type designation |  | Post type |  |
| 7.48 | Applicable standard |  | Based on bidder’s offer |  |
| 7.49 | One minute power frequency withstand Voltage (at IEC condition ) | kV rms |  |  |
| 7.49.1 | Dry |  | 520 |  |
| 7.49.2 | Wet |  | Based on bidder’s offer |  |
| 7.48 | Basic Insulation level (at IEC condition) | kV peak | 1425 |  |
| 7.49 | Basic Insulation level (at site condition) | kV peak | Based on bidder’s offer |  |
| 7.50 | Switching impulse withstand voltage | kV peak | 1050 |  |
| 7.51 | Color |  | Based on bidder’s offer |  |
| 7.52 | Insulator material |  | Ceramic |  |
| 7.53 | Top metal fitting material |  | Based on bidder’s offer |  |
| 7.54 | Bottom metal fitting material |  | Based on bidder’s offer |  |
| 7.55 | Bonding material |  | Based on bidder’s offer |  |
| 7.56 | Minimum creepage distance | mm | 13020 |  |
| 7.57 | Protected (90) creepage distance | mm | Based on bidder’s offer |  |
| 7.58 | Maximum cantilever working load (complete post insulator) | kN | Based on bidder’s offer |  |
| 7.59 | Minimum cantilever breaking load, upright (complete post insulator) | kN | Based on bidder’s offer |  |
| 7.60 | Minimum torsion strength | kNm | Based on bidder’s offer |  |
| 7.61 | Minimum compression strength | kN | Based on bidder’s offer |  |
| 7.62 | Total height | mm | Based on bidder’s offer |  |
| 7.63 | Arcing distance | mm | Based on bidder’s offer |  |
| 7.64 | Fixing bolts |  |  |  |
| 7.64.1 | Quantity per post insulator |  | Based on bidder’s offer |  |
| 7.64.2 | Diameter |  | Based on bidder’s offer |  |
| 7.65 | Bolt circle diameter (Top / Bottom ) | mm | Based on bidder’s offer |  |
| 7.66 | Total weight | kg | Based on bidder’s offer |  |
| 7.67 | Maximum R.I.V. at 100 KHz | µv | 500 |  |
| 7.68 | Whether washable in service? ( Yes / No) |  | Yes |  |
| 7.69 | Maximum weight of one package ready for Shipment | kg | Based on bidder’s offer |  |
| 7.70 | Whether corona ring at live side Provided? (Yes / No) |  | Yes |  |
| 7.71 | Number of units in complete post insulator |  | Based on bidder’s offer |  |
| 7.72 | Length of each unit | mm | Based on bidder’s offer |  |
|  | **Note:** The post insulator size adequacy shall be determined by calculation. |  |  |  |
|  | **Connectors and Hardware** |  |  |  |
| 7.73 | Manufacturer |  | Based on bidder’s offer |  |
| 7.74 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.75 | Material of connectors |  | Based on bidder’s offer |  |
| 7.76 | Material of bolts and nuts |  | Based on bidder’s offer |  |
| 7.77 | Material of washers |  | Based on bidder’s offer |  |
| 7.78 | Applicable standard for connectors |  | Based on bidder’s offer |  |
| 7.79 | Type of contact paste |  | Based on bidder’s offer |  |
|  | **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 | 3350 |  |
| 7.82 | Minimum height of energized parts above ground | mm | 6000 |  |
| 7.83 | Height of energized parts above access roads | mm | 13000 |  |
|  | 400kV SURGE ARRESTERS |  |  |  |
|  | **General** |  |  |  |
| 8.1 | Manufacturer of surge arrester: |  |  |  |
| 8.1.1 | Name |  | Based on bidder’s offer |  |
| 8.1.2 | Country |  | Based on bidder’s offer |  |
| 8.2 | Manufacturer of surge counter: |  |  |  |
| 8.2.1 | Name |  | Based on bidder’s offer |  |
| 8.2.2 | Country |  | Based on bidder’s offer |  |
| 8.3 | Type designation for surge arresters |  | Based on bidder’s offer |  |
| 8.4 | Type designation for surge counter (equipped with leakage current measuring device ) |  | Based on bidder’s offer |  |
| 8.5 | Applicable standard |  | IEC 60099-4 |  |
| 8.6 | Rated frequency | Hz | 50 |  |
| 8.7 | Nominal line to line voltage rating | kV | 420 |  |
| 8.8 | Type |  | Metal oxide |  |
| 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 | 360 |  |
| 8.18 | Continuous operating voltage | kV rms | 260 (minimum) |  |
| 8.19 | Long duration discharge class as per IEC 99-1 | Class | 4 |  |
| 8.20 | Number of phases |  | 3 |  |
| 8.21 | Type of system earthing |  | Effective |  |
| 8.22 | Nominal discharge current with 8/20 us wave | kA peak | 20 |  |
| 823 | Arrester designation |  | SH |  |
| 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 | Acc. to IEC 60099-4 |  |
| 8.32 | Reference current | mA | Acc. to IEC 60099-4 |  |
| 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 | Based on bidder’s offer |  |
| 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 | Acc. to IEC 60099-4 |  |
| 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 |  | Based on bidder’s offer |  |
| 8.41 | Rated voltage of each arrester unit | kV rms | Based on bidder’s offer |  |
| 8.42 | Number of parallel non-linear MO resistance block |  | 1 |  |
| 8.43 | Power frequency voltage versus time characteristics included? | (Yes/No) | Yes |  |
| 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 |  | Based on bidder’s offer |  |
| 8.47.2 | Country |  | Based on bidder’s offer |  |
| 8.47.3 | Type |  | Based on bidder’s offer |  |
| 8.47.4 | Material |  | Based on bidder’s offer |  |
| 8.48 | Creepage distance of insulator | mm | 13020 |  |
| 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 |  | Based on bidder’s offer |  |
| 8.53 | Method used for sealing test |  | Based on bidder’s offer |  |
| 8.54 | Whether washable in service (Yes/ No) | (Yes/ No) | Yes |  |
| 8.55 | Permissible force at HV terminals |  |  |  |
| 8.55.1 | Static Horizontal | N | Based on bidder’s offer |  |
| 8.55.2 | Static Vertical | N | Based on bidder’s offer |  |
| 8.55.3 | Dynamic Horizontal | N | Based on bidder’s offer |  |
| 8.55.4 | Dynamic vertical | N | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 8.57.2 | Country |  | Based on bidder’s offer |  |
| 8.57.3 | Type |  | Based on bidder’s offer |  |
| 8.58 | Dimension of each non-linear MO resistance block |  |  |  |
| 8.58.1 | Diameter | mm | Based on bidder’s offer |  |
| 8.58.2 | Height | mm | Based on bidder’s offer |  |
| 8.59 | Total weight of single unit | kg | Based on bidder’s offer |  |
| 8.60 | Total weight of complete surge arrester | kg | Based on bidder’s offer |  |
| 8.61 | Total height of surge arrester | mm | Based on bidder’s offer |  |
| 8.62 | Total width of surge arrester | mm | Based on bidder’s offer |  |
| 8.63 | Whether grading ring for high voltage terminal required? | (Yes/ No) | Yes |  |
| 8.64 | Maximum Package weight ready for shipment | kg | Based on bidder’s offer |  |

c) 220 kV OPEN TERMINAL SWITCHGEAR

| 1. 220 kV OPEN TERMINAL SWITCHGEAR | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **Required** | **Offered** |
|  | **220KV Circuit Breaker** |  |  |  |
|  | **General** |  |  |  |
| 1.1 | Manufacturer |  | Based on bidder’s offer |  |
| 1.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 1.3 | Type designation for breaker |  | Based on bidder’s offer |  |
| 1.4 | Type designation for operating mechanism |  | Based on bidder’s offer |  |
| 1.5 | Type of operation mechanism |  | Spring Charge  motor operated |  |
| 1.6 | Type of interrupting chamber |  | Based on bidder’s offer |  |
| 1.7 | Applicable standard |  | IEC 62271-100, 62271-101, 62271-110, 62271-302, 60376, 60480 |  |
| 1.8 | Rated voltage | kV | 245 |  |
| 1.9 | System Voltage | kV | 220 |  |
| 1.10 | Rated current at maximum site temperature | A |  |  |
| 1.10.1 | For line feeder |  | 2500 |  |
| 1.10.2 | For Transformer feeder |  | 2500 |  |
| 1.10.3 | For Diameters |  | 2500 |  |
| 1.11 | Rated frequency | Hz | 50 |  |
| 1.12 | Media of breaking chamber |  | SF6 |  |
| 1.13 | Single pressure, low pressure or others |  | Based on bidder’s offer |  |
| 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 |  | 1 pole operated |  |
| 1.16.2 | For Transformer feeder |  | 3 pole operated |  |
| 1.16.3 | For Diameter |  | 1 pole operated |  |
| Note | All 220 kV circuit breakers should be capable of both Single pole and three pole operation | | | |
| 1.17 | Number of interrupting chambers per pole |  | Based on bidder’s offer |  |
| 1.18 | Class (indoor / outdoor) |  | Outdoor |  |
| 1.19 | Circuit breaker type (live tank / dead tank) |  | Live tank |  |
| 1.20 | Type of system earthing |  | Effective |  |
| 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) |  | 1050 |  |
| 1.27.2 | Across the isolating distance |  | 1200 |  |
| 1.28 | One minute power frequency withstand voltage (at IEC condition) | kV rms |  |  |
| 1.28.1 | Common value (Phase-phase, Phase-ground) |  | 460 |  |
| 1.28.2 | Across isolating distance |  | 530 |  |
| 1.29 | Switching Impulse Withstand Voltage at IEC conditions | kV peak | N.A. |  |
| 1.29.1 | Phase to ground and across open switching device |  | Acc to IEC |  |
| 1.29.2 | Phase to phase |  | Acc to IEC |  |
| 1.29.3 | Across isolating distance |  | Acc to IEC |  |
| 1.30 | Rated transient recovery voltage for terminal faults | kV peak | 364 |  |
| 1.31 | Rated recovery voltage | kV peak |  |  |
| 1.31.1 | Amplitude factor |  | Based on bidder’s offer |  |
| 1.31.2 | Rate of rise | kV/µs | Based on bidder’s offer |  |
| 1.32 | Rate of rise of restriking voltage |  |  |  |
| 1.32.1 | For 30% breaking capacity | kV/µs | Based on bidder’s offer |  |
| 1.32.2 | For 60% breaking capacity | kV/µs | Based on bidder’s offer |  |
| 1.32.3 | For 100% breaking capacity | kV/µs | Based on bidder’s offer |  |
| 1.33 | Maximum recovery voltage on breaking a synchronous system | kV | Based on bidder’s offer |  |
| 1.34 | Rated characteristics for short line faults | kV rms | Based on bidder’s offer |  |
| 1.35 | First pole to clear factor |  | 1.3 |  |
| 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 | Based on bidder’s offer |  |
|  | **Current Ratings** |  |  |  |
| 1.41 | Rated short time withstand current & duration | kA rms/sec | 40/1 |  |
| 1.42 | Rated short circuit making current | kA peak | 2.5\*40 |  |
| 1.43 | Rated out of phase breaking current | kA rms | 12.5 |  |
| 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 | 40 |  |
| 1.46.2 | DC component | % | Acc. To IEC |  |
| 1.47 | Maximum current on breaking asynchronous system | kA peak | Based on bidder’s offer |  |
| 1.48 | 180° out of phase switching duty as a percentage of rated  breaking current | % | Based on bidder’s offer |  |
|  | **Other Characteristics** |  |  |  |
| 1.49 | Voltage drop across HV terminals of one pole at 100 A dc | mV | Based on bidder’s offer |  |
| 1.50 | Maximum temperature rise at normal current over maximum  ambient temperature | °C | Based on bidder’s offer |  |
| 1.51 | Opening time (from trip contact closing to the primary contacts separation in all poles) |  |  |  |
| 1.51.1 | Without current | ms | Based on bidder’s offer |  |
| 1.51.2 | With 100% rated breaking current | ms | Based on bidder’s offer |  |
| 1.52 | Opening time from trip contact closing to primary contact separation | ms | 21 |  |
| 1.53 | Closing time (from energization of close coil to latching of circuit breaker in fully closed position) | ms | 35 |  |
| 1.54 | Rated break or interrupting time (opening time plus arcing time) | µs | Based on bidder’s offer |  |
| 1.55 | Making time (energization of close coil to contact touch) |  |  |  |
| 1.55.1 | Without current | ms | Based on bidder’s offer |  |
| 1.55.2 | 100% making current | ms | Based on bidder’s offer |  |
| 1.56 | Maximum break time | ms | 40 |  |
| 1.57 | Maximum close time | ms | < 70 |  |
| 1.58 | Dead time (during auto-reclosing) | ms | Based on bidder’s offer |  |
| 1.59 | Reclosing | ms | Based on bidder’s offer |  |
| 1.60 | Arcing time | ms | Based on bidder’s offer |  |
| 1.61 | Maximum time interval between opening of first and last phase of three phase circuit breakers | ms | Based on bidder’s offer |  |
| 1.62 | Maximum time interval between opening of interrupters of one phase | µs | Based on bidder’s offer |  |
| 1.63 | Maximum time interval between closure of interrupters of one phase | µs | Based on bidder’s offer |  |
| 1.64 | Minimum time from extinction of main arc to contact make during auto-reclosing duty | ms | Based on bidder’s offer |  |
| 1.65 | Closing time from energisation of close coil to latching of circuit breaker in fully closed position | ms | Based on bidder’s offer |  |
| 1.66 | Making time (energisation of close coil to contact touch) |  |  |  |
| 1.66.1 | Without current | ms | Based on bidder’s offer |  |
| 1.66.2 | 100% making current | ms | Based on bidder’s offer |  |
|  | **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 | Based on bidder’s offer |  |
| 1.69.3 | Full-load current | A | Based on bidder’s offer |  |
| 1.69.4 | Maximum starting current | A | Based on bidder’s offer |  |
| 1.69.5 | Speed | rpm | Based on bidder’s offer |  |
| 1.69.6 | Required time by motor to charge the spring completely | s | Based on bidder’s offer |  |
| 1.69.7 | Type of protection of motor |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 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 |  | 18NO+18NC |  |
| 1.79 | Opening and closing nominal control voltage | V dc | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.81.4 | Closing coil current | A, DC | Based on bidder’s offer |  |
| 1.81.5 | Rated power of trip coil | W | Based on bidder’s offer |  |
| 1.81.6 | Rated power of close coil | W | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.87.2 | Insertion time | ms | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.92 | Limits of gas pressure for correct operation of breaker | Absolute  bar | Based on bidder’s offer |  |
| 1.93 | Signal loss of SF6 at 20°C | Absolute  bar | Based on bidder’s offer |  |
| 1.94 | General lockout at 20°C | Absolute  bar | Based on bidder’s offer |  |
| 1.95 | Leakage rate of SF6 at rated pressure per annum | % | < 0.5 |  |
| 1.96 | Type and material of gasket used to gas tightening the joints |  |  |  |
| 1.96.1 | Metal to metal joints |  | Based on bidder’s offer |  |
| 1.96.2 | Metal to porcelain joints |  | Based on bidder’s offer |  |
| 1.97 | Supplier of SF6 gas |  | Based on bidder’s offer |  |
| 1.98 | Supplier of Density meter |  | Based on bidder’s offer |  |
| 1.99 | Toxicological test |  | Based on bidder’s offer |  |
| 1.100 | Storage capacity of each gas cylinder | m³ | Based on bidder’s offer |  |
| 1.101 | Whether sufficient gas plus 20% supplied for first filling? | Yes / No | Yes |  |
| 1.102 | Mass of gas stored cylinder | kg | Based on bidder’s offer |  |
| 1.103 | Time required to fill the circuit breaker with SF6 gas ready  for operation | hour | Based on bidder’s offer |  |
| 1.104 | Time required to empty gas of the circuit breaker | hour | Based on bidder’s offer |  |
| 1.105 | Total mass of transportable gas handling equipment | kg | Based on bidder’s offer |  |
| 1.106 | Whether SF6 is stored as gas or liguid? |  | Gas |  |
|  | **Insulator Columns** |  |  |  |
| 1.107 | Manufacturer |  | Based on bidder’s offer |  |
| 1.108 | Type |  | Based on bidder’s offer |  |
| 1.109 | Color |  | Based on bidder’s offer |  |
| 1.110 | Creepage distance phase to ground | mm | 7595 |  |
| 1.111 | Creepage distance between terminals of one pole | mm | Based on bidder’s offer |  |
| 1.112 | Protected creepage distance (90° shadow) | mm | Based on bidder’s offer |  |
| 1.113 | Clearance (phase to phase ) | mm | Acc to IEC |  |
| 1.114 | External striking distance |  |  |  |
| 1.114.1 | Phase to ground | mm | Acc to IEC |  |
| 1.114.2 | Phase to phase | mm | Acc to IEC |  |
| 1.115 | Ultimate strength of columns |  |  |  |
| 1.115.1 | Cantilever | N | Based on bidder’s offer |  |
| 1.115.2 | Tension | N | Based on bidder’s offer |  |
| 1.115.3 | Torsion | N.m | Based on bidder’s offer |  |
| 1.115.4 | Compression | N | Based on bidder’s offer |  |
| 1.116 | Permissible force at HV terminals |  |  |  |
| 1.116.1 | Static at any direction | N | Based on bidder’s offer |  |
| 1.116.2 | Dynamic at any direction | N | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.120 | Whether a lock out device for preventing circuit breaker to close is provided? | Yes / No | Yes |  |
| 1.121 | Whether Switching Control Relay is provided? | Yes/No | No |  |
| 1.122 | Number and type of free auxiliary contacts for main contact monitoring |  | 18NC and 18NO |  |
| 1.123 | Number and type of free auxiliary contacts for SF6 gas pressure monitoring |  | 4 |  |
| 1.124 | Number and type of free auxiliary contacts for local/remote selector switch monitoring |  | 6 |  |
| 1.125 | Whether circuit breaker is equipped with rings? | Yes/No | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.135.2 | Total weight of complete circuit breaker | kg | Based on bidder’s offer |  |
| 1.135.3 | Maximum weight of package ready for shipment | kg | Based on bidder’s offer |  |
| 1.136 | CB main dimensions |  |  |  |
| 1.136.1 | Overall height of assembled circuit breaker | mm | Based on bidder’s offer |  |
| 1.136.2 | Phase spacing | mm | Based on bidder’s offer |  |
| 1.136.3 | Minimum vertical distance between upper and lower terminal of the circuit breaker | mm | Based on bidder’s offer |  |
| 1.136.4 | Minimum vertical distance between lower side of the circuit breaker and metallic support | mm | Based on bidder’s offer |  |
| 1.137 | Mechanical endurance class |  | M2 |  |
| 1.138 | Electrical endurance class |  | E2 |  |
| 1.139 | Restrike probability class due to capacitive current breaking |  | C2 |  |
|  | **220KV ISOLATOR** |  |  |  |
|  | **General** |  |  |  |
| 2.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 2.3 | Type designation for Isolator |  | Based on bidder’s offer |  |
| 2.4 | Type designation for grounding switch |  | Based on bidder’s offer |  |
| 2.5 | Type of Isolator |  | Horizontal Double Break/Centre break |  |
| 2.6 | Applicable standard |  | IEC 62271-102 |  |
| 2.7 | Quantity of poles |  | Single pole op. |  |
| 2.8 | Rated voltage | kV | 245 |  |
| 2.9 | Rated current | A |  |  |
| 2.9.1 | At maximum site temperature |  |  |  |
| 2.9.1.1 | For line feeder |  | Acc. to SLD |  |
| 2.9.1.2 | For Transformer feeder |  | Acc. to SLD |  |
| 2.9.1.3 | For Diameter |  | Acc. to SLD |  |
| 2.9.2 | At IEC condition |  | Acc. to SLD |  |
| 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 |  | Acc. to SLD |  |
| 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 | 1050 |  |
| 2.19.2 | Across the isolating distance | kV peak | 1200 |  |
| 2.20 | One minute power frequency withstand voltage (at site condition) |  |  |  |
| 2.20.1 | Common value | kV rms | 460 |  |
| 2.20.2 | Across the isolating distance | kV rms | 530 |  |
| 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 | 40/1 |  |
| 2.23.2 | For grounding switch | kA rms/sec | 40/1 |  |
| 2.24 | Rated short circuit making current for grounding switches | kA rms | 2.5\*40 |  |
| 2.25 | Rated peak short circuit withstand current | kA peak | Based on bidder’s offer |  |
| 2.26 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | kVA | Based on bidder’s offer |  |
| 2.27 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | kVA | Based on bidder’s offer |  |
|  | **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 | Based on bidder’s offer |  |
| 2.30 | Maximum temperature rise at normal current over Maximum ambient temperature | °C | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 2.35 | Motor |  | 110 VDC |  |
| 2.35.1 | Rated voltage | V | Based on bidder’s offer |  |
| 2.35.2 | Power demand | W | Based on bidder’s offer |  |
| 2.35.3 | Full load current | A | Based on bidder’s offer |  |
| 2.35.4 | Speed | rpm | Based on bidder’s offer |  |
| 2.36 | Type of motor protection |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 2.39 | Total time from initiation of opening operation to time when Isolator gap can withstand phase voltage |  | Based on bidder’s offer |  |
| 2.40 | Breaking and closing of: |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 2.42 | Maximum required force for hand operation with supplied handle |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 2.46.2 | Nominal Voltage | V | 240AC |  |
| 2.47 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | Yes / No | Yes |  |
| 2.48 | Whether open/neutral /close control switch is provided? ( Yes / No) | Yes / No | Yes |  |
| 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 | Based on bidder’s offer |  |
| 2.52 | Total load of heaters for Isolator | W | Based on bidder’s offer |  |
|  | **Insulators** |  |  |  |
| 2.53 | Manufacturer |  | Based on bidder’s offer |  |
| 2.54 | Place of manufacturing |  | Based on bidder’s offer |  |
| 2.55 | Type (porcelain /composite) |  | porcelain |  |
| 2.56 | Colour |  | Based on bidder’s offer |  |
| 2.57 | Creepage distance | mm | 7595 |  |
| 2.58 | Protected creepage distance | mm | Based on bidder’s offer |  |
| 2.59 | Permissible cantilever working load | N | C12 |  |
| 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 |  | Based on bidder’s offer |  |
| 2.61.2 | Between poles when Isolator is open |  | Based on bidder’s offer |  |
| 2.61.3 | Between phase and ground |  | Based on bidder’s offer |  |
| 2.61.4 | Between one pole terminals at open condition |  | Based on bidder’s offer |  |
|  | **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 |  | Based on bidder’s offer |  |
| 2.67.2 | For grounding switch |  | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 2.69.2 | For grounding switch |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 2.72.2 | Dynamic in any direction | N | Based on bidder’s offer |  |
| 2.73 | Weight of maximum package ready for shipment | kg | Based on bidder’s offer |  |
| 2.74 | Weight of complete |  |  |  |
| 2.74.1 | Isolator | kg | Based on bidder’s offer |  |
| 2.74.2 | Isolator with associated grounding switch | kg | Based on bidder’s offer |  |
| 2.74.3 | Single phase | kg | Based on bidder’s offer |  |
| 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 | | | | |
|  | | | | |
|  | **220KV EARTHING SWITCH** |  |  |  |
|  | **General** |  |  |  |
| 3.1 | Manufacturer |  | Based on bidder’s offer |  |
| 3.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 3.3 | Type designation |  | Based on bidder’s offer |  |
| 3.4 | Type of operating mechanism |  | DC Motor |  |
| 3.5 | Applicable standard |  | IEC 62271-102 |  |
| 3.6 | Rated voltage | kV | 245 |  |
| 3.7 | Rated current | A | Based on bidder’s offer |  |
| 3.8 | At maximum site temperature |  | Acc. to SLD |  |
| 3.9 | At IEC condition |  | Acc. to SLD |  |
| 3.9.1 | Rated frequency | Hz | 50 |  |
| 3.9.2 | Class (outdoor / indoor) |  | Outdoor |  |
| 3.10 | Withstanding in load combinations of earthquake, wind, short circuit and etc.? (Yes / No) | Yes / No | Yes |  |
| 3.11 | Hand operating facility is provided? ( Yes / No) | Yes / No | Yes |  |
| 3.12 | Accessibility to operating mechanism from ground level | Yes / No | Yes |  |
| 3.13 | Manufacturer quality system in accordance with ISO 9000 | Yes / No | Yes |  |
| 3.14 | Date of issue |  | Latest |  |
| 3.15 | Validity |  |  |  |
| 3.16 | Certificate attached to the offer | Yes / No | Yes |  |
| 3.17 | Type test certificate to be issued by independent laboratory or independently witnessed type test | Yes / No | Yes |  |
| 3.17.1 | Certificate to be attached to the offer |  | Yes |  |
| 3.17.2 | Report to be attached to the offer |  | Yes |  |
|  | **Insulation Rating** |  |  |  |
| 3.18 | Basic Insulation level (at site condition) |  |  |  |
| 3.18.1 | Common value | kV peak | 1050 |  |
| 3.18.2 | Across the isolating distance | kV peak | 1200 |  |
| 3.19 | One minute power frequency withstand voltage (at site condition) |  |  |  |
| 3.19.1 | Common value | kV rms | 460 |  |
| 3.19.2 | Across the isolating distance | kV rms | 530 |  |
| 3.20 | Switching impulse withstand voltage (at site condition) |  |  |  |
| 3.20.1 | Common value | kV peak | - |  |
| 3.20.2 | Across the isolating distance | kV peak | - |  |
| 3.21 | Type of Insulation(porcelain/silicon rubber) |  | porcelain |  |
|  | **Current Rating** |  |  |  |
| 3.22 | Rated short time withstand current |  |  |  |
| 3.22.1 | For grounding switch | kA rms/sec | 40/1 |  |
| 3.22.2 | Rated short circuit making current for grounding switches | kA rms | 2.5\*40 |  |
| 3.23 | Rated peak short circuit withstand current | kA peak | Based on bidder’s offer |  |
| 3.24 | Maximum inductive current breaking capacity for grounding switch (acc.to IEC 62271/102) | kVA | Based on bidder’s offer |  |
| 3.25 | Maximum capacitive current breaking capacity for grounding switch (acc. to IEC 62271/102) | kVA | Based on bidder’s offer |  |
|  | **Other Characteristic** |  |  |  |
| 3.26 | Rated Supply Voltage |  |  |  |
| 3.26.1 | For motor, control and interlock | Vdc | 110 |  |
| 3.26.2 | For AC auxiliaries | Vac | 240 |  |
| 3.27 | Voltage drop across terminals of one pole at 100 A.dc for ground switches | mV | Based on bidder’s offer |  |
| 3.28 | Maximum temperature rise at normal current over Maximum ambient temperature | °C | Based on bidder’s offer |  |
| 3.29 | Maximum and minimum ambient temperature for design | °C | Acc. to section 1 |  |
| 3.30 | Altitude above sea level | m | Acc. to section 1 |  |
|  | **Operating Mechanism** |  |  |  |
| 3.31 | Type of operating mechanism |  | DC Motor |  |
| 3.31.1 | Motor type |  | Based on bidder’s offer |  |
| 3.31.2 | Motor |  |  |  |
| 3.32 | Rated voltage | V | Based on bidder’s offer |  |
| 3.33 | Power demand | W | Based on bidder’s offer |  |
| 3.33.1 | Full load current | A | Based on bidder’s offer |  |
| 3.33.2 | Speed | rpm | Based on bidder’s offer |  |
| 3.34 | Type of motor protection |  | Based on bidder’s offer |  |
| 3.35 | Total time from initiation of opening operation in fully open position | sec | ≤15 |  |
| 3.36 | Breaking and closing of: |  |  |  |
| 3.36.1 | Magnetizing current of power transformers | Yes / No | Yes |  |
| 3.36.2 | Mutual inductive/capacitive current of parallel circuit in double circuit line | Yes / No | Yes |  |
| 3.36.3 | Charging current of unloaded lines and/or cables | Yes / No | Yes |  |
| 3.37 | Minimum guaranteed no. of operations for grounding switches before maintenance | N | Based on bidder’s offer |  |
| 3.38 | Maximum required force for hand operation with supplied handle |  | Based on bidder’s offer |  |
| 3.39 | Thickness of steel control cabinet | mm | Min (2) |  |
| 3.40 | Degree of protection (IP) of mechanism housing |  | IP55 |  |
| 3.41 | Cubicle space heaters (thermostat Controlled) | Yes / No | Yes |  |
| 3.42 | Cabinet heater |  |  |  |
| 3.42.1 | Power | W | Based on bidder’s offer |  |
| 3.42.2 | Nominal Voltage | V | 240 AC |  |
| 3.43 | Whether local/ remote/ disconnect selector switch is provided? (Yes / No) | Yes / No | Yes |  |
| 3.44 | Whether open/neutral /close control switch is provided? ( Yes / No) | Yes / No | Yes |  |
| 3.45 | Whether under voltage relay is provided for motor supply? | Yes / No | Yes |  |
| 3.46 | Whether all of the heaters are equipped with a M.C.B ? | Yes / No | Yes |  |
| 3.47 | Rated power of operation coil | W | Based on bidder’s offer |  |
| 3.48 | Total load of heaters | W | Based on bidder’s offer |  |
|  | **Insulators** |  |  |  |
| 3.49 | Manufacturer |  | Based on bidder’s offer |  |
| 3.50 | Place of manufacturing |  | Based on bidder’s offer |  |
| 3.51 | Type (porcelain /composite) |  | porcelain |  |
| 3.52 | Colour |  | Based on bidder’s offer |  |
| 3.53 | Creepage distance | mm | 7595 |  |
| 3.54 | Protected creepage distance | mm | Based on bidder’s offer |  |
| 3.55 | Permissible cantilever working load | N | C8 |  |
| 3.56 | Operating handle or lever mounting height above ground | m | 1.2 |  |
| 3.57 | Permissible tensional strength | N.m | Based on bidder’s offer |  |
| 3.58 | Minimum clearance | mm |  |  |
| 3.58.1 | Between poles when earth switch is closed |  | Acc to IEC |  |
| 3.58.2 | Between poles when earth switch is open |  | Acc to IEC |  |
| 3.58.3 | Between phase and ground |  | Acc to IEC |  |
| 3.58.4 | Between one pole terminals at open condition |  | Acc to IEC |  |
|  | **Interlocks** |  |  |  |
| 3.59 | Type of interlocking |  | Electrical and Mechanical |  |
| 3.60 | Locking arrangement in on/off position | Yes / No | Yes |  |
| 3.61 | Automatic isolation of control supplies when lock off | Yes / No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 3.62 | Type of main contacts |  | Based on bidder’s offer |  |
| 3.63 | For grounding switch |  | Based on bidder’s offer |  |
| 3.64 | Material of main contacts |  |  |  |
| 3.64.1 | For grounding switch |  | Based on bidder’s offer |  |
| 3.65 | Material of blades |  |  |  |
| 3.65.1 | For grounding switch |  | Based on bidder’s offer |  |
| 3.66 | Whether main contacts are silver plated |  |  |  |
| 3.66.1 | For grounding switches |  | Yes |  |
| 3.67 | Quantity and type of free auxiliary contacts |  |  |  |
| 3.67.1 | For grounding switches |  | 10NO+10NC |  |
| 3.68 | Permissible force on HV terminals |  |  |  |
| 3.68.1 | Static in any direction | N | Based on bidder’s offer |  |
| 3.68.2 | Dynamic in any direction | N | Based on bidder’s offer |  |
| 3.69 | Weight of maximum package ready for shipment | kg | Based on bidder’s offer |  |
| 3.70 | Weight of complete earth switch | kg | Based on bidder’s offer |  |
| 3.71 | Cubicle Light (Compact LED) | Yes / No | Yes |  |
|  | 220kV CURRENT TRANSFOMERS |  |  |  |
|  | **General** |  |  |  |
| 4.1 | Manufacturer |  | Based on bidder’s offer |  |
| 4.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 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 | 220 |  |
| 4.11 | Rated current at max. site temperature : | A |  |  |
| 4.11.1 | For line feeders |  | 2500 |  |
| 4.11.2 | For transformer feeders |  | 2500 |  |
| 4.11.3 | For Diameters |  | 2500 |  |
| 4.12 | Rated frequency | Hz | 50 |  |
| 4.13 | Max. and min. ambient temperatures used for design | °C | Acc. to section 1 |  |
| 4.14 | Rated short time withstand current | kA rms | 40/1sec |  |
| 4.15 | Rated short time dynamic current | kA peak | 2.5\*40 |  |
| 4.16 | Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No) | (Yes / No) | Yes |  |
| 4.17 | Altitude above sea level | m | Acc. to section 1 |  |
| 4.18 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 4.18.1 | Date of issue |  | Latest |  |
| 4.18.2 | Validity |  |  |  |
| 4.18.3 | Certificate attached to the offer | Yes/No | Yes |  |
| 4.19 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | Yes/No | Yes |  |
| 4.19.1 | Certificate to be attached to the offer | Yes/No | Yes |  |
| 4.19.2 | Report to be attached to the offer | Yes/No | Yes |  |
|  | **Insulation** |  |  |  |
| 4.20 | Maximum continuous line to line operating voltage | kV rms | 245 |  |
| 4.21 | Basic Insulation level (at site condition) | kV peak | 1050 |  |
| 4.22 | Switching impulse withstand level (at site condition ) | kV peak | - |  |
| 4.23 | One minute power frequency withstand voltage (at site condition) | kV rms |  |  |
| 4.23.1 | Dry |  | 460 |  |
| 4.23.2 | Wet |  | Acc to IEC |  |
| 4.24 | One minute power frequency withstand voltage for secondary winding | kV rms | Acc to IEC |  |
| 4.25 | Highest value of partial discharge when tested acc. to IEC | pc | 5 |  |
| 4.26 | Voltage at secondary winding terminals with normal primary load current , and secondary open circuit | kV | Based on bidder’s offer |  |
| 4.27 | Time permitted with open circuit secondary | sec | Based on bidder’s offer |  |
| 4.28 | Dielectric dissipation factor |  | Based on bidder’s offer |  |
|  | **Ratings and Accuracies** |  |  |  |
| 4.29 | Rated primary current | A | 2500 |  |
| 4.30 | Rated extended primary current |  | 120% |  |
| 4.31 | Rated secondary current | A | 1 |  |
| 4.32 | Change of CT ratio shall be possible at the secondary circuit only | Yes/No | Yes |  |
| 4.33 | specification of CTs on: Line feeders, Transformer feeders,Bus couple, Tie coupler, Auxiliary transformer, Power transformer neutral, Core balance |  |  |  |
| 4.33.1 | Number of cores |  | Acc. to PSLD |  |
| 4.33.2 | Ratio (TR – turns ratio) | A | Acc. to PSLD |  |
| 4.33.3 | Class |  | Acc. to PSLD |  |
| 4.33.4 | Knee point voltage (Ek) | V | Based on bidder’s offer |  |
| 4.33.5 | Exciting current (IE) at Ek | mA | Based on bidder’s offer |  |
| 4.33.6 | Rated output (burden to be 25-100% rated burden) | VA | 50 |  |
|  | **External Insulation** |  |  |  |
| 4.34 | Material |  | Based on bidder’s offer |  |
| 4.35 | Manufacturer |  | Based on bidder’s offer |  |
| 4.36 | Place of manufacturing |  | Based on bidder’s offer |  |
| 4.37 | Type designation |  | Based on bidder’s offer |  |
| 4.38 | Minimum creepage distance | mm | 7595 |  |
| 4.39 | Color |  | Brown |  |
| 4.40 | Protected creepage distance (90 shadow) | mm | Based on bidder’s offer |  |
| 4.41 | Shortest flash-over distance | mm | Based on bidder’s offer |  |
| 4.42 | Whether washable in service ? (Yes / No) | (Yes / No) | Yes |  |
|  |  |  |  |  |
|  | **Miscellaneous** |  |  |  |
| 4.43 | Maximum R.I.V. level at 1.2 max. rated voltage at 1 MHz according to NEMA 107 | μv | 2500 |  |
| 4.44 | Whether oil level indicator/oil sampling valve/oil filling valve are provided ? (Yes / No) |  | Yes |  |
| 4.45 | Means for compensation of oil expansion |  | Based on bidder’s offer |  |
| 4.46 | Temperature rise at rated continuous thermal current | °C | Based on bidder’s offer |  |
| 4.47 | Rated continuous thermal current (% of rated primary current ) |  | Rated extended primary current |  |
| 4.48 | Electrostatic capacity of complete current transformer. PF |  | Based on bidder’s offer |  |
| 4.49 | Loss angle at rated voltage |  | Based on bidder’s offer |  |
| 4.50 | Permissible force at HV terminals |  |  |  |
| 4.50.1 | Static at any direction | N | 3000 |  |
| 4.50.2 | Dynamic at any direction | N | 5000 |  |
| 4.51 | Type , grade and manufacturer of oil |  | Based on bidder’s offer |  |
| 4.52 | Weight of oil | kg | Based on bidder’s offer |  |
| 4.53 | Primary conductor material |  | Based on bidder’s offer |  |
| 4.54 | Secondary conductor material |  | Based on bidder’s offer |  |
| 4.55 | Overall height | mm | Based on bidder’s offer |  |
| 4.56 | Overall width | mm | Based on bidder’s offer |  |
| 4.57 | Overall length | mm | Based on bidder’s offer |  |
| 4.58 | Total weight of complete current transformer | Kg | Based on bidder’s offer |  |
| 4.59 | Max. package weight ready for shipment | Kg | Based on bidder’s offer |  |
| 4.60 | ting up of CT are provided? (Yes / No) |  | Yes |  |
| 4.61 | Permitted inclination refer to vertical axis during transport or storage | Degree | Based on bidder’s offer |  |
| 4.62 | Degree protection of Terminal box |  | IP55 |  |
|  | 220kV CAPACITIVE VOLTAGE TRANSFORMERS |  |  |  |
|  | **General** |  |  |  |
| 5.1 | Manufacturer |  | Based on bidder’s offer |  |
| 5.2 | Place of manufacturing |  | Based on bidder’s offer |  |
| 5.3 | Type of CVT |  | Single-phase/self cooled |  |
| 5.4 | Applicable standard |  | IEC 61869-1/-5 |  |
| 5.5 | Rated voltage | kV rms | 245 |  |
| 5.6 | Rated frequency | Hz | 50 |  |
| 5.7 | Max. and min. ambient temperatures used for design | °C | Acc. to Section1 |  |
| 5.8 | Class (indoor/ outdoor ) |  | Outdoor |  |
| 5.9 | Type (Oil-immersed / dry) |  | Oil-immensed/ Oil-impregnated paper |  |
| 5.8 | Maximum permissible partial discharge level at Um | pC | 10 |  |
| 5.9 | Maximum permissible partial discharge level at 1.2Um /Ö3 | pC | 5 |  |
| 5.10 | Whether withstanding in load combinations of earthquake , wind , short circuit? (Yes / No) | (Yes / No) | Yes |  |
| 5.11 | Altitude above sea level | m | Acc. to Section1 |  |
| 5.12 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 5.12.1 | Date of issue |  | Latest |  |
| 5.12.2 | Validity |  | Yes |  |
| 5.12.3 | Certificate attached to the offer | Yes/No | Yes |  |
|  | **Insulation ratings** |  |  |  |
| 5.13 | Basic insulation level (at site condition) | kV peak | 1050 |  |
| 5.14 | Switching impulse withstand voltage (at site condition ) | kV peak | - |  |
| 5.15 | One minute power frequency withstand voltage (at site condition ) | kV rms | 460 |  |
| 5.16 | Power frequency withstand voltage between secondaries and secondary to earth | kV rms | Based on bidder’s offer |  |
| 5.17 | Rated voltage factor |  |  |  |
| 5.17.1 | Continuous |  | 1.2 |  |
| 5.17.2 | 30 seconds |  | 1.5 |  |
| 5.18 | Minimum HV terminal withstand |  |  |  |
| 5.18.1 | Static terminal load | N | 1000 |  |
| 5.18.2 | Dynamic terminal load | N | 2000 |  |
| 5.19 | Max. RIV measured at 1.2 highest system voltage , 1 Mega-Hz acc. to CISPR | μV | Based on bidder’s offer |  |
|  | **Burdens and accuracies** |  |  |  |
|  | * **3-Winding CVT** |  | 3 |  |
| 5.20 | Number of secondary windings |  | 3 |  |
| 5.21 | Accuracy class for |  | Acc. to SLD |  |
| 5.21.1 | Winding 1 |  | Acc. to PSLD |  |
| 5.21.2 | Winding 2 |  | Acc. to PSLD |  |
| 5.21.3 | Winding 3 |  | Acc. to PSLD |  |
| 5.22 | Rated primary voltage | KVrms | 220/√3 |  |
| 5.23 | Rated secondary voltage | KVrms | 0.110/√3 |  |
| 5.24 | Rated burden for |  | Acc. to SLD |  |
| 5.24.1 | Winding 1 | VA | 50 |  |
| 5.24.2 | Winding 2 | VA | 50 |  |
| 5.24.3 | Winding 3 | VA | 50 |  |
| 5.25 | Continuous thermal burden of |  |  |  |
| 5.25.1 | Winding 1 alone | VA | Based on bidder’s offer |  |
| 5.25.2 | Winding 2 alone | VA | Based on bidder’s offer |  |
|  | * **2-Winding CVT** |  |  |  |
| 5.26 | Number of secondary windings |  | 2 |  |
| 5.27 | Accuracy class for |  |  |  |
| 5.27.1 | Winding 1 |  | Acc. to PSLD |  |
| 5.27.2 | Winding 2 | KVrms | Acc. to PSLD |  |
| 5.28 | Rated primary voltage | KVrms | 220/√3 |  |
| 5.29 | Rated secondary voltage | KVrms | 0.110/√3 |  |
| 5.30 | Rated burden for |  | Acc. to PSLD |  |
| 5.30.1 | Winding 1 | VA | Acc. to PSLD |  |
| 5.30.2 | Winding 2 | VA | Acc. to PSLD |  |
| 5.31 | Continuous thermal burden of |  |  |  |
| 5.31.1 | Winding 1 alone | VA | Effective |  |
| 5.31.2 | Winding 2 alone | VA | phase to ground |  |
| 5.32 | Type of system grounding |  | Effective |  |
| 5.33 | Type of connection |  | phase to ground |  |
| 5.34 | Connections |  | Based on bidder’s offer |  |
| 5.34.1 | Primary |  | Stud type |  |
| 5.34.2 | Secondary |  | Standard terminal block (screw and bolt) |  |
| 5.35 | Type of protection device in secondary side |  | MCB with auxiliary contact |  |
| 5.36 | Total continuous thermal burden of secondary windings | VA | Based on bidder’s offer |  |
| 5.36.1 | Primary |  | Stud type |  |
| 5.36.2 | Secondary |  | Standard terminal block (screw and bolt) |  |
|  | **Other Characteristics** |  |  |  |
| 5.37 | Temperature rise at rated burden and at 1.2 times rated primary voltage and ambient temperature | K | 60K Wind. 50K Oil |  |
| 5.38 | Permissible secondary short circuit time with rated primary voltage | sec | 1 |  |
| 5.39 | Short circuit impedance | Ohm | Max(0.25) |  |
| 5.40 | Method of suppressing for ferro-resonance |  | RLC Dumping |  |
| 5.41 | Available ranges of high voltage capacitor | pF | Based on bidder’s offer |  |
| 5.42 | Coupling capacitor \* | pF | Max (10000) |  |
| 5.43 | Loss angle at rated voltage |  | 35\*10-4 |  |
| 5.44 | Frequency range for PLC use | KHz | Based on bidder’s offer |  |
| 5.45 | Equipment series resistance for 35-450 KHz | Ohm | Max(40) |  |
| 5.46 | Natural frequency | MHz | Based on bidder’s offer |  |
| 5.47 | Intermediate stage voltage | kV | Based on bidder’s offer |  |
| 5.48 | Attenuation of intermediate voltage transformer within 35-450 KHz | dB | Based on bidder’s offer |  |
| 5.49 | Max. insertion loss when used for PLC | dB | Based on bidder’s offer |  |
| 5.50 | Whether intermediate tap is brought out? (Yes / No) |  | YES |  |
| \* Min. coupling capacitance of CVT could be changed by manufacture | | | | |  |  |  | Based on bidder’s offer |
|  | **Insulator columns** |  |  |  |
| 5.51 | Manufacturer |  | Based on bidder’s offer |  |
| 5.52 | Place of manufacturing |  | Based on bidder’s offer |  |
| 5.53 | Type designation |  | Based on bidder’s offer |  |
| 5.54 | Material |  | Based on bidder’s offer |  |
| 5.55 | Min. creepage distance | mm | 7595 |  |
| 5.56 | Protected creepage distance | mm | Based on bidder’s offer |  |
| 5.57 | Color |  | Brown |  |
|  | **Miscellaneous** |  |  |  |
| 5.58 | Type and manufacturer of oil for capacitor section |  | Based on bidder’s offer |  |
| 5.59 | Type and manufacturer of oil for intermediate section |  | Based on bidder’s offer |  |
| 5.60 | Whether oil level indicator is provided? (Yes / No) | (Yes / No) | Yes |  |
| 5.61 | Class and grade of insulation material used in capacitors |  | Based on bidder’s offer |  |
| 5.62 | Permitted inclination during transport/ storage | Degree | Based on bidder’s offer |  |
| 5.63 | Material of windings |  | Based on bidder’s offer |  |
| 5.64 | Whether CVT is designed to mount line trap on top? (Yes / No) |  | NO |  |
| 5.65 | Permissible force at HV terminals |  |  |  |
| 5.65.1 | Static at any direction | N | Based on bidder’s offer |  |
| 5.65.2 | Dynamic at any direction | N | Based on bidder’s offer |  |
| 5.66 | Total weight | kg | Based on bidder’s offer |  |
| 5.67 | Total oil weight | kg | Based on bidder’s offer |  |
| 5.68 | Overall height | mm | Based on bidder’s offer |  |
| 5.69 | Overall width | mm | Based on bidder’s offer |  |
| 5.70 | Max. package dimensions ready for shipment | m3 | Based on bidder’s offer |  |
| 5.71 | Washable in service? (Yes / No) |  | Yes |  |
|  | **220KV Conductors** |  |  |  |
|  | **General** |  |  |  |
| 6.1 | Rated current | A |  |  |
| 6.1.1 | Line feeders |  | 2500 |  |
| 6.1.2 | Trans feeders |  | 2500 |  |
| 6.1.3 | Busbars |  | 3150 |  |
| 6.1.4 | Rated frequency | Hz | 50 |  |
| 6.2 | Rated voltage | kV | 245 |  |
| 6.2.1 | Basic insulation level of equipment at site condition | kV peak | 1050 |  |
| 6.2.2 | Rated one minute power frequency withstand voltage at site condition | kV rms | 460 |  |
| 6.2.3 | Rated short circuit withstand current and its duration | kA/sec | 40/3 |  |
| 6.3 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? (Yes / No) | (Yes / No) | Yes |  |
| 6.4 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | °C | 80 |  |
| 6.5 | Minimum assumed tension for each stranded conductor at E.D.S condition | % of UTS | 3 |  |
| 6.6 | Minimum assumed tension for each stranded conductor of incoming and outgoing overhead lines (per phase ) | % of UTS | 20 |  |
| 6.7 | Minimum tension of incoming and outgoing shield wires | % of UTS | 10 |  |
| 6.8 | Maximum permissible surface gradient | kV/cm | 16 |  |
| 6.9 | Maximum permissible angle for incoming and outgoing overhead lines |  | ±30 |  |
| 6.10 | Ambient condition |  |  |  |
| 6.10.1 | Minimum ambient temperature |  | Acc. to section 1 |  |
| 6.10.2 | Maximum ambient temperature |  | Acc. to section 1 |  |
| 6.10.3 | Solar radiation |  | Acc. to section 1 |  |
| 6.10.4 | Seismic acceleration |  | Acc. to section 1 |  |
| 6.10.5 | Wind speed |  | Acc. to section 1 |  |
| 6.10.6 | Ice thickness |  | Acc. to section 1 |  |
| 6.11 | Solar radiation absorption coefficient (ϒ) |  | Acc. to section 1 |  |
| 6.12 | Emissivity coefficient in respect to black body (Ke) |  | 0.5 |  |
| 6.13 | Altitude above sea level | m | Acc. to section 1 |  |
|  |  |  |  |  |
|  | **Stranded Conductors** |  |  |  |
| 6.14 | Manufacturer |  | Based on bidder’s offer |  |
| 6.15 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.16 | Material and alloy type |  | AAAC/AAC |  |
| 6.17 | Nominal cross section | mm² | Based on bidder’s offer |  |
| 6.18 | Number of strands |  | Based on bidder’s offer |  |
| 6.19 | Overall diameter of conductor | mm | Based on bidder’s offer |  |
| 6.20 | Ultimate strength of conductor | kN | Based on bidder’s offer |  |
| 6.21 | Continuous current rating of conductor at max. ambient temperature and 80° conductor Temperature | A | Based on bidder’s offer |  |
|  | **Note:** The stranded conductor size adequacy shall be determined by calculation. |  |  |  |
|  | **Tubular Conductors** |  |  |  |
| 6.22 | Manufacturer |  | Based on bidder’s offer |  |
| 6.23 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.24 | Material and alloy type |  | Aluminum alloy |  |
| 6.25 | Outside diameter | mm | Based on bidder’s offer |  |
| 6.26 | Thickness | mm | Based on bidder’s offer |  |
| 6.27 | Weight | kg/m | Based on bidder’s offer |  |
| 6.28 | Max. deflection after installation | mm | Based on bidder’s offer |  |
| 6.29 | Continuous current rating of conductor at max. ambient temperature at and tube Temperature 80 °C | A | Based on bidder’s offer |  |
| 6.30 | Moment of inertia | cm | Based on bidder’s offer |  |
| 6.31 | Minimum yield strength | kg/cm² | Based on bidder’s offer |  |
|  | **Note:** The tubular conductor size adequacy shall be determined by calculation. |  |  |  |
|  | **Shield wires** |  |  |  |
| 6.32 | Manufacturer |  | Based on bidder’s offer |  |
| 6.33 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.34 | Material |  | Al clad steel |  |
| 6.35 | Cross section | mm² | 58.56 |  |
| 6.36 | Diameter | mm | 9.78 |  |
| 6.37 | Number of strands |  | Based on bidder’s offer |  |
| 6.38 | Resistance (at 20 °C) | ohm/km | 1.463 |  |
| 6.39 | Ultimate strength | kN | 70.76 |  |
| 6.40 | Modulus of elasticity | kg/mm2 | 16000 |  |
| 6.41 | Coefficient of linier expansion | 1/°C | 13\* 10^(−6) |  |
| 6.42 | Aluminium coating thickness | μm | Based on bidder’s offer |  |
|  | **Connectors and Hardware** |  |  |  |
| 6.43 | Manufacturer |  | Based on bidder’s offer |  |
| 6.44 | Place of manufacturing |  | Based on bidder’s offer |  |
| 6.45 | Material of connectors |  | Based on bidder’s offer |  |
| 6.46 | Material of bolts and nuts |  | Based on bidder’s offer |  |
| 6.47 | Material of washers |  | Based on bidder’s offer |  |
| 6.48 | Applicable standard for connectors |  | Based on bidder’s offer |  |
| 6.49 | Type of contact paste |  | Based on bidder’s offer |  |
|  | **Minimum Clearances** (Not applicable for equipment subject to impulse voltage tests ) |  |  |  |
| 6.50 | Clearance between live parts and ground (Basic value ) | mm | 2530 |  |
| 6.51 | Clearance between different phases in bays | mm | 4500 |  |
| 6.52 | Minimum Spacing between phases of rigid buses | mm | 4500 |  |
| 6.53 | Minimum height of energized parts above ground | mm | 5000 |  |
| 6.54 | Height of energized parts above access roads | mm | 10000 |  |
| 6.55 | Minimum Distance between over-span phases | mm | 5500 |  |
| 6.56 | Shield wire clearance over bus conductors | mm | 5000 |  |
|  | **220KV Insulators** |  |  |  |
|  | **General** |  |  |  |
| 7.1 | Rated current | A | Based on bidder’s offer |  |
| 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 | Rated frequency | Hz | 50 |  |
| 7.2 | Rated voltage | kV | 245 |  |
| 7.2.1 | Basic insulation level of equipment at site condition | kV peak | 1050 |  |
| 7.2.2 | Rated one minute power frequency withstand voltage at site condition | kV rms | 460 |  |
| 7.2.3 | Rated short circuit withstand current and its duration | kA/sec | 40/3 |  |
| 7.3 | Withstanding in load combinations of earthquake, wind, short circuit, as mentioned in Technical Specification? ( Yes / No) | ( Yes / No) | Yes |  |
| 7.4 | Maximum permissible temperature of conductors at rated current and Max. ambient temperature | °C | 80 |  |
| 7.5 | Maximum permissible surface gradient | kV/cm | 16 |  |
| 7.6 | Maximum permissible angle for incoming and outgoing overhead lines |  | ±30 |  |
| 7.7 | Ambient condition |  |  |  |
| 7.7.1 | Minimum ambient temperature |  | Acc. to section 1 |  |
| 7.7.2 | Maximum ambient temperature |  | Acc. to section 1 |  |
| 7.7.3 | Solar radiation |  | Acc. to section 1 |  |
| 7.7.4 | Seismic acceleration |  | Acc. to section 1 |  |
| 7.7.5 | Wind speed |  | Acc. to section 1 |  |
| 7.7.6 | Ice thickness |  | Acc. to section 1 |  |
| 7.7 | Solar radiation absorption coefficient (ϒ) |  | Acc. to section 1 |  |
| 7.8 | 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 |  | Yes |  |
| 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 |  | Based on bidder’s offer |  |
| 7.13 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.14 | Type designation |  | ball & socket |  |
| 7.15 | Applicable standard |  | Based on bidder’s offer |  |
| 7.16 | Insulator material |  | Glazed porcelain |  |
| 7.17 | Color |  | Based on bidder’s offer |  |
| 7.18 | Wet power frequency withstand voltage of each unit | kV | 47 |  |
| 7.19 | Lightning impulse withstand voltage of each unit | kV | 125 |  |
| 7.20 | Electromecanical failing load of each unit | kN | 160 |  |
| 7.21 | Puncture voltage of each unit | kV | 130 |  |
| 7.22 | Minimum creepage distance of each unit | mm | 370 |  |
| 7.23 | Total creepage distance of string | mm | 7595 |  |
| 7.24 | Nominal spacing | mm | 170 |  |
| 7.25 | Protected ( 90 ) creepage distance | mm | Based on bidder’s offer |  |
| 7.26 | Size of ball and socket | mm | Based on bidder’s offer |  |
| 7.27 | IEC coupling ball |  | Based on bidder’s offer |  |
| 7.28 | Material of fittings |  | Based on bidder’s offer |  |
| 7.29 | Minimum quantity of disks per string |  | 22 |  |
| 7.30 | Power frequency withstand voltage of complete String | kV rms |  |  |
| 7.30.1 | Dry |  | 460 |  |
| 7.30.2 | Wet |  | Acc to IEC |  |
| 7.31 | Basic Insulation level of complete string | KV peak |  |  |
| 7.31.1 | Positive |  | 1050 |  |
| 7.31.2 | Negative |  | Acc to IEC |  |
| 7.32 | Max. R.I.V. at 1MHz as per CISPR no.1 | μ V | Based on bidder’s offer |  |
| 7.33 | Overall length of string with accessories | mm | Based on bidder’s offer |  |
| 7.34 | Ultimate tensile strength of string | kN | Based on bidder’s offer |  |
| 7.35 | Total weight of string | kg | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 7.41 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.42 | Material |  | Based on bidder’s offer |  |
| 7.43 | Applicable standard |  | Based on bidder’s offer |  |
| 7.44 | Rated ultimate tensile strength | kN | Based on bidder’s offer |  |
|  | **Post Insulators** |  |  |  |
| 7.45 | Manufacturer |  | Based on bidder’s offer |  |
| 7.46 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.47 | Type designation |  | Post type |  |
| 7.48 | Applicable standard |  | Based on bidder’s offer |  |
| 7.49 | One minute power frequency withstand Voltage (at IEC condition ) | kV rms |  |  |
| 7.49.1 | Dry |  | 460 |  |
| 7.49.2 | Wet |  | Acc to IEC |  |
| 7.48 | Basic Insulation level (at IEC condition) | kV peak | 1050 |  |
| 7.49 | Basic Insulation level (at site condition) | kV peak | Based on bidder’s offer |  |
| 7.50 | Switching impulse withstand voltage | kV peak | 1050 |  |
| 7.51 | Color |  | Based on bidder’s offer |  |
| 7.52 | Insulator material |  | Ceramic |  |
| 7.53 | Top metal fitting material |  | Based on bidder’s offer |  |
| 7.54 | Bottom metal fitting material |  | Based on bidder’s offer |  |
| 7.55 | Bonding material |  | Based on bidder’s offer |  |
| 7.56 | Minimum creepage distance | mm | 7595 |  |
| 7.57 | Protected (90) creepage distance | mm | Based on bidder’s offer |  |
| 7.58 | Maximum cantilever working load (complete post insulator) | kN | Based on bidder’s offer |  |
| 7.59 | Minimum cantilever breaking load, upright (complete post insulator) | kN | Based on bidder’s offer |  |
| 7.60 | Minimum torsion strength | kNm | Based on bidder’s offer |  |
| 7.61 | Minimum compression strength | kN | Based on bidder’s offer |  |
| 7.62 | Total height | mm | Based on bidder’s offer |  |
| 7.63 | Arcing distance | mm | Based on bidder’s offer |  |
| 7.64 | Fixing bolts |  |  |  |
| 7.64.1 | Quantity per post insulator |  | Based on bidder’s offer |  |
| 7.64.2 | Diameter |  | Based on bidder’s offer |  |
| 7.65 | Bolt circle diameter (Top / Bottom ) | mm | Based on bidder’s offer |  |
| 7.66 | Total weight | kg | Based on bidder’s offer |  |
| 7.67 | Maximum R.I.V. at 100 KHz | µv | 500 |  |
| 7.68 | Whether washable in service? ( Yes / No) |  | Yes |  |
| 7.69 | Maximum weight of one package ready for Shipment | kg | Based on bidder’s offer |  |
| 7.70 | Whether corona ring at live side Provided? (Yes / No) |  | Yes |  |
| 7.71 | Number of units in complete post insulator |  | Based on bidder’s offer |  |
| 7.72 | Length of each unit | mm | Based on bidder’s offer |  |
|  | **Note:** The post insulator size adequacy shall be determined by calculation. |  |  |  |
|  | **Connectors and Hardware** |  |  |  |
| 7.73 | Manufacturer |  | Based on bidder’s offer |  |
| 7.74 | Place of manufacturing |  | Based on bidder’s offer |  |
| 7.75 | Material of connectors |  | Based on bidder’s offer |  |
| 7.76 | Material of bolts and nuts |  | Based on bidder’s offer |  |
| 7.77 | Material of washers |  | Based on bidder’s offer |  |
| 7.78 | Applicable standard for connectors |  | Based on bidder’s offer |  |
| 7.79 | Type of contact paste |  | Based on bidder’s offer |  |
|  | **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 | 2530 |  |
| 7.82 | Minimum height of energized parts above ground | mm | 5000 |  |
| 7.83 | Height of energized parts above access roads | mm | 10000 |  |
|  | 220kV SURGE ARRESTERS |  |  |  |
|  | **General** |  |  |  |
| 8.1 | Manufacturer of surge arrester: |  |  |  |
| 8.1.1 | Name |  | Based on bidder’s offer |  |
| 8.1.2 | Country |  | Based on bidder’s offer |  |
| 8.2 | Manufacturer of surge counter: |  |  |  |
| 8.2.1 | Name |  | Based on bidder’s offer |  |
| 8.2.2 | Country |  | Based on bidder’s offer |  |
| 8.3 | Type designation for surge arresters |  | Based on bidder’s offer |  |
| 8.4 | Type designation for surge counter (equipped with leakage current measuring device ) |  | Based on bidder’s offer |  |
| 8.5 | Applicable standard |  | IEC 60099-4 |  |
| 8.6 | Rated frequency | Hz | 50 |  |
| 8.7 | Nominal line to line voltage rating | kV | 245 |  |
| 8.8 | Type |  | Metal Oxide |  |
| 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 | 198 |  |
| 8.18 | Continuous operating voltage | kV rms | 158 |  |
| 8.19 | Long duration discharge class as per IEC 99-1 | Class | 4 |  |
| 8.20 | Number of phases |  | 3 |  |
| 8.21 | Type of system earthing |  | Effective |  |
| 8.22 | Nominal discharge current with 8/20 us wave | kA peak | 20 |  |
| 823 | Arrester designation |  | SH |  |
| 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 | Repitative charge transfer rating (Qrs) | C | > 2.4 |  |
| 8.31 | Reference voltage | kV rms | Based on bidder’s offer |  |
| 8.32 | Reference current | mA | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 8.41 | Rated voltage of each arrester unit | kV rms | Based on bidder’s offer |  |
| 8.42 | Number of parallel non-linear MO resistance block |  | 1 |  |
| 8.43 | Power frequency voltage versus time characteristics included? | (Yes/No) | Based on bidder’s offer |  |
| 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 |  | Yes |  |
| 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 |  | Based on bidder’s offer |  |
| 8.47.2 | Country |  | Based on bidder’s offer |  |
| 8.47.3 | Type |  | Based on bidder’s offer |  |
| 8.47.4 | Material |  | Based on bidder’s offer |  |
| 8.48 | Creepage distance of insulator | mm | 7595 |  |
| 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 |  | Based on bidder’s offer |  |
| 8.53 | Method used for sealing test |  | Based on bidder’s offer |  |
| 8.54 | Whether washable in service (Yes/ No) | (Yes/ No) | Yes |  |
| 8.55 | Permissible force at HV terminals |  |  |  |
| 8.55.1 | Static Horizontal | N | Based on bidder’s offer |  |
| 8.55.2 | Static Vertical | N | Based on bidder’s offer |  |
| 8.55.3 | Dynamic Horizontal | N | Based on bidder’s offer |  |
| 8.55.4 | Dynamic vertical | N | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 8.57.2 | Country |  | Based on bidder’s offer |  |
| 8.57.3 | Type |  | Based on bidder’s offer |  |
| 8.58 | Dimension of each non-linear MO resistance block |  |  |  |
| 8.58.1 | Diameter | mm | Based on bidder’s offer |  |
| 8.58.2 | Height | mm | Based on bidder’s offer |  |
| 8.59 | Total weight of single unit | kg | Based on bidder’s offer |  |
| 8.60 | Total weight of complete surge arrester | kg | Based on bidder’s offer |  |
| 8.61 | Total height of surge arrester | mm | Based on bidder’s offer |  |
| 8.62 | Total width of surge arrester | mm | Based on bidder’s offer |  |
| 8.63 | Whether grading ring for high voltage terminal required? | (Yes/ No) | Yes |  |
| 8.64 | Maximum Package weight ready for shipment | kg | Based on bidder’s offer |  |

d) 400/220KV AUTO TRANSFORMERS (AIS-AIS)

| 1. 400/220KV AUTO TRANSFORMERS (AIS-AIS) | | **UNIT** | **Data** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **REQUIRED DATA** | | | | **OFFERED DATA** | | | |
| **1** | **Substation name** |  | KIMUKA SUBSTATION | | | |  | | | |
| **2** | **Manufacture name & country** |  | Should be Proposed By Tenderer | | | |  | | | |
| **3** | **Type designation** |  | Should be Proposed By Tenderer | | | |  | | | |
| **4** | **Type of transformers** |  | Auto Transformer | | | |  | | | |
| 4.1 | Auto or separate windings |  | Auto | | | |  | | | |
| 4.2 | Shell or core |  | Core | | | |  | | | |
| 4.3 | Indoor or outdoor |  | Outdoor | | | |  | | | |
| 4.4 | Three phases or single phases units |  | Three phase | | | |  | | | |
| 4.5 | Standards |  | IEC 60076, 60137, 60214, 60529 NEMA TR1 | | | |  | | | |
| **5** | **Type of cooling acc. to IEC** |  |  | | | |  | | | |
| 5.1 | First stage |  | ONAN | | | |  | | | |
| 5.2 | Second stage |  | ONAF1 | | | |  | | | |
| 5.3 | Third stage |  | ONAF2 | | | |  | | | |
| **6** | **Rated frequency** | Hz | 50 | | | |  | | | |
| **7** | **Rated voltage** |  |  | | | |  | | | |
| 7.1 | HV | kVrms | 400 | | | |  | | | |
| 7.2 | LV | kVrms | 220 | | | |  | | | |
| 7.3 | TV | kVrms | 11 | | | |  | | | |
| **8** | **Continuous power rating at principle tap** |  |  | | | |  | | | |
| 8.1 | Type |  | ONAN/ONAF1/ONAF2 | | | |  | | | |
| 8.2 | Nominal power rating at site conditions | MVA | 200 | | | |  | | | |
| 8.3 | At first stage of cooling: |  |  | | | |  | | | |
| 8.3.1 | HV winding | MVA | 120 | | | |  | | | |
| 8.3.2 | LV winding | MVA | 120 | | | |  | | | |
| 8.3.3 | TV winding | MVA | 24 | | | |  | | | |
| 8.4 | At second stage of cooling: |  |  | | | |  | | | |
| 8.4.1 | HV winding | MVA | 160 | | | |  | | | |
| 8.4.2 | LV winding | MVA | 160 | | | |  | | | |
| 8.4.3 | TV winding | MVA | 32 | | | |  | | | |
| 8.5 | At third stage of cooling: |  |  | | | |  | | | |
| 8.5.1 | HV winding | MVA | 200 | | | |  | | | |
| 8.5.2 | LV winding | MVA | 200 | | | |  | | | |
| 8.5.3 | TV winding | MVA | 70 | | | |  | | | |
| **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 Germany | | | |  | | | |
| 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 (347) | | | |  | | | |
| 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 | % | ±10 | | | |  | | | |
| 11.13 | Total number of steps |  | 17 | | | |  | | | |
| 11.14 | Variation per step | V | 5000 | | | |  | | | |
| 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 |  | 4 | | | |  | | | |
| 11.26 | Method of parallel control |  | Acc. to Specifications | | | |  | | | |
| 11.26.1 | Master /follower |  | Yes | | | |  | | | |
| 11.26.2 | Min circulating current |  | Yes | | | |  | | | |
| 11.26.3 | Reverse reactance method |  | Yes | | | |  | | | |
| 11.27 | Is line drop compensation required? | Yes/No | Yes | | | |  | | | |
| 11.28 | Tap position output type |  | BCD/mA/Ohm/Contact | | | |  | | | |
| **12** | **Vector group** |  | YNa0d11 | | | |  | | | |
| **13** | **Impedance** |  |  | | | |  | | | |
|  | On the base of rated power of main windings | MVA | 200 | | | |  | | | |
| 13.1 | Positive sequence impedance at 75ْ C, on principal tapping and on: |  |  | | | |  | | | |
| 13.1.1 | Between HV & LV winding | % | 14 | | | |  | | | |
| 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 75ْ C, on max. raise voltage and on: |  |  | | | |  | | | |
| 13.2.1 | Between HV & LV windings | % | Should be Filled By Manufacturer | | | |  | | | |
| 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 | % | Should be Filled By Manufacturer | | | |  | | | |
| 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 75ْ 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: |  |  | | | |  | | | |
| 13.6.1 | Series capacitance of HV phase winding | PF | Should be Proposed By Tenderer | | | |  | | | |
| 13.6.2 | Series capacitance of LV phase winding | PF | Should be Proposed By Tenderer | | | |  | | | |
| 13.6.3 | Shunt capacitance to earth of each HV phase winding with LV unearthed | PF | Should be Proposed By Tenderer | | | |  | | | |
| 13.6.4 | Shunt capacitance to earth of each LV phase winding with HV unearthed | PF | Should be Proposed By Tenderer | | | |  | | | |
| 13.6.5 | Capacitance of HV-LV phase winding with LV unearthed | PF | Should be Proposed By Tenderer | | | |  | | | |
| **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 | 40 | | | |  | | | |
| 14.2 | LV system Indicate 1 and 3 phase | kA/kA | 40 | | | |  | | | |
| 14.3 | TV system Indicate 1 and 3 phase | kA/kA | 31.5 | | | |  | | | |
| 14.4 | Short circuit duration | sec | 2 | | | |  | | | |
| 14.5 | 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 | 1425 | | | |  | | | |
| 15.1.2 | LV winding/bushing | kVpeak / kVpeak | 1050 | | | |  | | | |
| 15.1.3 | TV winding/bushing (if applicable) | kVpeak / kVpeak | ≥75 | | | |  | | | |
| 15.1.4 | Neutral end winding/bushing | kVpeak / kVpeak | 170 | | | |  | | | |
| 15.2 | Switching impulse withstand voltages: |  |  | | | |  | | | |
| 15.2.1 | HV winding/bushing | kVpeak / kVpeak | 1050 | | | |  | | | |
| 15.2.2 | LV winding/bushing | kVpeak / kVpeak | 850 | | | |  | | | |
| 15.2.3 | TV winding/bushing (if applicable) | kVpeak / kVpeak | N.A | | | |  | | | |
| 15.2.4 | Neutral end winding/bushing | kVpeak / kVpeak | N.A | | | |  | | | |
| 15.3 | One minute power frequency withstand voltages: |  |  | | | |  | | | |
| 15.3.1 | HV winding/bushing | kVrms / kVrms | 630 | | | |  | | | |
| 15.3.2 | LV winding/bushing | kVrms / kVrms | 416 | | | |  | | | |
| 15.3.3 | TV winding/bushing | kVrms / kVrms | ≥28 | | | |  | | | |
| 15.3.4 | Neutral end winding/bushing | kVrms / kVrms | 70 | | | |  | | | |
| 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 |  | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer |  |  |  |  |
| 16.2 | Type (OIP/RIP/RBP/...) |  | OIP | OIP | OIP | OIP |  |  |  |  |
| 16.3 | Rated service voltage | kV | 400 | 220 | 11 | 24 |  |  |  |  |
| 16.4 | Nominal current rating | A | 347 | 630 | 2520 | 2000 |  |  |  |  |
| 16.5 | Rated short circuit current | kA | 40 | 40 | 31.5 | 31.5 |  |  |  |  |
| 16.6 | Rated thermal short time current duration | sec | 2 | 2 | 2 | 2 |  |  |  |  |
| 16.7 | Power frequency withstand voltage (complete with all fittings) | kV | 750 | 505 | 55 | 77 |  |  |  |  |
| 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 | Yes | No | No |  |  |  |  |
| 16.10. | Quantity of oil per bushing | liters | Acc. to Manufacturer Data | 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 | Acc. to Manufacturer Data |  |  |  |  |
| 16.12 | Equipped with magnetic oil indicator (in case of oil type) | Yes/No | Yes | Yes | No | No |  |  |  |  |
| 16.13 | Creepage distance (31mm/kV) | mm | 13020 | 7595 | 372 | >900 |  |  |  |  |
| 16.14 | Protected creepage distance | mm | Acc. to Manufacturer Data | 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 | Acc. to Manufacturer Data |  |  |  |  |
| 16.16 | Electrostatic capacity of complete bushing | PF | Acc. to Manufacturer Data | 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 | Level II |  |  |  |  |
| 16.18 | Max. mechanical forces |  | Acc. to Buswork Calc. | Acc. to Buswork Calc. | Acc. to Buswork Calc. | Acc. to Buswork Calc. |  |  |  |  |
|  | Static, horizontal | N | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer |  |  |  |  |
| Static, vertical | N | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer |  |  |  |  |
| Dynamic, horizontal | N | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer |  |  |  |  |
| Dynamic, vertical | N | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer |  |  |  |  |
| 16.19 | Min. corona inception voltage | kV | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer | Should be Proposed By Tenderer |  |  |  |  |
| 16.20. | Washable in service | Yes/No | Yes | Yes | Yes | Yes |  |  |  |  |
| 16.21 | Terminal leads full insulated at factory | Yes/No | Yes | Yes | Yes | Yes |  |  |  |  |
| 16.22 | Bushing can be removed/ installed | Yes/No | Yes | Yes | Yes | Yes |  |  |  |  |
| 16.23 | Bushing can be interchanged with spares | Yes/No | Yes | 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 | 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 | 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 | Should be Filled By Tenderer | | | |  | | | |
| 18.2 | Load losses at rated frequency, 75 ºC And rated current on principal tapping: | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.2.1 | At first stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.2.2 | At second stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.2.3 | At third stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| 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 75⁰ C and max. raise Voltage tapping: |  |  | | | |  | | | |
| 18.3.1 | At first stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.3.2 | At second stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.3.3 | At third stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.4 | Load losses at 75⁰ C and max. lower voltage tapping: |  |  | | | |  | | | |
| 18.4.1 | At first stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.4.2 | At second stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.4.3 | At third stage of cooling |  |  | | | |  | | | |
| a | HV/LV | kW | Should be Filled By Tenderer | | | |  | | | |
| b | HV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| c | LV/TV (if applicable) | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.5 | Cooling plant losses at ONAF/OFAF1/ONAF2 rating | kW | Should be Filled By Tenderer | | | |  | | | |
| 18.6 | Evaluation rate of losses as per Section III at Tendering stage |  |  | | | |  | | | |
| 18.6.1 | No load loss | $/kW | 12,000 | | | |  | | | |
| 18.6.2 | Load loss & Aux. loss | $/kW | 7,000 | | | |  | | | |
| 18.7 | Penalty of higher measured losses than the guaranteed values as per Section IX |  |  | | | |  | | | |
| 18.7.1 | No load loss | $/kW | 18,000 | | | |  | | | |
| 18.7.2 | Load loss & Aux. loss | $/kW | 11,000 | | | |  | | | |
| 18.7.3 | Noise Level | $/dB | 5,000 | | | |  | | | |
| **19** | **Efficiency at winding temperature of 75ْ C & PF=1** |  |  | | | |  | | | |
| 19.1 | At ONAN rating, full load, ¾ full load, ½ full load | % | Should be Filled By Tenderer | | | |  | | | |
| 19.2 | At ONAF rating, full load, ¾ full load, ½ full load (ONAF1) | % | Should be Filled By Tenderer | | | |  | | | |
| 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 | Should be Proposed By Tenderer | | | |  | | | |
| 21.2 | 100% of air forced cooling | Minute | Should be Proposed By Tenderer | | | |  | | | |
| 21.3 | All of air and oil forced cooling | Minute | Should be Proposed By Tenderer | | | |  | | | |
| 21.4 | Condition of injurious heating (hot spot temp.) | °C | Should be Proposed By Tenderer | | | |  | | | |
| **22** | **Exciting current** |  |  | | | |  | | | |
| 22.1 | At rated voltage when excited from HV side | Arms | Should be Filled By Tenderer | | | |  | | | |
| 22.2 | At 110% rated voltage when excited from HV side | Arms | Should be Filled By Tenderer | | | |  | | | |
| **23** | **Core and winding data** |  |  | | | |  | | | |
| 23.1 | Three limb/ five limb |  | Should be Filled By Tenderer | | | |  | | | |
| 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 |  | Should be Filled By Tenderer | | | |  | | | |
| 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 | Should be Filled By Tenderer | | | |  | | | |
| 23.6.2 | At 110% rated HV voltage | Wb/m2 | Should be Filled By Tenderer | | | |  | | | |
| 23.7 | Main limb/yoke cross section | cm2/cm2 | Should be Filled By Tenderer | | | |  | | | |
| 23.8. | Types and arrangement of winding |  |  | | | |  | | | |
| 23.8.1 | HV winding |  | Should be Filled By Tenderer | | | |  | | | |
| 23.8.2 | LV winding |  | Should be Filled By Tenderer | | | |  | | | |
| 23.8.3 | TV winding |  | Should be Filled By Tenderer | | | |  | | | |
| 23.9 | Winding arrangement |  | Should be Filled By Tenderer | | | |  | | | |
| 23.10 | Current density at rated power and voltage |  |  | | | |  | | | |
| 23.10.1 | HV winding | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 23.10.2 | LV winding | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 23.10.3 | TV winding | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 23.10.4 | Tap winding | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 23.11 | Insulation of core |  |  | | | |  | | | |
| 23.11.1 | Lamination |  | Should be Filled By Tenderer | | | |  | | | |
| 23.11.2 | Core bolts |  | Should be Filled By Tenderer | | | |  | | | |
| 23.11.3 | Strapping |  | Should be Filled By Tenderer | | | |  | | | |
| 23.12 | Type of Insulation of winding (uniform/graded) |  |  | | | |  | | | |
| 23.12.1 | HV |  | Graded | | | |  | | | |
| 23.12.2 | LV |  | Graded | | | |  | | | |
| 23.12.3 | TV |  | Uniform | | | |  | | | |
| 23.13 | Insulation material |  |  | | | |  | | | |
| 23.13.1 | Turn insulation HV/LV |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.2 | Between windings HV/LV |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.3 | Between core and LV side |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.4 | Between laminations |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.5 | Core bolts |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.6 | Core bolts washers |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.7 | Side plates |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.8 | Core lamination |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.9 | Tapping |  | Should be Filled By Tenderer | | | |  | | | |
| 23.13.10 | Tapping connections |  | Should be Filled By Tenderer | | | |  | | | |
| **24** | **Calculated thermal time constant** |  |  | | | |  | | | |
| 24.1 | Natural cooling | sec | Should be Filled By Tenderer | | | |  | | | |
| 24.2 | Forced cooling | sec | Should be Filled By Tenderer | | | |  | | | |
| **25** | **Tank** |  |  | | | |  | | | |
| 25.1 | Tank design conventional/bell shaped |  | Conventional | | | |  | | | |
| 25.2 | Thickness of transformer plates: |  |  | | | |  | | | |
| 25.2.1 | Cover of tank | mm | Should be Filled By Tenderer | | | |  | | | |
| 25.2.2 | Sides | mm | Should be Filled By Tenderer | | | |  | | | |
| 25.2.3 | Bottom | mm | Should be Filled By Tenderer | | | |  | | | |
| 25.2.4 | Conservator | mm | Should be Filled By Tenderer | | | |  | | | |
| 25.2.5 | Radiator plates | mm | Should be Filled By Tenderer | | | |  | | | |
| **26** | **Vacuum withstand capability** |  | Should be Filled By Tenderer | | | |  | | | |
| 26.1 | Tank | mm Hg | Should be Filled By Tenderer | | | |  | | | |
| 26.2 | Radiators | mm Hg | Should be Filled By Tenderer | | | |  | | | |
| 26.3 | Conservator | mm Hg | Should be Filled By Tenderer | | | |  | | | |
| 26.4 | Positive pressure withstand capability for complete Transformer | mm Hg | Should be Filled By Tenderer | | | |  | | | |
| **27** | **Oil** |  |  | | | |  | | | |
| 27.1 | Manufacture |  | Shell, nynas, michang | | | |  | | | |
| 27.2 | Type designation |  | Diala S4 ZX-I | | | |  | | | |
| 27.3 | Oil preservation system |  | Air-bag | | | |  | | | |
| 27.4 | Country of manufacture |  | Should be Filled By Tenderer | | | |  | | | |
| 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. 0.8 | | | |  | | | |
| 27.27.4 | DDF at 90 °C  (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247) |  | Max. 0.5 | | | |  | | | |
| 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 | Should be Filled By Tenderer | | | |  | | | |
| 32.2 | Overall width, including mounted accessories | mm | Should be Filled By Tenderer | | | |  | | | |
| 32.3 | Overall length, including mounted accessories | mm | Should be Filled By Tenderer | | | |  | | | |
| 32.4 | Height over cover for lifting core and coils | mm | Should be Filled By Tenderer | | | |  | | | |
| 32.5 | Dimensions of transformer arranged for transport |  | Should be Filled By Tenderer | | | |  | | | |
| 32.6 | Length | m | Should be Filled By Tenderer | | | |  | | | |
| 32.7 | Height | m | Should be Filled By Tenderer | | | |  | | | |
| 32.8 | Width | m | Should be Filled By Tenderer | | | |  | | | |
| 32.9 | Weight of oil | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.10. | Weight of on load tap changer | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.11 | Total weight of core and coils | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.12 | Total weight of tank/cooler and fittings | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.13 | Total weight of windings | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.14 | Total weight of core (steel lamination) | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.15 | Total weight steel (tank, fittings, conservator, etc) | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.16 | Total weight of complete transformer | kg | Should be Filled By Tenderer | | | |  | | | |
| 32.17 | Max. shipping weight (heaviest item) | kg | Should be Filled By Tenderer | | | |  | | | |
| **33** | **Provisions for tank mounting lightning arresters** |  |  | | | |  | | | |
| 33.1 | HV | Yes/No | No | | | |  | | | |
| 33.2 | LV | Yes/No | No | | | |  | | | |
| 33.3 | TV | Yes/No | Yes (inside of Cable Box) | | | |  | | | |
| 33.3.1 | Type |  | MOA | | | |  | | | |
| 33.3.2 | Type designation |  | Should be Filled By Tenderer | | | |  | | | |
| 33.3.3 | Standard |  | IEC 60099-4 | | | |  | | | |
| 33.3.4 | Rated/system voltage | kV | Should be Filled By Tenderer | | | |  | | | |
| 33.3.5 | Maximum overvoltage factor on the system due to any switching duty | pu | Should be Filled By Tenderer | | | |  | | | |
| 33.3.6 | Rated system frequency | Hz | 50 | | | |  | | | |
| 33.3.7 | Condition of system neutral |  | Solid | | | |  | | | |
| 33.3.8 | Nominal Discharge current | KA crest | 20 | | | |  | | | |
| 33.3.9 | Energy capability as per IEC 60099-4 | kJ/kV | Should be Filled By Tenderer | | | |  | | | |
| 33.3.10 | Rated Voltage – MOA | kV | Should be Filled By Tenderer | | | |  | | | |
| 33.3.11 | Long duration discharge class as per IEC 99-1 | Class | 4 | | | |  | | | |
| 33.3.12 | Maximum Continuous Operating Voltage (COV) | kV | Should be Filled By Tenderer | | | |  | | | |
| 33.3.13 | TOV capability for |  |  | | | |  | | | |
|  | * 1sec | kV | Should be Filled By Tenderer | | | |  | | | |
|  | * 10sec | kV | Should be Filled By Tenderer | | | |  | | | |
| 33.3.14 | Maximum residual voltage with current wave |  |  | | | |  | | | |
|  | * Switching Surges – 1kA/2kA | kV | To IEC 60099-4 | | | |  | | | |
|  | * 8/20 μs – 5kA | kV | To IEC 60099-4 | | | |  | | | |
|  | * 8/20 μs – 20kA | kV | To IEC 60099-4 | | | |  | | | |
| 33.3.15 | Discharge current withstand strength |  |  | | | |  | | | |
|  | * High current 4/10 μs | KAp | To IEC 60099-4 | | | |  | | | |
|  | * Low current 2000 μs | KAp | To IEC 60099-4 | | | |  | | | |
| **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 | Should be Filled By Tenderer | | | |  | | | |
| **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 | Yes | | | |  | | | |
| **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 |  | Should be Filled By Tenderer | | | |  | | | |
| 42.9.2 | Water sprinkler system |  | Should be Filled By Tenderer | | | |  | | | |
| 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 | Should be Filled By Tenderer | | | |  | | | |
| b | Asymmetrical crest current | AmpPeak | Should be Filled By Tenderer | | | |  | | | |
| 43.1.2 | LV winding |  |  | | | |  | | | |
| a | Symmetrical component current | Arms | Should be Filled By Tenderer | | | |  | | | |
| b | Asymmetrical crest current | AmpPeak | Should be Filled By Tenderer | | | |  | | | |
| 43.1.3 | Tapped winding |  |  | | | |  | | | |
| a | Symmetrical component current | Arms | Should be Filled By Tenderer | | | |  | | | |
| b | Asymmetrical crest current | AmpPeak | Should be Filled By Tenderer | | | |  | | | |
| 43.2 | Max. fault current on which mechanical stresses are based for OLTC (main+arcing contacts): |  |  | | | |  | | | |
| 43.2.1 | Symmetrical short circuit current | kArms | Should be Filled By Tenderer | | | |  | | | |
| 43.2.2 | Dynamic short circuit current value |  | Should be Filled By Tenderer | | | |  | | | |
| 43.2.2 | Asymmetrical crest current | Ampcrest | Should be Filled By Tenderer | | | |  | | | |
| 43.3 | Max. fault current on which mechanical stresses are based for leads to OLTC are: |  |  | | | |  | | | |
| 43.3.1 | Symmetrical short circuit current | Arms | Should be Filled By Tenderer | | | |  | | | |
| 43.3.2 | Asymmetrical crest current | Ampcrest | Should be Filled By Tenderer | | | |  | | | |
| 43.4 | Max. fault current on which mechanical Stresses are based for various bushings of: |  |  | | | |  | | | |
| 43.4.1 | HV side | kArms | Should be Filled By Tenderer | | | |  | | | |
| 43.4.2 | LV side | kArms | Should be Filled By Tenderer | | | |  | | | |
| 43.4.3 | Neutral HV/LV | kArms | Should be Filled By Tenderer | | | |  | | | |
| 43.5 | Current density in windings on principal tapping under the most onerous fault condition |  |  | | | |  | | | |
| 43.5.1 | HV winding | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.2 | LV winding | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.3 | Tapped windings | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.4 | Tapping lead connections | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.5 | Neutral | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.6 | HV bushings | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.7 | LV bushings | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.5.8 | Neutral bushings | A/mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.6 | Hoop stress in winding conductors: |  |  | | | |  | | | |
| 43.6.1 | HV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.6.2 | LV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.6.3 | Tapping | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.7 | Total axial compressive force in windings: |  |  | | | |  | | | |
| 43.7.1 | HV winding | N | Should be Filled By Tenderer | | | |  | | | |
| 43.7.2 | LV winding | N | Should be Filled By Tenderer | | | |  | | | |
| 43.7.3 | Tapped winding | N | Should be Filled By Tenderer | | | |  | | | |
| 43.7.4 | Tertiary winding | N | Should be Filled By Tenderer | | | |  | | | |
| 43.8 | Max. stress to flexion of conductor between two adjacent spacers: |  |  | | | |  | | | |
| 43.8.1 | HV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.8.2 | LV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.8.3 | Tapping | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.9 | Total axial and thurst in windings: |  |  | | | |  | | | |
| 43.9.1 | HV winding | N | Should be Filled By Tenderer | | | |  | | | |
| 43.9.2 | LV winding | N | Should be Filled By Tenderer | | | |  | | | |
| 43.9.3 | Tapping | N | Should be Filled By Tenderer | | | |  | | | |
| 43.10. | Max. stresses in end insulation and supports: |  |  | | | |  | | | |
| 43.10.1 | HV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.10.2 | LV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.10.3 | Tapped winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 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: | % | Should be Filled By Tenderer | | | |  | | | |
| 43.12.1 | HV winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.12.2 | LV winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.12.3 | Tapped winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.13 | Cross section area of insulation for: |  |  | | | |  | | | |
| 43.13.1 | HV winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.13.2 | LV winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.13.3 | Tapped winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.14 | Specific heat in watt- seconds per degree Celsius per pound of conductor Material for: |  |  | | | |  | | | |
| 43.14.1 | HV winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.14.2 | LV winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.14.3 | Tapped winding | mm2 | Should be Filled By Tenderer | | | |  | | | |
| 43.15 | Position and magnitude of max. axial stress on inter turn insulation in: |  |  | | | |  | | | |
| 43.15.1 | HV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.15.2 | LV winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| 43.15.3 | Tapped winding | N/m2 | Should be Filled By Tenderer | | | |  | | | |
| **44** | **On-line gas monitoring** |  |  | | | |  | | | |
| 44.1 | Manufacturer |  | Should be Filled By Tenderer | | | |  | | | |
| 44.2 | Country of manufacturer |  | Should be Filled By Tenderer | | | |  | | | |
| 44.3 | Model/Type |  | Should be Filled By Tenderer | | | |  | | | |
| 44.4 | Detectable key gases |  | Should be Filled By Tenderer | | | |  | | | |
| 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 | Should be Filled By Tenderer | | | |  | | | |
| 44.9.2 | Operating oil temperature | ºC | Should be Filled By Tenderer | | | |  | | | |
| 44.9.3 | Operating oil pressure | PSI | Should be Filled By Tenderer | | | |  | | | |
| 44.9.4 | Operating humidity | % RH | Should be Filled By Tenderer | | | |  | | | |
| 44.9.5 | Storage temperature | ºC | Should be Filled By Tenderer | | | |  | | | |
| 44.9.6 | Storage humidity | % RH | Should be Filled By Tenderer | | | |  | | | |
| 44.9.7 | Altitude | m | Acc. to section 1 | | | |  | | | |
| 44.10 | Input power requirement |  |  | | | |  | | | |
| 44.10.1 | Voltage | V AC | Should be Filled By Tenderer | | | |  | | | |
| 44.10.2 | Frequency | Hz | Should be Filled By Tenderer | | | |  | | | |
| 44.10.3 | Current or power | A or kW | Should be Filled By Tenderer | | | |  | | | |
| 44.11 | Communication option |  |  | | | |  | | | |
| 44.11.1 | Display |  | Should be Filled By Tenderer | | | |  | | | |
| 44.11.2 | Communication protocols |  | Should be Filled By Tenderer | | | |  | | | |
| 44.11.3 | Communication ports and analog I/O |  | Should be Filled By Tenderer | | | |  | | | |
| 44.11.4 | Measurement alarms |  | Should be Filled By Tenderer | | | |  | | | |
| 44.11.5 | Alarm contacts |  | Should be Filled By Tenderer | | | |  | | | |
| 44.11.6 | Data storage | Year | Should be Filled By Tenderer | | | |  | | | |
| 44.12 | Software |  | Should be Filled By Tenderer | | | |  | | | |
| 44.13 | Dimensions |  | Should be Filled By Tenderer | | | |  | | | |
| 44.14 | Weight | kg | Should be Filled By Tenderer | | | |  | | | |
| 44.15 | Whether all catalogues and description of the system attached | Yes/No | Should be Filled By Tenderer | | | |  | | | |
| **45** | **Minimum Clearances (IEC 60076-3)** |  | Should be confirmed by Tenderer | | | |  | | | |
| 45.1 | Line to earth |  |  | | | |  | | | |
| 45.1.1 | HV side | mm | 3100 | | | |  | | | |
| 45.1.2 | LV side | mm | 1900 | | | |  | | | |
| 45.1.3 | TV side | mm | 200 | | | |  | | | |
| 45.2 | Phase to phase |  |  | | | |  | | | |
| 45.2.1 | HV side | mm | 4200 | | | |  | | | |
| 45.2.2 | LV side | mm | 2600 | | | |  | | | |
| 45.2.3 | TV side | mm | 200 | | | |  | | | |
| **45** | **System Grounding** |  |  | | | |  | | | |
| 45.1 | HV system |  | Effective | | | |  | | | |
| 45.2 | LV system |  | Effective | | | |  | | | |
| 45.3 | TV system |  | Grounding TR | | | |  | | | |
| **45** | **Winding and oil temp. (Dial type or temp. monitoring)** |  | Dial type | | | |  | | | |
| **46** | **Size of copper ground conductor** |  | 240 | | | |  | | | |
| **47** | **Type of terminals** |  |  | | | |  | | | |
| 47.1 | HV |  | Air bushing | | | |  | | | |
| 47.2 | LV |  | Air bushing | | | |  | | | |
| 47.3 | TV |  | Cable box | | | |  | | | |
| 47.4 | 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** |  |  | | | |  | | | |
| **51.1** | According to ISO 9000, 9001, 9002, 9003 and 9004 | Validity | Yes | | | |  | | | |
| **51.2** | Certificate attached to the offer | Yes/No | Yes | | | |  | | | |
| **52** | **Type test certificate to be issued by:** |  |  | | | |  | | | |
| **52.1** | Independent laboratory or independently witnessed type test certificate | Yes/No | Yes | | | |  | | | |
| **52.2** | Certificate attached to the offer | Yes/No | Yes | | | |  | | | |
| **54** | **Special Tests to be performed:**  **As Type test = T**  **As Routine test = R** |  |  | | | |  | | | |
| **54.1** | Chopped Wave Lightning Impulse Test  (\*)Type or routine test as appropriate to transformer HV Um |  | Yes (\*) | | | |  | | | |
| **54.2** | Measurement of zero-sequence impedance |  | Yes (T) | | | |  | | | |
| **54.3** | Determination of sound levels |  | Yes (T) | | | |  | | | |
| **54.4** | Measurement of harmonics of no-load current |  | Yes (T) | | | |  | | | |
| **54.5** | Frequency response analysis (FRA) |  | Yes (R) | | | |  | | | |
| **54.6** | Measurement of the power by the fan motors and oil pumps |  | Yes (T) | | | |  | | | |
| **54.7** | Check of external coating |  | Yes, R) | | | |  | | | |
| **54.8** | Determination of capacitance, windings to earth and between windings |  | Yes, R) | | | |  | | | |
| **54.9** | Measurement of insulation resistance to earth and loss angle of insulation system capacitances |  | Yes, R) | | | |  | | | |
| **54.10** | Short circuit withstand test/calculations |  | Yes (Calculation) | | | |  | | | |
| **55** | **Wheel locking capability on Transformer rails** | Yes/No | Yes | | | |  | | | |

e) 11/0.415kV EARTHING/ AUXILIARY TRANSFORMER (CAF-CAF)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 11/0.415kV EARTHING/ AUXILIARY TRANSFORMER (CAF-CAF) | | **UNIT** | **DATA** | |
| **ITEM** | **DESCRIPTION** | **REQUIRED** | **OFFERED** |
| **1** | **System performance data** |  |  |  |
| 1.1 | Nominal power rating at site conditions | MVA | 200 |  |
| 1.2 | Nominal service voltage | kVrms | 400/220/11 |  |
| 1.3 | Max. system voltage | kVrms | 420 |  |
| 1.4 | System earthing |  | Solid |  |
| 1.5 | Rated frequency | Hz | 50 |  |
| 1.6 | 3-Phase short circuit |  |  |  |
| 1.6.1 | Rated value | kArms | 40 |  |
| 1.6.2 | Dynamic value | kApeak | 100 |  |
| 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** | **EAT specifications** |  |  |  |
| 2.1 | Number of transformers |  | 2 |  |
| 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 | 500 |  |
| 2.5 | Type of cooling |  | ONAN |  |
| 2.6 | Vector group |  | ZNyn11 |  |
| 2.7 | Impedance voltage between HV and LV windings at 75 °C | % | 5 |  |
| 2.8 | Rated voltage of windings | kVrms | 11 |  |
| 2.9 | Highest system voltages | kVrms | 12 |  |
| 2.10 | Rated frequency | Hz | 50 |  |
| 2.11 | Insulation levels |  |  |  |
| 2.11.1 | Windings (HV/LV) |  |  |  |
| 2.11.1.1 | Rated voltage | kVrms | 11/0.415 |  |
| 2.11.1.2 | Highest voltage for equipment | kVrms | 12/1 |  |
| 2.11.1.3 | Rated one min. power frequency withstand voltage | kVrms | 28/3 |  |
| 2.11.1.4 | Rated lightning impulse withstand voltage | kVpeak | 95/N.A |  |
| 2.11.2 | Bushings (HV/LV) |  |  |  |
| 2.11.2.1 | Rated voltage | kVrms | 20/1 |  |
| 2.11.2.2 | Highest voltage for equipment | kVrms | 24/1 |  |
| 2.11.2.3 | Rated one min. power frequency withstand voltage | kVrms | 55/10 |  |
| 2.11.2.4 | Rated lightning impulse withstand voltage | kVpeak | 125/20 |  |
| 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 |  | Should be Filled By Tenderer |  |
| 2.12.4 | Total range(number of steps) |  | ±2\*2.5% |  |
| 2.12.5 | Location |  | HV-N |  |
| 2.12.6 | Rated current | A | Min. 33 |  |
| 2.13 | Losses |  |  |  |
| 2.13.1 | No load losses at 75 ºC, rated frequency and rated voltage on principal tapping | kW | Max. 1 |  |
| 2.13.2 | Load losses at rated frequency, 75 ْ C And rated current on principal tapping | kW | Max. 4.5 |  |
| 2.13.3 | Evaluation rate of no load loss at Tendering stage | $/kW | 12000 |  |
| 2.13.4 | Evaluation rate of load loss & cooling loss at Tendering stage | $/kW | 7000 |  |
| 2.14 | Zero sequence impedance at HV side at 75°C | Ohm/ph | 18.1 |  |
| 2.15 | Rated interconnected star winding current (short time) |  |  |  |
| 2.15.1 | Phase | A | 350 |  |
| 2.15.2 | Neutral | A | 1050 |  |
| 2.15.3 | Duration | sec | 30 |  |
| 2.16 | Rated continuous neutral current (at principle tap & max. ambient temp.) | A | By manufacturer |  |
| 2.17 | Exciting current |  |  |  |
| 2.17.1 | At rated voltage | A | By manufacturer |  |
| 2.17.2 | At 110% rated voltage | A | By manufacturer |  |
| 2.18 | Temperature rise (corrected for altitude, ambient condition and IEC 60076-2) |  |  |  |
| 2.18.1 | Top oil | °C | 57 |  |
| 2.18.2 | Winding | °C | 62 |  |
| 2.18.3 | Hot Spot | °C | 75 |  |
| 2.19 | Max. sound level (acc. to IEC 60076-10) | dB | 50 |  |
| 2.20 | Vacuum withstand capacity of total transformer | mmHg | Acc. To Technical Specification |  |
| 2.21 | Core and winding data |  |  |  |
| 2.21.1 | Manufacturer of steel core material |  | Should be Filled By Tenderer |  |
| 2.21.2 | Type of steel core lamination |  | By manufacturer |  |
| 2.21.3 | Flux density of core |  |  |  |
| 2.21.3.1 | At rated voltage | Wb/m2 | 1.727 |  |
| 2.21.3.2 | As above at 110% rated voltage | Wb/m2 | 1.9 |  |
| 2.21.4 | Thickness of steel core lamination | mm | ≤0.3 |  |
| 2.21.5 | Main limb/yoke cross section | cm2 | By manufacturer |  |
| 2.21.6 | Current density at rated power and voltage |  |  |  |
| 2.21.6.1 | HV winding | A/mm2 | By manufacturer |  |
| 2.21.6.2 | LV winding | A/mm2 | By manufacturer |  |
| 2.21.7 | Current density at rated short circuit current |  |  |  |
| 2.21.7.1 | HV winding | A/mm2 | By manufacturer |  |
| 2.21.7.2 | LV winding | A/mm2 | By manufacturer |  |
| 2.22 | Thickness of transformer plates |  |  |  |
| 2.22.1 | Tank | mm | By manufacturer |  |
| 2.22.2 | Sides | mm | By manufacturer |  |
| 2.22.3 | Bottom | mm | By manufacturer |  |
| 2.22.4 | Radiator plates | mm | By manufacturer |  |
| 2.23 | Bushings (HV/LV) |  |  |  |
| 2.23.1 | Manufacturer & country |  | Should be Filled By Tenderer |  |
| 2.23.2 | External creepage distance | mm | min (372) |  |
| 2.23.3 | Protected creepage distance | mm | By manufacturer |  |
| 2.23.4 | Rated normal | A | 32/835 |  |
| 2.23.5 | Short circuit current (HV) | kA | 25 |  |
| 2.23.6 | Test tap required | Yes/No | No |  |
| 2.23.7 | Rated normal/short circuit current for neutral | (A/kA) | Should be Filled By Tenderer |  |
| 2.23.4 | Bushing type current transformers (Required) | Yes/No | Yes |  |
| 2.23.4.1 | No of cores (HV,HVN,LV,LVN) |  | According to SLD |  |
| 2.23.4.2 | Specifications |  | According to SLD |  |
| 2.24 | Type of terminals |  |  |  |
| 2.24.1 | HV |  | Cable Box |  |
| 2.24.2 | LV |  | Cable Box |  |
| 2.24.3 | HV-N |  | Cable Box |  |
| 2.24.4 | LV-N |  | Cable Box |  |
| 2.24.5 | Filling medium for cable box |  | Air |  |
| 2.25 | Overall Dimensions (H\*W\*L) | mm\*mm\*mm | Should be Filled By Tenderer |  |
| 2.26 | Weights |  |  |  |
| 2.26.1 | Core and coils | kg | By manufacturer |  |
| 2.26.2 | Tank and fittings | kg | By manufacturer |  |
| 2.26.3 | Weight of oil | kg | By manufacturer |  |
| 2.26.4 | Total Weight of complete transformer | kg | By manufacturer |  |
| 2.27 | Regulation at full load and 75°C winding temperature |  |  |  |
| 2.27.1 | a) Unity Power Factor |  | By manufacturer |  |
| 2.27.2 | b) 0.8 PF lag |  | By manufacturer |  |
| 2.28 | Efficiency (at P.F.=1 ) |  |  |  |
| 2.28.1 | At full load | % | By manufacturer |  |
| 2.28.2 | At 3/4 full load | % | By manufacturer |  |
| 2.28.3 | At 1/2 full load | % | By manufacturer |  |
| 2.28.3 | Max. and the load at which it occurs | % | By manufacturer |  |
| 2.29 | Oil |  |  |  |
| 2.29.1 | Manufacture |  | Should be Filled By Tenderer |  |
| 2.29.2 | Country of manufacture |  | Should be Filled By Tenderer |  |
| 2.29.3 | Naphthenic or Paraphenic based oil |  | Naphthenic |  |
| 2.29.4 | Type – inhibited/ trace inhibited/ non-inhibited |  | non-inhibited |  |
| 2.29.5 | Details of inhibitor |  | Should be Filled By Tenderer |  |
| 2.29.6 | Details of passivators |  | Should be Filled By Tenderer |  |
| 2.29.7 | Viscosity at 40 °C (Acc. to ISO 3104) | mm2/s | Max. 12 |  |
| 2.29.8 | Viscosity at –30 °C (Acc. to ISO 3104) | mm2/s | Max. 1800 |  |
| 2.29.9 | Pour point (Acc. To ISO 3016) | °C | Max. -40 |  |
| 2.29.10 | Water content (Acc. To IEC 60814) | mg/kg | Max. 40 |  |
| 2.29.11 | Breakdown voltage (Acc. To IEC 60156) |  |  |  |
| 2.29.11.1 | As delivered | kV | Min. 30 |  |
| 2.29.11.2 | After laboratory treatment | kV | Min. 70 |  |
| 2.29.12 | Density at 20 °C (Acc. To ISO3675 or ISO12185) | g/ml | Max. 0.895 |  |
| 2.29.13 | DDF at 90 °C (Acc. To IEC 60247 / IEC 61620) |  | Max. 0.005 |  |
| 2.29.14 | Appearance |  | Clear, free from sediment and suspended matter |  |
| 2.29.15 | Acidity (Acc. To IEC 62021-1 / IEC 62021-2) | mg KOH/g | Max. 0.01 |  |
| 2.29.16 | Interfacial tension  (Acc. To EN 14210/ASTM D971) | mN/m | Min. 40 |  |
| 2.29.17 | Total Sulphur content  (Acc. To IP 373 / ISO 14596) | % | Max. 0.05 |  |
| 2.29.18 | Corrosive Sulphur (Acc. To DIN 51353) |  | Not corrosive |  |
| 2.29.19 | Copper Corrosion (Acc. To IEC 62535) |  | Not corrosive |  |
| 2.29.20 | Potentially corrosive Sulphur  (Acc. To IEC 62535) |  | Not corrosive |  |
| 2.29.21 | DBDS (Acc. To IEC 62697-1) | mg/kg | Not detectable ( <5 ) |  |
| 2.29.22 | Inhibitors of IEC 60666  (Acc. To IEC 60666) | % | (U) uninhibited oil  (Max. 0.01) |  |
| 2.29.23 | Metal passivator additives of IEC 60666 | mg/kg | Max. 5 |  |
| 2.29.24 | 2-Furfural and related compounds content (Acc. To IEC 61198) | mg/kg | Max. 0.05 (for each individual compound) |  |
| 2.29.25 | Oxidation stability (Acc. To IEC 61125:1992 (Method C)) |  |  |  |
| 2.29.25.1 | Test duration (for uninhibited oil) | h | 164 |  |
| 2.29.25.2 | Total acidity (Acc. To 1.9.4 of IEC 61125:1992) | mg KOH/g | Max. 1.2 |  |
| 2.29.25.3 | Sludge (Acc. To 1.9.1 of IEC 61125:1992) | % | Max. 0.8 |  |
| 2.29.25.4 | DDF at 90 °C  (Acc. To 1.9.6 of IEC 61125, Amendment 1 (2004) +IEC 60247) |  | Max. 0.5 |  |
| 2.29.26 | Flash point (Acc. To ISO 2719) | °C | Min. 135 |  |
| 2.29.27 | PCA content (Acc. To IP 346) | % | Max. 3 |  |
| 2.29.28 | PCB content (Acc. To IEC 61619) | mg/kg | Not detectable (Max. 2) |  |
| 2.29.29 | Quantity of oil |  |  |  |
| 2.29.29.1 | Main tank | Liters | Should be Filled By Tenderer |  |
| 2.29.29.2 | Conservator | Liters | Should be Filled By Tenderer |  |
| 2.29.29.3 | Radiator | Liters | Should be Filled By Tenderer |  |
| 2.29.31 | Total oil required for commissioning | Liters | Should be Filled By Tenderer |  |
| 2.29.32 | Total oil provided (including 5% extra) | Liters | Should be Filled By Tenderer |  |
| 2.29.33 | Way of shipping |  | By drums |  |
| 2.29.34 | Total number of drums provided |  | Should be Filled By Tenderer |  |
| 2.30 | Accessories make, type and country |  | Should be filled By Tenderer |  |
| 2.30.1 | Buchholz relay |  | Yes |  |
| 2.30.2 | Pressure relief device |  | Yes |  |
| 2.30.3 | Silicagel breather |  | Yes |  |
| 2.30.4 | Control Cabinet |  | Yes |  |
| 2.30.5 | Cables |  | Yes |  |
| 2.30.6 | Oil level gauge |  | Yes |  |
| 2.30.7 | Winding temperature indicator |  | Yes |  |
| 2.30.8 | Oil temperature indicator |  | Yes |  |
| 2.31 | Whether wheels are required | Yes/No | No |  |
| 2.32 | Whether switch-fuse unit is required | Yes/No | No |  |
| 2.33 | Type of conservator (Air bag/ Conventional ) |  | Conventional |  |
| 2.34 | Max. vibration (at rated condition) P-P | Micron | 50 |  |

f) NEUTRAL EARTHING RESISTOR (NER)

| 1. NEUTRAL EARTHING RESISTOR (NER) | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
| **REQUIRED** | **OFFERED** |
| 1 | Related Standard |  | IEEE Std 32 |  |
| 2 | Design environmental site condition |  | Acc. to Section a) site condition |  |
| 3 | Installation (Indoor/Outdoor) |  | Outdoor |  |
| 4 | Type of cooling |  | Air |  |
| 5 | Rated frequency | Hz | 50 |  |
| 6 | Service voltages | kV | 11/√3 |  |
| 7 | Rated voltages | kV | Should be Filled By Tenderer |  |
| 8 | One minute Power frequency withstand voltage | kV | 38 |  |
| 9 | Impulse withstand voltage | kV | 95 |  |
| 10 | Rated Current |  | 500A- 10 Sec |  |
| 11 | Degree of protection |  | IP55 |  |
| 12 | Provisions for accommodating current transformers | Yes/No | Yes |  |
| 13 | Current transformers type |  | Internal |  |
| 14 | Current transformers rating |  | Acc. to SLD |  |

g) 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding)

| 1. 11kV XLPE INSULATED CABLE SYSTEM (with solid bonding) | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | Required | Offered |
| **1** | GENERAL |  |  |  |
| 1.1 | Name of manufacturer |  | Should be Filled By Tenderer |  |
| 1.2 | Place of manufacturing |  | Should be Filled By Tenderer |  |
| 1.3 | Manufacturers Quality Certification |  | ISO 9001 |  |
|  | * Certified by (Company Name) |  | Should be Filled By Tenderer |  |
|  | * Certification valid till (year) |  | Should be Filled By Tenderer |  |
| 1.4 | Circuit rating required | kVA | 500 |  |
| 1.5 | General description of cable |  | Should be Filled By Tenderer |  |
|  | * number of cores |  | 1 or 3 |  |
|  | * system voltage | kV | 11 |  |
|  | * conductor size | mm2 | 2\*95 |  |
|  | * conductor type |  | Cu |  |
|  | * Insulation type |  | XLPE |  |
|  | * metal sheath type |  | Al |  |
|  | * over sheath type |  | MDPE |  |
| 1.6 | Year of first commercial operation of cable type |  | Should be Filled By Tenderer |  |
| **2** | **INSULATION CO-ORDINATION** |  |  |  |
| 2.1 | Highest system voltage (Um) (insulation class) | kV | 12 |  |
| 2.2 | Nominal voltage between conductors (U) | kV | 11 |  |
| 2.3 | Rated frequency | Hz | 50 |  |
| 2.4 | Nominal voltage between conductor and sheath (Uo) | kV | 6.35 |  |
| 2.5 | Rated impulse withstand voltage (Up) (at altitude <1000m) | kV | 95 |  |
| 2.6 | Rated short duration power frequency withstand voltage (at altitude <1000m) | kV | 28 |  |
| **3** | **RATINGS** |  |  |  |
| 3.1 | Maximum continuous current carrying capacity at installed site condition for auxiliary transformer feeders | A | Should be Filled By Tenderer |  |
|  |  |  |  |  |
| 3.2 | Maximum continuous direct-buried current rating, assuming, |  |  |  |
|  | * Soil thermal resistivity of 2.0K.m/W |  | 2.0K.m/W |  |
|  | * Flat spaced configuration, phase spacing of 250mm |  | Should be Filled By Tenderer |  |
|  | * Special bonding of metal sheaths |  | Should be Filled By Tenderer |  |
|  | For, |  | Should be Filled By Tenderer |  |
|  | * Guaranteed Current Rating (Single Circuit in Trench) | A | Should be Filled By Tenderer |  |
|  | * Guaranteed Current Rating (Double Circuit in one Trench, distance between middle phases, s = 1500 mm) | A | Should be Filled By Tenderer |  |
|  | * Ground temperature at burial depth | °C | Should be Filled By Tenderer |  |
|  | * Calculation Method |  | IEC 60287 |  |
| 3.3 | Maximum continuous in-air current rating, assuming, |  |  |  |
|  | * Air temperature (in shade) of 35 °C |  | Should be Filled By Tenderer |  |
|  | * Special bonding of metal sheaths |  | Should be Filled By Tenderer |  |
|  | * Flat spaced configuration, group/phase spacing of 150mm |  | Should be Filled By Tenderer |  |
|  | * Thermally independent of other cable circuits |  | Should be Filled By Tenderer |  |
|  | For, |  | Should be Filled By Tenderer |  |
|  | * Guaranteed Current Rating (single circuit) | A | Should be Filled By Tenderer |  |
|  | * Calculation Method |  | IEC 60287 |  |
| 3.4 | Maximum permissible core temperature for continuous operation | °C | 90 |  |
| 3.5 | Short circuit capacity for 1 sec |  |  |  |
|  | * Short circuit current | kA | As per IEC60502 |  |
|  | * Permissible maximum sheath temperature | °C | 200 |  |
|  | * Permissible maximum conductor temperature | °C | 250 |  |
| 3.6 | Short circuit level |  |  |  |
|  | * Symmetrical current | kA rms/sec | 25/1 |  |
|  | * Maximum dynamic current | kA peak | Should be Filled By Tenderer |  |
| 3.7 | Short circuit withstand current/time of armour | kA rms/sec | 25/1 |  |
| 3.8 | Permissible emergency overload |  |  |  |
| 3.8.1 | Applied on 100% continuous load |  |  |  |
|  | * Emergency current rating | A | Should be Filled By Tenderer |  |
|  | * Maximum emergency temperature | °C | Should be Filled By Tenderer |  |
|  | * Allowable duration/operation | hours | Should be Filled By Tenderer |  |
|  | * Allowable total duration/annum | hours | Should be Filled By Tenderer |  |
|  | * Maximum average duration/annum on total life of cable | hours | Should be Filled By Tenderer |  |
| 3.8.2 | Applied on 50% continuous load |  |  |  |
|  | * Emergency current rating | A | Should be Filled By Tenderer |  |
|  | * Maximum emergency temperature | °C | Should be Filled By Tenderer |  |
|  | * Allowable duration/operation | hours | Should be Filled By Tenderer |  |
|  | * Allowable total duration/annum | hours | Should be Filled By Tenderer |  |
|  | * Maximum average duration/annum on total life of cable | hours | Should be Filled By Tenderer |  |
| 3.8.3 | Applied on 20% continuous load |  |  |  |
|  | * Emergence current rating | A | Should be Filled By Tenderer |  |
|  | * Maximum emergency temperature | °C | Should be Filled By Tenderer |  |
|  | * Allowable duration/operation | hours | Should be Filled By Tenderer |  |
|  | * Allowable total duration/annum | hours | Should be Filled By Tenderer |  |
|  | * Maximum average duration/annum on total life of cable | hours | Should be Filled By Tenderer |  |
| **4** | CONSTRUCTION FEATURES |  |  |  |
| 4.1 | Conductor |  |  |  |
|  | * Material |  | Cu |  |
|  | * Nominal cross-section | mm2 | Should be Filled By Tenderer |  |
|  | * Shape of conductor |  | circular |  |
|  | * Overall diameter | mm | Should be Filled By Tenderer |  |
|  | * Waterblocking method |  | Tape/yarn |  |
|  | * Semiconducting binder tape |  | yes |  |
| 4.2 | Conductor screen |  |  |  |
|  | * Type of material |  | Fully bonded semicon. XLPE |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Nominal overall diameter | mm | Should be Filled By Tenderer |  |
|  | * Compound Identification Reference |  | yes |  |
| 4.3 | Insulation |  |  |  |
|  | * Material |  | XLPE |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Nominal overall diameter | mm | Should be Filled By Tenderer |  |
|  | * Maximum continuous operating temperature | °C | 90 |  |
|  | * Compound Identification Reference | Yes/No | Yes |  |
|  | * Maximum stress at nominal voltage |  | Should be Filled By Tenderer |  |
|  | * At conductor screen | kV/mm | Should be Filled By Tenderer |  |
|  | * At insulation screen | kV/mm | Should be Filled By Tenderer |  |
|  | * Maximum stress at impulse voltage |  | Should be Filled By Tenderer |  |
|  | * At conductor screen | kV/mm | Should be Filled By Tenderer |  |
|  | * At insulation screen | kV/mm | Should be Filled By Tenderer |  |
| 4.4 | Insulation screen |  |  |  |
|  | * Type of material |  | Fully bonded semicon. XLPE |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Nominal overall diameter | mm | Should be Filled By Tenderer |  |
|  | * Compound Identification Reference | Yes/No | Yes |  |
|  | * Indelible ink marking on screen | Yes/No | Yes |  |
| 4.5 | XLPE Manufacturing Methods |  |  |  |
|  | * Extrusion line type e.g. CCV, MDCV, VCV |  | Should be Filled By Tenderer |  |
|  | * Single pass, triple extrusion | Yes/No | Yes |  |
|  | * Curing method |  | Dry |  |
|  | * Cooling method |  | Dry |  |
|  | * Degassing Period | days | Should be Filled By Tenderer |  |
| 4.6 | Bedding for moisture absorption |  |  |  |
|  | * Type and material |  | Should be Filled By Tenderer |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Nominal overall diameter over bedding | mm | Should be Filled By Tenderer |  |
| 4.7 | Metallic screen |  |  |  |
|  | * Type and material |  | Copper wire |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Wire diameter | No. | Should be Filled By Tenderer |  |
|  | * Nominal diameter over the screen | mm | Should be Filled By Tenderer |  |
|  | * Cross sectional area of screen | mm2 | Should be Filled By Tenderer |  |
|  | * Short time current density (1 sec) | kA/mm2 | Should be Filled By Tenderer |  |
| 4.8 | Bedding/Binder tape |  |  |  |
|  | * Type and material |  | Should be Filled By Tenderer |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Nominal overall diameter over bedding | mm | Should be Filled By Tenderer |  |
| 4.9 | Metallic sheath |  |  |  |
|  | * Type and material |  | Aluminum |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Nominal diameter over the sheath | mm | Should be Filled By Tenderer |  |
|  | * Cross sectional area of sheath | mm2 | Should be Filled By Tenderer |  |
|  | * Short time current density (1 sec.) | kA/mm2 | Should be Filled By Tenderer |  |
| 4.10 | Protective anti-corrosion external sheath covering |  |  |  |
|  | * Bitumen undercoat layer |  | Yes |  |
|  | * Type and material |  | MDPE |  |
|  | * Color |  | Black |  |
|  | * Nominal thickness | mm | Should be Filled By Tenderer |  |
|  | * Minimum thickness | mm | Should be Filled By Tenderer |  |
|  | * Termite resistant | Yes/No | Yes |  |
|  | * Type of anti-termite protection |  | Should be Filled By Tenderer |  |
|  | * Thermal resistivity | K.m/W | Max 2.0 |  |
| 4.11 | Type of conductive outer layer |  | Graphite/or semicon. polymer |  |
| 4.12 | Nominal overall cable diameter | mm | Should be Filled By Tenderer |  |
| 4.13 | Weight of completed cable |  |  |  |
|  | * Copper | kg/m | Should be Filled By Tenderer |  |
|  | * Insulation | kg/m | Should be Filled By Tenderer |  |
|  | * Aluminium | kg/m | Should be Filled By Tenderer |  |
|  | * Gross Weight | kg/m | Should be Filled By Tenderer |  |
| 5 | LOSSES |  |  |  |
| 5.1 | Maximum dielectric loss per metre / phase when operating at nominal voltage and frequency and at maximum conductor temperature | W/m | Should be Filled By Tenderer |  |
| 5.2 | Maximum sheath loss per metre / phase when operating at nominal voltage and frequency and at full load condition with sheath bonded and earthed as recommended (sectionalizing cross bonding) | W/m | Should be Filled By Tenderer |  |
| 5.3 | Maximum conductor loss per metre / phase when operating at nominal voltage and frequency and at full load condition. | W/m | Should be Filled By Tenderer |  |
| 5.4 | Total loss of cable per metre / phase of three phase circuit | W/m | Should be Filled By Tenderer |  |
| **6** | ELECTRICAL VALUES |  |  |  |
| 6.1 | Maximum d.c. resistance of conductor at 20oC | μΩ/m | Should be Filled By Tenderer |  |
| 6.2 | Maximum a.c. resistance of conductor at operating temperature | μΩ/m | Should be Filled By Tenderer |  |
| 6.3 | Equivalent reactance of three phase circuit at 50 Hz | μΩ/m | Should be Filled By Tenderer |  |
| 6.4 | Electrostatic capacitance per conductor of cable at nominal voltage and operating temperature | pF/m | Should be Filled By Tenderer |  |
| 6.5 | Maximum charging current per conductor at nominal voltage | mA/m | Should be Filled By Tenderer |  |
| 6.6 | Charging capacity of three phase system (at Uo) | VAr/m | Should be Filled By Tenderer |  |
| 6.7 | Maximum dielectric loss factor of cable at normal voltage and frequency at a conductor temperature of: |  |  |  |
|  | * 20°C |  | Should be Filled By Tenderer |  |
|  | * 90°C |  | Should be Filled By Tenderer |  |
| 6.8 | Positive & Negative sequence impedance | Ω/m | Should be Filled By Tenderer |  |
| 6.9 | Zero sequence impedance (as installed conditions) |  |  |  |
|  | * Resistance | Ω/m | Should be Filled By Tenderer |  |
|  | * Reactance | Ω/m | Should be Filled By Tenderer |  |
|  | * Capacitance | pF/m | Should be Filled By Tenderer |  |
| 6.10 | Surge impedance | Ω | Should be Filled By Tenderer |  |
| **7** | BONDING & EARTHING |  |  |  |
| 7.1 | Number of connections to earth |  | Should be Filled By Tenderer |  |
| 7.2 | Interconnected sheaths at joint positions | Yes/No | Yes |  |
| **8** | **TYPE TEST CERTIFICATE** |  |  |  |
| 8.1 | 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 |  |
| **9** | **OTHER INSTALLATION DATA** |  |  |  |
| 9.1 | Minimum cable bending radius when laid: |  |  |  |
|  | * Direct burial | mm | Should be Filled By Tenderer |  |
|  | * In air | mm | Should be Filled By Tenderer |  |
|  | * In ducts | mm | Should be Filled By Tenderer |  |
|  | * At terminations (with former) | mm | Should be Filled By Tenderer |  |
| 9.2 | Maximal permissible pulling force of total cable | kN | Should be Filled By Tenderer |  |
| 9.3 | Maximal side wall bearing pressure to the cable at bending points | kN/m | Should be Filled By Tenderer |  |
| 9.4 | Delivery length per drum |  |  |  |
|  | * Normal | m | Should be Filled By Tenderer |  |
|  | * Maximum | m | Should be Filled By Tenderer |  |
| 9.5 | Maximal weight of full drum with maximum delivery length of cable | kg | Should be Filled By Tenderer |  |
| 9.6 | Drum dimensions: |  |  |  |
|  | * Flange diameter | m | Should be Filled By Tenderer |  |
|  | * Core diameter | m | Should be Filled By Tenderer |  |
|  | * Width | m | Should be Filled By Tenderer |  |

h) 11kV SURGE ARRESTER

| 1. 11kV SURGE ARRESTER | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
|  | 11kV SURGE ARRESTERS |  |  |  |
|  | **General** |  |  |  |
| 1.1 | Manufacturer of surge arrester: |  |  |  |
| 1.1.1 | Name |  | Should be Filled By Tenderer |  |
| 1.1.2 | Country |  | Should be Filled By Tenderer |  |
| 1.2 | Manufacturer of surge counter: |  |  |  |
| 1.2.1 | Name |  | Should be Filled By Tenderer |  |
| 1.2.2 | Country |  | Should be Filled By Tenderer |  |
| 1.3 | Type designation for surge arresters |  | Should be Filled By Tenderer |  |
| 1.4 | Type designation for surge counter (equipped with leakage current measuring device ) |  | Should be Filled By Tenderer |  |
| 1.5 | Applicable standard |  | IEC 60099-4 |  |
| 1.6 | Rated frequency | Hz | 50 |  |
| 1.7 | Nominal line to line voltage rating | kV | 12 |  |
| 1.8 | Type |  | MOA |  |
| 1.9 | Class of surge arrester |  | Very Heavy |  |
| 1.10 | Maximum and Minimum ambient temperature for design | °C | Acc. to section a |  |
| 1.11 | Altitude above sea level | m | Acc. to section a |  |
| 1.12 | Design seismic acceleration | g | Acc. to section a |  |
| 1.13 | Ice thickness | mm | Acc. to section a |  |
| 1.14 | Wind velocity | m/s | Acc. to section a |  |
| 1.15 | Maximum overvoltage factor on the system due to any switching duty | pu | 2.3 |  |
| 1.16 | Whether withstanding in load combinations of earthquake , wind , short circuit, as mentioned In Technical Specification? | (Yes / No ) | Yes |  |
|  | **Surge Arresters** |  |  |  |
| 1.17 | Rated voltage | kV rms | 9 |  |
| 1.18 | Continuous operating voltage | kV rms | 7.2 |  |
| 1.19 | Long duration discharge class as per IEC 99-1 | Class | 2 |  |
| 1.20 | Number of phases |  | 3 |  |
| 1.21 | Type of system earthing |  | Effective |  |
| 1.22 | Nominal discharge current with 8/20 us wave | kA peak | 10 |  |
| 1.23 | Arrester designation |  | SL |  |
| 1.24 | Type of housing in the case of utilizing porcelain and its classification acc to Std. 60672 |  | Brown glazed Aluminum porcelain class C130 |  |
| 1.25 | 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 |  |
| 1.26 | Earth fault factor |  | 1.4 |  |
| 1.27 | Place of installation |  | Transformer Tertiary Cable Box |  |
| 1.28 | Pressure relief class |  |  |  |
| 1.28.1 | High current 0.2 sec | kA | 25 |  |
| 1.28.2 | Low current 1 sec |  | 600±200 |  |
| 1.29 | Thermal energy rating (Wth) | (kJ / kV) of  U rated | > 4 |  |
| 1.30 | Repetitive charge transfer rating (Qrs) | C | > 1 |  |
| 1.31 | Reference voltage | kV rms | Should be Filled By Tenderer |  |
| 1.32 | Reference current | mA | Should be Filled By Tenderer |  |
| 1.33 | TOV capability for |  |  |  |
| 1.33.1 | 1 sec | kV | Acc. to IEC 60099-4 |  |
| 1.33.2 | 10 sec | kV | Acc. to IEC 60099-4 |  |
| 1.34 | Continuous current under ambient temperature | mA | Should be Filled By Tenderer |  |
| 1.35 | Maximum residual voltage for lightning impulse current with 8/20 microsecond wave for following impulse peaks |  |  |  |
| 1.35.1 | Switching surges-1kA/2kA | kV peak | Acc. to IEC 60099-4 |  |
| 1.35.2 | 5 KA | kV peak | Acc. to IEC 60099-4 |  |
| 1.35.3 | 10 KA | kV peak | Acc. to IEC 60099-4 |  |
| 1.35.4 | 20 KA | kV peak | Acc. to IEC 60099-4 |  |
| 1.36 | Maximum residual voltage for switching impulse current with 30/60 microsecond wave for following impulse peaks |  |  |  |
| 1.36.1 | 500 A | kV peak | Acc. to IEC 60099-4 |  |
| 1.36.2 | 1 KA | kV peak | Acc. to IEC 60099-4 |  |
| 1.36.3 | 2 KA | kV peak | Acc. to IEC 60099-4 |  |
| 1.37 | Maximum residual voltage for steep current impulse with 1/20 microsecond wave and 10 KA peak | kV peak | Should be Filled By Tenderer |  |
| 1.38 | High current 4/10 microsecond impulse withstand level | kA peak | Acc. to IEC 60099-4 |  |
| 1.39 | Low current 2000 microsecond withstand level | kA peak | Acc. to IEC 60099-4 |  |
| 1.40 | Number of arrester units |  | Should be Filled By Tenderer |  |
| 1.41 | Rated voltage of each arrester unit | kV rms | Should be Filled By Tenderer |  |
| 1.42 | Number of parallel non linear MO resistance block |  | 1 |  |
| 1.43 | Power frequency voltage versus time characteristics included? | (Yes/No) | Yes |  |
| 1.44 | Maximum internal partial discharge | pC | Acc. to IEC 60099 |  |
| 1.45 | Manufacturer quality system in accordance with ISO 9000 | Yes/No | Yes |  |
| 1.45.1 | Date of issue |  | Latest |  |
| 1.45.2 | Validity |  | Should be Filled By Tenderer |  |
| 1.45.3 | Certificate attached to the offer | Yes/No | Yes |  |
| 1.46 | Type test certificate to be issued by independent laboratory or independently witnessed type test certificate to be submitted | Yes/No | Yes |  |
| 1.46.1 | Certificate to be attached to the offer | Yes/No | Yes |  |
| 1.46.2 | Report to be attached to the offer | Yes/No | Yes |  |
|  | **Miscellaneous** |  |  |  |
| 1.47 | Insulator |  |  |  |
| 1.47.1 | Manufacturer |  | Should be Filled By Tenderer |  |
| 1.47.2 | Country |  | Should be Filled By Tenderer |  |
| 1.47.3 | Type |  | disc |  |
| 1.47.4 | Material |  | Porcelain |  |
| 1.48 | Creepage distance of insulator | mm | 372 |  |
| 1.49 | Basic insulation level of insulator at site condition | kV peak | 1.3\*LIPL |  |
| 1.50 | One minute power frequency withstand voltage of insulator at site condition | kV rms | 1.06\*SIWL/ √2 |  |
| 1.51 | Switching Impulse withstand voltage of insulator at site condition | kV peak | 1.25\*SIWL |  |
| 1.52 | Filling medium |  | Should be Filled By Tenderer |  |
| 1.53 | Method used for sealing test |  | Should be Filled By Tenderer |  |
| 1.54 | Whether washable in service (Yes/ No) | (Yes/ No) | Yes |  |
| 1.55 | Permissible force at HV terminals |  |  |  |
| 1.55.1 | Static Horizontal | N | Should be Filled By Tenderer |  |
| 1.55.2 | Static Vertical | N | Should be Filled By Tenderer |  |
| 1.55.3 | Dynamic Horizontal | N | Should be Filled By Tenderer |  |
| 1.55.4 | Dynamic vertical | N | Should be Filled By Tenderer |  |
| 1.56 | Whether isolating pads for surge arresters with surge counter provided? (Yes/No) | (Yes/ No) | Yes, separated |  |
| 1.57 | Non Linear MO resistor |  |  |  |
| 1.57.1 | Manufacturer |  | Should be Filled By Tenderer |  |
| 1.57.2 | Country |  | Should be Filled By Tenderer |  |
| 1.57.3 | Type |  | Should be Filled By Tenderer |  |
| 1.58 | Dimension of each non-linear MO resistance block |  |  |  |
| 1.58.1 | Diameter | mm | Should be Filled By Tenderer |  |
| 1.58.2 | Height | mm | Should be Filled By Tenderer |  |
| 1.59 | Total weight of single unit | kg | Should be Filled By Tenderer |  |
| 1.60 | Total weight of complete surge arrester | kg | Should be Filled By Tenderer |  |
| 1.61 | Total height of surge arrester | mm | Should be Filled By Tenderer |  |
| 1.62 | Total width of surge arrester | mm | Should be Filled By Tenderer |  |
| 1.63 | Whether grading ring for high voltage terminal required? | (Yes/ No) | Yes |  |
| 1.64 | Maximum Package weight ready for shipment | kg | Should be Filled By Tenderer |  |

i) EARTHING AND LIGHTNING PROTECTION

| 1. EARTHING AND LIGHTNING PROTECTION | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | Required | Offered |
| **1** | **EARTHING SYSTEM** |  |  |  |
| **1.1** | **General** |  |  |  |
| 1.1.1 | Manufacturers |  | Should be Filled By Tenderer |  |
| 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 | 40 |  |
| 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 | Should be Filled By Tenderer |  |
| 1.1.8 | Body resistance | Ohm | Should be Filled By Tenderer |  |
| 1.1.9 | Maximum touch voltage | V | Should be Filled By Tenderer |  |
| 1.1.10 | Maximum step voltage | V | Should be Filled By Tenderer |  |
| 1.1.11 | Tolerable touch voltage | V | Should be Filled By Tenderer |  |
| 1.1.12 | Tolerable step voltage | V | Should be Filled By Tenderer |  |
| 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 |  | Should be Filled By Tenderer |  |
|  | * Material |  | Stranded soft drawn annealed copper |  |
|  | * Minimum cross-section area   to be confirmed by acceptance calculation | mm2 | min 150 /after acceptance of calculation |  |
|  | * Number of wires | No. | Should be Filled By Tenderer |  |
|  | * Diameter of each wire | mm | Should be Filled By Tenderer |  |
|  | * Conductor diameter | mm | Should be Filled By Tenderer |  |
|  | * Density | kg/m | Should be Filled By Tenderer |  |
| 1.2.2 | Riser conductor |  |  |  |
|  | * Type |  | Should be Filled By Tenderer |  |
|  | * 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. | Should be Filled By Tenderer |  |
|  | * Diameter of each wire | mm | Should be Filled By Tenderer |  |
|  | * Conductor diameter | mm | Should be Filled By Tenderer |  |
|  | * Density | kg/m | Should be Filled By Tenderer |  |
| 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 |  | Should be Filled By Tenderer |  |
|  | Country |  | Should be Filled By Tenderer |  |
| 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 | Should be Filled By Tenderer |  |
|  | * Copper cross-section area | mm2 | Should be Filled By Tenderer |  |
|  | * Number of wires | pcs | Should be Filled By Tenderer |  |
|  | * Diameter of each wire | mm | Should be Filled By Tenderer |  |
|  | * Conductor diameter | mm | Should be Filled By Tenderer |  |
|  | * Density | kg/m | Should be Filled By Tenderer |  |
| 1.3.1.2. | Earth rod |  |  |  |
|  | * Manufacturer |  | Should be Filled By Tenderer |  |
|  | * Length | m | Min (3) |  |
|  | * Diameter | mm | Min (16) |  |
|  | * Material (copper, stainless steel) |  | Should be Filled By Tenderer |  |
| 1.3.1.3. | Stainless steel electrodes |  |  |  |
|  | The following steel flat bars will be used as earth electrodes: |  |  |  |
|  | * Cross-section area | mm2 | Should be Filled By Tenderer |  |
|  | * Dimensions | mm x mm | Should be Filled By Tenderer |  |
|  | * Density | kg/m | Should be Filled By Tenderer |  |
| 1.3.2 | Equipment mat |  |  |  |
|  | Material |  | Should be Filled By Tenderer |  |
|  | Size |  | Should be Filled By Tenderer |  |
| 1.3.3 | Manufacturer of moulds |  | Should be Filled By Tenderer |  |
| 3.4 | Type and size of cable connectors and cable lugs |  | Should be Filled By Tenderer |  |
| **1.4** | **Miscellaneous** |  |  |  |
| 1.4.1 | Minimum estimated length of ground grid (without risers) | m | Should be Filled By Tenderer |  |
| 1.4.2 | Minimum estimated quantity of rods inside substation |  | Should be Filled By Tenderer |  |
| 1.4.3 | Minimum estimated quantity of rods located at primeters of substation |  | Should be Filled By Tenderer |  |
| 1.4.4 | Is required one set of portable temporary earthing equipment? | Yes/No | Yes |  |
| 1.4.5 | Temporary grounding device |  |  |  |
|  | Type |  | Should be Filled By Tenderer |  |
|  | Material |  | Should be Filled By Tenderer |  |
|  | Short time current (3 sec ) | kA peak | Should be Filled By Tenderer |  |
|  | Length of insulated stick |  | Should be Filled By Tenderer |  |
|  | Type of insulated stick |  | Should be Filled By Tenderer |  |
| **2.** | **LIGHTNING PROTECTION** |  |  |  |
| 2.1. | Manufacturers |  | Should be Filled By Tenderer |  |
| 2.2. | Standard Applied: |  |  |  |
|  | * Protection of structures against lightning |  | IEC 62305 |  |
| 2.3. | Cross-section area | mm2 | Should be Filled By Tenderer |  |
| 2.4. | Thickness of lead-sheath | mm | Should be Filled By Tenderer |  |
| 2.5. | Supports |  |  |  |
|  | Conductor supports of the lightning protection system |  |  |  |
|  | * Type |  | Should be Filled By Tenderer |  |
| 2.6. | Earth rod |  |  |  |
|  | * Manufacturer |  | Should be Filled By Tenderer |  |
|  | * Length | m | Should be Filled By Tenderer |  |
|  | * Diameter | mm | Should be Filled By Tenderer |  |
|  | * Material (copper, stainless steel) |  | Should be Filled By Tenderer |  |
| **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 |  |

j) TRANSFORMER ONLINE CONDITION MONITORING SYSTEM

| 1. TRANSFORMER ONLINE CONDITION MONITORING SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
| **1.** | **GENERAL** |  |  |  |
| 1.1 | Manufacturer |  | Should be Filled By Tenderer |  |
| 1.2 | Type |  | Should be Filled By Tenderer |  |
| **2.** | **Field module** |  |  |  |
| 2.1 | Sampling rate | ms | Should be Filled By Tenderer |  |
| 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 | Should be Filled By Tenderer |  |
| 2.6 | Communication |  |  |  |
| 2.6.1 | Local interface for PC/Laptop connection |  |  |  |
|  | * Communication ports (Front/rear etc.) |  | Should be Filled By Tenderer |  |
|  | * Physical links (RS232/Ethernet etc.) |  | Should be Filled By Tenderer |  |
| 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.) |  | Should be Filled By Tenderer |  |
|  | * Physical links (RS485/Fibre optic etc.) |  | Fibre Optic |  |
|  | * Protocol |  | Should be Filled By Tenderer |  |
| **3.** | **Centralized HMI PC for analysis, evaluation and diagnostic** |  |  |  |
| 3.1 | Manufacturer |  | Should be Filled By Tenderer |  |
| 3.2 | Model |  | Should be Filled By Tenderer |  |
| 3.3 | Processor |  |  |  |
|  | * Type |  | Should be Filled By Tenderer |  |
|  | * Word length | Bits | Should be Filled By Tenderer |  |
|  | * Clock speed (minimun) | GHz | 3 |  |
| 3.4 | Memory size | GB | 6 |  |
|  | * Supplied (minimum) | Mb | Should be Filled By Tenderer |  |
|  | * Supportable/expandable | Gb | Should be Filled By Tenderer |  |
| 3.5 | Hard disk size | GB |  |  |
|  | * Supplied (minimum) | Gb | Should be Filled By Tenderer |  |
|  | * Supportable/expandable | Gb | Should be Filled By Tenderer |  |
| 3.6 | Optical Storage | Yes/No | Yes |  |
| 3.7 | Pointer Device |  | Should be Filled By Tenderer |  |
| 3.8 | Operating system |  | Should be Filled By Tenderer |  |
| 3.9 | Operator interface screen | inch | 24 |  |
| 3.10 | Operating temperature range | °C | Should be Filled By Tenderer |  |
| 3.11 | Maximum relative humidity | % | Should be Filled By Tenderer |  |
| 3.12 | Nominal voltage | Vac | Should be Filled By Tenderer |  |
| 3.13 | Operating frequency | Hz | Should be Filled By Tenderer |  |
| 3.14 | Power requirement | W | Should be Filled By Tenderer |  |
| **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 |  |
|  | * 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 |  |

k) 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 | |  | |
| 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 |  | 400kV/220kV: Solid | |  | |
| 11 kV Solid | |  | |
| 1.9 | Accuracy class of CTs for protection and metering equipment |  | Acc. to Bid Drawing & relay requirement | |  | |
| 1.10 | Accuracy class of CVTs for protection and metering |  | Acc. to Bid 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 | |  | |
| **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 | |  | |
| **1.13** | **Packing, transportation and storage** |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| **1.14** | **Supervision over installation and erection procedure** |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| **1.15** | **Inspection and test** |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| **2** | **Panel** |  |  | |  | |
| 2.1 | Manufacturer : |  |  | |  | |
| 2.1.1 | Name |  | Should be Filled By Tenderer | |  | |
| 2.1.2 | Country |  | Should be Filled By Tenderer | |  | |
| 2.2 | Type of panels construction |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| 2.2 | Degree of protection of panels: |  |  | |  | |
|  | Indoor | IP51 | |  | |
|  | Outdoor | IP55 | |  | |
| 2.3 | Color of Panel: |  |  | |  | |
|  | Indoor | RAL7035 | |  | |
|  | Outdoor | RAL7032 | |  | |
| 2.4 | Thickness of Panel color | Micron | between 80 and 120 | |  | |
| 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 | 4/2.5 | |  | |
|  | control circuit | mm2 | 2.5 | |  | |
| 2.8 | Voltage rating of wirings | V | Should be Filled By Tenderer | |  | |
| 2.9 | Terminal blocks : |  |  | |  | |
|  | Manufacturer / Name / Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
|  | Spare | % | 20 | |  | |
| 2.10 | 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 |  | Should be Filled By Tenderer | |  | |
| 2.14 | Other requirement |  | Acc. to Protection, control and metering system Technical Specification | |  | |
| **\*** | **Over Head Line Protection** | | | | | |
| **1** | **Distance Protection (Main I Protection)** |  | **400/220kV** | | **400/220kV** | |
| 1.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 1.2 | Applicable standard |  | Should be Filled By Tenderer | |  | |
| 1.3 | Type | Static/ Microprocessor based | Microprocessor based | |  | |
| 1.4 | Rated current |  | Should be Filled By Tenderer | |  | |
| 1.5 | Rated voltage |  | 110V DC | |  | |
| 1.6 | Rated auxiliary DC |  | 110V DC | |  | |
| 1.7 | Method of starting |  | Should be Filled By Tenderer | |  | |
| 1.8 | Number of zones : |  | Minimum 5 zone ph-ph & ph-E | |  | |
|  | Forward reach |  | Should be Filled By Tenderer | |  | |
|  | Reverse reach |  | Should be Filled By Tenderer | |  | |
| 1.9 | Mounting arrangement |  | Flush mounted | |  | |
| 1.10 | Maximum zone 1 operating time |  | Should be Filled By Tenderer | |  | |
| 1.11 | Time setting range for : |  |  | |  | |
|  | Zone 2 |  | Should be Filled By Tenderer | |  | |
|  | Zone 3 |  | Should be Filled By Tenderer | |  | |
| 1.12 | power swing blocking provided | yes/no | yes | |  | |
| 1.13 | Dielectric test voltage |  | Should be Filled By Tenderer | |  | |
| 1.14 | Type of relay characteristics |  | Should be Filled By Tenderer | |  | |
| 1.15 | Type of characteristics for phase-ground and three phase faults |  | Should be Filled By Tenderer | |  | |
| 1.16 | Number of measuring units |  | Should be Filled By Tenderer | |  | |
| 1.17 | Type of impedance measuring characteristic for phase to ground faults /setting range / step |  |  | |  | |
|  | Zone 1 |  | Should be Filled By Tenderer | |  | |
|  | Zone 2 |  | Should be Filled By Tenderer | |  | |
|  | Zone 3 |  | Should be Filled By Tenderer | |  | |
| 1.18 | Type of impedance measuring characteristic for phase to phase faults /setting range / step |  |  | |  | |
|  | Zone 1 |  | Should be Filled By Tenderer | |  | |
|  | Zone 2 |  | Should be Filled By Tenderer | |  | |
|  | Zone 3 |  | Should be Filled By Tenderer | |  | |
| 1.19 | Method of ensuring correct discrimination for three phase close up faults |  | Should be Filled By Tenderer | |  | |
| 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 | yes | |  | |
| 1.26 | internal Fuse failure blocking provided | yes/no | yes | |  | |
| 1.27 | Filtering against CVT transients provided | yes/no | yes | |  | |
| 1.28 | Current carrying /making/breaking capacity for trip contacts | A | Should be Filled By Tenderer | |  | |
| 1.29 | Weak-end in feed trip feature provided | yes/no | yes | |  | |
| 1.30 | Current reversal logic (for double lines) provided | yes/no | yes | |  | |
| **2** | **Directional EF Relay (Included Main I Distance)** |  | **400/220kV** | | **400/220kV** | |
| 2.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 2.2 | Applicable standard |  | Should be Filled By Tenderer | |  | |
| 2.3 | Rated zero sequence current | A | Should be Filled By Tenderer | |  | |
| 2.4 | Rated zero sequence polarizing voltage | V | Should be Filled By Tenderer | |  | |
| 2.5 | Whether the following characteristics provided : |  | Should be Filled By Tenderer | |  | |
| 2.6 | Normal inverse /Very inverse / Extremely inverse |  | Should be Filled By Tenderer | |  | |
| 2.7 | Whether instantaneous unit provided | yes/no | yes | |  | |
| 2.8 | Mounting arrangement |  | Flush mounted | |  | |
| 2.9 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | |  | |
| 2.10 | Current setting range in instantaneous/ definite characteristic / step | A | Should be Filled By Tenderer | |  | |
| 2.11 | Time setting range / step | Sec | Should be Filled By Tenderer | |  | |
| 2.12 | Relay characteristic angle | deg | Should be Filled By Tenderer | |  | |
| 2.13 | Drop-off / pick-up ratio |  | Should be Filled By Tenderer | |  | |
| 2.14 | Hand reset operation indicator | yes/no | yes | |  | |
| 2.15 | Power consumption | VA | Should be Filled By Tenderer | |  | |
| 2.16 | Inrush current blocking | yes/no | yes | |  | |
| 2.17 | Transient over reach | yes/no | yes | |  | |
| 2.18 | Current reversal logic (for parallel lines) provided | yes/no | yes | |  | |
| 2.19 | Echo feature for tele-protection provided | yes/no | yes | |  | |
| **3** | **Current Differential Protection (Main II Protection)** |  | **400/220kV** | | **400/220kV** | |
| 3.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 3.2 | Fault setting with maximum number of current transformers connected primary amperes for : |  |  | |  | |
|  | Phase/earth fault | A | Should be Filled By Tenderer | |  | |
|  | Phase/phase fault | A | Should be Filled By Tenderer | |  | |
| 3.3 | Basic sensitivity setting range | % | Should be Filled By Tenderer | |  | |
| 3.4 | Rated current | A | Should be Filled By Tenderer | |  | |
| 3.5 | Current setting range | A | Should be Filled By Tenderer | |  | |
| 3.6 | Current transformer supervision alarm setting with maximum number of current transformer |  | Should be Filled By Tenderer | |  | |
| 3.7 | Connected (primary amperes) | A | Should be Filled By Tenderer | |  | |
| 3.8 | Pick up ration (slop) setting range | % | Should be Filled By Tenderer | |  | |
| 3.9 | Pick-up time : |  |  | |  | |
|  | At “3” times fault setting | Ms | Should be Filled By Tenderer | |  | |
|  | At “ 10” times fault setting | Ms | Should be Filled By Tenderer | |  | |
| 3.10 | Maximum through fault current at which protection is stable | A | Should be Filled By Tenderer | |  | |
| 3.11 | Current transformer requirement : |  |  | |  | |
|  | Knee point voltage | V | Should be Filled By Tenderer | |  | |
|  | Winding resistance | Ohm | Should be Filled By Tenderer | |  | |
|  | Maximum exciting current at knee point voltage | MA | Should be Filled By Tenderer | |  | |
| 3.12 | Max operating time | Ms | Should be Filled By Tenderer | |  | |
| 3.13 | Number of contacts available |  | Should be Filled By Tenderer | |  | |
| 3.14 | Relay burden | VA | Should be Filled By Tenderer | |  | |
| 3.15 | Setting of series connected reinforcing contactor | A | Should be Filled By Tenderer | |  | |
| 3.16 | Resistance of series connected | Ohm | Should be Filled By Tenderer | |  | |
| 3.17 | Values of series resistance and wattage |  | Should be Filled By Tenderer | |  | |
| 3.18 | Isolator Aux switches requirement : |  |  | |  | |
|  | Number of contacts normally open |  | Should be Filled By Tenderer | |  | |
|  | Number of contacts normally closed |  | Should be Filled By Tenderer | |  | |
|  | Timing sequence between aux switches and main contacts |  | Should be Filled By Tenderer | |  | |
| 3.19 | Maximum total lead burden | VA | Should be Filled By Tenderer | |  | |
| 3.20 | Recommended cable lead burden | Mm | Should be Filled By Tenderer | |  | |
| 3.21 | CT circuit supervision time setting range | S | Should be Filled By Tenderer | |  | |
| 3.22 | IEC 61850 communication protocol support | yes/no | yes | |  | |
| **4** | **Directional Earth Fault Relay (Include Main II protection)** |  | **400/220kV** | | **400/220kV** | |
| 4.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 4.2 | Applicable standard |  | Should be Filled By Tenderer | |  | |
| 4.3 | Rated zero sequence current | A | Should be Filled By Tenderer | |  | |
| 4.4 | Rated zero sequence polarizing voltage | V | Should be Filled By Tenderer | |  | |
| 4.5 | Rated auxiliary DC voltage | V | Should be Filled By Tenderer | |  | |
| 4.6 | Whether the following characteristics provided : |  |  | |  | |
|  | Normal inverse |  | Should be Filled By Tenderer | |  | |
|  | Very inverse |  | Should be Filled By Tenderer | |  | |
|  | Extremely inverse |  | Should be Filled By Tenderer | |  | |
| 4.7 | Mounting arrangement |  | Flush mounted | |  | |
| 4.8 | Whether instantaneous unit provided | yes/no | yes | |  | |
| 4.9 | Current setting range | A | Should be Filled By Tenderer | |  | |
| 4.10 | Drop-off / pick-up ratio |  | Should be Filled By Tenderer | |  | |
| 4.11 | Hand reset operation indicator provided | yes/no | yes | |  | |
| 4.12 | Power consumption | VA | Should be Filled By Tenderer | |  | |
| 4.13 | IEC 61850 communication protocol support | yes/no | yes | |  | |
|  |  |  |  | |  | |
| **5** | **Under & Over Voltage Relay** |  | **Under Voltage** | **Over Voltage** | **Under Voltage** | **Over Voltage** |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.3 | Rated voltage | V | 110v DC | 110v DC |  |  |
| 5.4 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 5.5 | Resetting ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.6 | Time delay setting range / step | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.7 | Time characteristic |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.8 | voltage Setting range / step | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.9 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.10 | Mounting arrangement |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 5.12 | Manual blocking possibility | yes/no | yes | yes |  |  |
| **6** | **Autorecloser with Check synchro relay** |  | **400/220kV** | | **400/220kV** | |
| 6.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 6.2 | Applied standard |  | Should be Filled By Tenderer | |  | |
| 6.3 | number of auto recloser shots |  | Should be Filled By Tenderer | |  | |
| 6.4 | Relay type | Static/ Microprocessor based | microprocessor | |  | |
| 6.5 | whether operation indicator provided | yes/no | Should be Filled By Tenderer | |  | |
| 6.6 | provision for blocking and switching in the relay from : | Hz | Should be Filled By Tenderer | |  | |
| 6.7 | control / relay panel | yes/no | yes | |  | |
| 6.8 | remote control | yes/no | yes | |  | |
| 6.9 | range of dead time adjustment / step | sec | Should be Filled By Tenderer | |  | |
| 6.10 | range of reclaim time adjustment / step | sec | Should be Filled By Tenderer | |  | |
| 6.11 | closing pulse time | sec | Should be Filled By Tenderer | |  | |
| 6.12 | Method of blocking auto recloser |  | Should be Filled By Tenderer | |  | |
| 6.13 | when circuit breaker is open |  | Should be Filled By Tenderer | |  | |
| 6.14 | when closing into a fault |  | Should be Filled By Tenderer | |  | |
| 6.15 | Single and 3 pole reclosing | yes/no | Yes | |  | |
| 6.16 | whether operation counter provided | yes/no | Yes | |  | |
| 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 |  | Should be Filled By Tenderer | |  | |
|  | Auxiliary voltage | V | 110v DC | |  | |
|  | Timing range | sec | Should be Filled By Tenderer | |  | |
| 6.23 | Number of phases |  | Should be Filled By Tenderer | |  | |
| 6.24 | Range of voltage difference in percent of Un |  | Should be Filled By Tenderer | |  | |
| 6.25 | Range of phase angle difference |  | Should be Filled By Tenderer | |  | |
| 6.26 | Range of frequency difference |  | Should be Filled By Tenderer | |  | |
| 6.27 | Limiting Short time thermal withstand value |  | Should be Filled By Tenderer | |  | |
| 6.28 | Values of Auxiliary DC and its permissible variation | V | Should be Filled By Tenderer | |  | |
| 6.29 | DC consumption | W | Should be Filled By Tenderer | |  | |
| 6.30 | Contact data: |  |  | |  | |
|  | Number |  | Should be Filled By Tenderer | |  | |
|  | Continuous rating at 110VDC | A | Should be Filled By Tenderer | |  | |
| 6.31 | Mounting position | flush/ Surface/etc. | Flush Mounted | |  | |
| 6.32 | Accessories (if essential to relay performance) provided | yes/no | yes | |  | |
| 6.33 | Hand reset operation indicator with inscription provided | yes/no | yes | |  | |
| 6.34 | Burden | VA | Should be Filled By Tenderer | |  | |
| 6.35 | Manual close inhibit timer |  | Should be Filled By Tenderer | |  | |
| **7** | **Breaker Failure Protection (with Short zone)** |  | **400/220kV** | | **400/220kV** | |
| 7.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 7.2 | Applied standard |  | Should be Filled By Tenderer | |  | |
| 7.3 | Rated Value of Current |  | Should be Filled By Tenderer | |  | |
| 7.4 | Setting range & accuracy class of characteristic quantity |  | Should be Filled By Tenderer | |  | |
| 7.5 | Drop out current as % of pick up current |  | Should be Filled By Tenderer | |  | |
| 7.6 | Pick up time | ms | Should be Filled By Tenderer | |  | |
| 7.7 | Resetting time | ms | Should be Filled By Tenderer | |  | |
| 7.8 | Frequency | Hz | 50Hz | |  | |
| 7.9 | Burden |  | Should be Filled By Tenderer | |  | |
| 7.10 | Time details (rag etc.): |  |  | |  | |
|  | Number of timer |  | Should be Filled By Tenderer | |  | |
|  | Auxiliary voltage | V | 110v DC | |  | |
|  | Timing range | sec | Should be Filled By Tenderer | |  | |
| 7.11 | Number of phases |  | Should be Filled By Tenderer | |  | |
| 7.12 | Limiting Short time thermal withstand value |  | Should be Filled By Tenderer | |  | |
| 7.13 | Values of Auxiliary DC and its permissible variation | V | Should be Filled By Tenderer | |  | |
| 7.14 | DC consumption | W | Should be Filled By Tenderer | |  | |
| 7.15 | Contact data: |  |  | |  | |
|  | Number |  | Should be Filled By Tenderer | |  | |
|  | Continuous rating at 110VDC | A | Should be Filled By Tenderer | |  | |
| 7.16 | Mounting position | flush/Surface/etc | Flush Mounted | |  | |
| 7.17 | Accessories (if essential to relay performance) provided | yes/no | yes | |  | |
| 7.18 | Hand reset operation indicator with inscription provided | yes/no | yes | |  | |
| 7.19 | Burden | VA | Should be Filled By Tenderer | |  | |
| 7.20 | Dielectric test voltage | KV/sec | Should be Filled By Tenderer | |  | |
| 7.21 | IEC 61850 communication protocol support | yes/no | yes | |  | |
| **8** | **STUB Protection** |  | **400/220kV** | | **400/220kV** | |
| 8.1 | Manufacturer |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 8.2 | Applicable standard |  | Should be Filled By Tenderer | |  | |
| 8.3 | Rated current |  | Should be Filled By Tenderer | |  | |
| 8.4 | Current setting range |  | Should be Filled By Tenderer | |  | |
| 8.5 | Mounting arrangement |  | Should be Filled By Tenderer | |  | |
| 8.6 | Number of phases |  |  | |  | |
| 8.7 | Rated aux DC voltage |  | 110v DC | |  | |
| 8.8 | Hand reset operation indicator |  |  | |  | |
| 8.9 | Time setting range |  | Should be Filled By Tenderer | |  | |
| 8.10 | Burden |  | Should be Filled By Tenderer | |  | |
| 8.11 | IEC 61850 communication protocol support |  | yes | |  | |
| **\*** | **Power Transformer Protection** | **400/220kV** |  | |  | |
| **1** | **Biased Differential Protection Relay** |  | **400/220 kV** | | **400/220 kV** | |
| 1.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 1.2 | Applicable standard |  | Should be Filled By Tenderer | |  | |
| 1.3 | Relay type | Static/ Microprocessor based | microprocessor | |  | |
| 1.4 | Rated current | A | Should be Filled By Tenderer | |  | |
| 1.5 | Rated auxiliary DC voltage | V | 110V DC | |  | |
| 1.6 | Bias setting range | (%) | Should be Filled By Tenderer | |  | |
| 1.7 | Mounting arrangement |  | Should be Filled By Tenderer | |  | |
| 1.8 | Hand reset operation indicator provided | yes/no | Should be Filled By Tenderer | |  | |
| 1.9 | Method of preventing tripping during magnetizing inrush current |  | Should be Filled By Tenderer | |  | |
| 1.10 | Maximum through fault current for which the relay is stable | A | Should be Filled By Tenderer | |  | |
| 1.11 | Rated value of the auxiliary DC voltage | V | 110v DC | |  | |
| 1.12 | Fifth harmonic restrain feature | yes/no | yes | |  | |
| **2** | **Restricted Earth Fault Relay** |  | **400kV SIDE** | **220kV SIDE** | **400kV SIDE** | **220kV SIDE** |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.2 | Relay type | Static/ Microprocessor based | microprocessor | microprocessor |  |  |
| 2.3 | Hand reset operation indicator provided | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.4 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 2.5 | Mounting arrangement |  | Flush Mounted | Flush Mounted |  |  |
| 2.6 | Current setting range | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.7 | Voltage setting range | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.8 | Time setting range | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.9 | Resetting ratio | (%) | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **3** | **Over Current Protection Relay** |  | **400kV SIDE** | **220kV SIDE** | **400kV SIDE** | **220kV SIDE** |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.3 | Rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.4 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.5 | Current setting range in instantaneous/ definite characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.6 | Time setting range / step | Sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.7 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.8 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 3.9 | Number of phases |  |  |  |  |  |
| 3.10 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 3.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 3.12 | Current setting range of instantaneous unit | A | yes | yes |  |  |
| 3.13 | Second harmonic blocking feature | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.14 | Minimum pick-up time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.15 | Relay design (microprocessor-based, numerical) | Yes/No | Yes | Yes |  |  |
| **4** | **Neutral point Earth Fault Relay** |  | **400kV SIDE** | **220kV SIDE** | **400kV SIDE** | **220kV SIDE** |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.3 | Rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.4 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.5 | Current setting range in instantaneous/ definite charactristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.6 | Time setting range / step | Sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.7 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.8 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 4.9 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.10 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 4.11 | Hand reset operation indicator | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.12 | Current setting range of instantaneous unit | A | yes | yes |  |  |
| 4.13 | Second harmonic blocking feature | yes/no | yes | yes |  |  |
| 4.14 | Minimum pick-up time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **5** | **Aux/Earthing Trans OC & EF Protection Relay** |  | **OC** | **EF** | **OC** | **EF** |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.3 | Rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.4 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.5 | Current setting range in instantaneous/ definite characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.6 | Time setting range / step | Sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.7 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.8 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 5.9 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.10 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 5.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 5.12 | Current setting range of instantaneous unit | A | yes | yes |  |  |
| 5.13 | Second harmonic blocking feature | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.14 | Minimum pick-up time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **6** | **Directional Over Current Relay** |  | **400kV SIDE** | **220kV SIDE** | **400kV SIDE** | **220kV SIDE** |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.3 | Rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.4 | Rated polarizing voltage | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.5 | Whether the following characteristics provided : |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.6 | Normal inverse /Very inverse / Extremely inverse |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.7 | Whether instantaneous unit provided | yes/no | Yes | Yes |  |  |
| 6.8 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 6.9 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.10 | Current setting range in instantaneous/ definite characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.11 | Time setting range / step | Sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.12 | Relay characteristic angle | deg | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.13 | Drop-off / pick-up ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.14 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 6.15 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.16 | Inrush current blocking | yes/no | yes | yes |  |  |
| 6.17 | Transient over reach | yes/no | yes | yes |  |  |
| 6.18 | Current reversal logic (for parallel lines) provided | yes/no | yes | yes |  |  |
| 6.19 | Echo feature for tele-protection provided | yes/no | yes | yes |  |  |
|  |  |  |  |  |  |  |
| **7** | **Directional Earth Fault Relay** |  | **400kV SIDE** | **220kV SIDE** | **400kV SIDE** | **220kV SIDE** |
| 7.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.3 | Rated zero sequence current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.4 | Rated zero sequence polarizing voltage | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.5 | Whether the following characteristics provided : |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.6 | Normal inverse /Very inverse / Extremely inverse |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.7 | Whether instantaneous unit provided | yes/no | yes | yes |  |  |
| 7.8 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 7.9 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.10 | Current setting range in instantaneous/ definite characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.11 | Time setting range / step | Sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.12 | Relay characteristic angle | deg | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.13 | Drop-off / pick-up ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.14 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 7.15 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.16 | Inrush current blocking | yes/no | yes | yes |  |  |
| 7.17 | Transient over reach | yes/no | yes | yes |  |  |
| 7.18 | Current reversal logic (for parallel lines) provided | yes/no | yes | yes |  |  |
| 7.19 | Echo feature for tele-protection provided | yes/no | yes | yes |  |  |
| **8** | **Under & Over Relay** |  | **Under Voltage** | **Over Voltage** | **Under Voltage** | **Over Voltage** |
| 8.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.3 | Rated voltage | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.4 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 8.5 | Resetting ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.6 | Time delay setting range / step | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.7 | Time characteristic |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.8 | voltage Setting range / step | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.9 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.10 | Mounting arrangement |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 8.12 | Manual blocking possibility | yes/no | yes | yes |  |  |
| **9** | **Over Flux Relay** |  |  |  |  |  |
| 9.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.3 | Rated voltage | V | 110v DC | 110v DC |  |  |
| 9.4 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 9.5 | Resetting ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.6 | Time delay setting range / step | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.7 | Time characteristic |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.8 | voltage Setting range / step | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.9 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.10 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 9.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 9.12 | Manual blocking possibility | yes/no | yes | yes |  |  |
| **10** | **High Set and Low Set Over Current Relay** |  | **HS** | **LS** | **HS** | **LS** |
| 10.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.3 | Rated current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.4 | Current setting range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.5 | Mounting arrangement |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.6 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.7 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 10.8 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 10.9 | Current setting range of instantaneous unit | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.10 | Second harmonic blocking feature | yes/no | yes | yes |  |  |
| 10.11 | IEC 61850 communication protocol support | yes/no | yes | yes |  |  |
| **11** | **Thermal over load Protection Relay** |  |  |  |  |  |
| 11.1 | Manufacturer : |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.3 | Rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.4 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 11.5 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.6 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 11.7 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 11.8 | Current setting range of inverse unit / step |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.9 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.10 | fifth harmonic blocking feature | yes/no | yes | yes |  |  |
| 11.11 | Current setting range / step of instantaneous unit |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.12 | type of characteristic |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **12** | **Aux/Earthing Transformer Sensitive Earth Fault Protection Relay** |  |  |  |  |  |
| 12.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.3 | Rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.4 | Current setting range in inverse characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.5 | Current setting range in instantaneous/ definite characteristic / step | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.6 | Time setting range / step | Sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.7 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.8 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 12.9 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.10 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 12.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 12.12 | Current setting range of instantaneous unit | A |  |  |  |  |
| 12.13 | Second harmonic blocking feature | yes/no | yes | yes |  |  |
| 12.14 | Minimum pick-up time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  |  |  |  |  |  |  |
| **13** | **Breaker Failure Protection (with Short zone)** |  | **400kV Side** | **220kV Side** | **400kV Side** | **220kV Side** |
| 13.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.2 | Applied standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.3 | Rated Value of Current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.4 | Setting range & accuracy class of characteristic quantity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.5 | Drop out current as % of pick up current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.6 | Pick up time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.7 | Resetting time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.8 | Frequency | Hz | 50 | 50 |  |  |
| 13.9 | Burden |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.10 | Time details (rag etc): |  |  |  |  |  |
|  | Number of timer |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Auxiliary voltage | V | 110v DC | 110v DC |  |  |
|  | Timing range | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.11 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.12 | Limiting Short time thermal withstand value |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.13 | Values of Auxiliary DC and its permissible variation | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.14 | DC consumption | W | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.15 | Contact data: |  |  |  |  |  |
|  | Number |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Continuous rating at 110VDC | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.16 | Mounting position | flush/Surface/etc | Flush Mounted | Flush Mounted |  |  |
| 13.17 | Accessories (if essential to relay performance) provided | yes/no | yes | yes |  |  |
| 13.18 | Hand reset operation indicator with inscription provided | yes/no | yes | yes |  |  |
| 13.19 | Burden | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.20 | Dielectric test voltage | KV/sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 13.21 | IEC 61850 communication protocol support | yes/no | yes | yes |  |  |
| **14** | **AVR Relay** |  | **400/220 kV** | | **400/220 kV** | |
| 14.1 | Manufacturer : |  |  | |  | |
|  | Name |  | Should be Filled By Tenderer | |  | |
|  | Country |  | Should be Filled By Tenderer | |  | |
|  | Type designation |  | Should be Filled By Tenderer | |  | |
| 14.2 | Applicable standard |  | Should be Filled By Tenderer | |  | |
| 14.3 | Relay rated current | A | Should be Filled By Tenderer | |  | |
| 14.4 | Relay rated voltage | V | Should be Filled By Tenderer | |  | |
| 14.5 | Rated auxiliary DC voltage | Vdc | 110V DC | |  | |
| 14.6 | Current circuit power consumption | VA | Should be Filled By Tenderer | |  | |
| 14.7 | Voltage circuit power consumption | VA | Should be Filled By Tenderer | |  | |
| 14.8 | Rated frequency range | Hz | 50 | |  | |
| 14.9 | Regulating voltage setting range / step | V | Should be Filled By Tenderer | |  | |
| 14.10 | Dead band voltages setting / step | V | Should be Filled By Tenderer | |  | |
| 14.11 | Initial time delay setting / step : |  |  | |  | |
|  | Inverse |  | Should be Filled By Tenderer | |  | |
|  | Definite |  | Should be Filled By Tenderer | |  | |
| 14.12 | Inter tap delay |  | Should be Filled By Tenderer | |  | |
| 14.13 | Under voltage setting /step | V | Should be Filled By Tenderer | |  | |
| 14.14 | Over voltage setting / step | V | Should be Filled By Tenderer | |  | |
| 14.15 | Load over current setting / step | A | Should be Filled By Tenderer | |  | |
| 14.16 | Circulating current setting /step |  | Should be Filled By Tenderer | |  | |
| 14.17 | Line drop compensation setting / step : |  |  | |  | |
|  | Reactive setting |  | Should be Filled By Tenderer | |  | |
|  | Reactive setting |  | Should be Filled By Tenderer | |  | |
| 14.18 | Out-put contacts : |  |  | |  | |
|  | Number |  | Should be Filled By Tenderer | |  | |
|  | Type | NO/NC | Should be Filled By Tenderer | |  | |
|  | Rated breaking capacity | VA | Should be Filled By Tenderer | |  | |
|  | Rated continuous current | A | Should be Filled By Tenderer | |  | |
| 14.19 | Mounting arrangement |  | Should be Filled By Tenderer | |  | |
| 14.20 | Hand reset operation indicator | yes/no | yes | |  | |
| 14.21 | IEC 61850 communication protocol support | yes/no | yes | |  | |
| 14.22 | Transformer Monitoring in accordance to IEC 60354 and IEC 60076 | yes/no | yes | |  | |
| **\*** | **Busbar Protection** |  |  |  |  |  |
| **1** | **Differential Protection Relay** |  | **400kV** | **220kV** | **400kV** | **220kV** |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.2 | Type reference |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.3 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.4 | Relay type, static or elec. Mech. or other system of measuring basis ( High imp, restrain current , directional comparison, etc) |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.5 | Relay rated current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.6 | Relay burden | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.7 | Frequency | Hz | 50 | 50 |  |  |
| 1.8 | Current setting range : |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.9 | Phase / earth fault | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.10 | Phase / Phase fault | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.11 | Time between fault commencement and initiation of trip: |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.12 | At 3 times fault setting | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.13 | At 10 times fault setting | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.14 | Max through fault current for which relay is stable | KA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.15 | CT supervision relay | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.16 | Current Transformer requirement : |  |  |  |  |  |
|  | Formula for knee point voltage |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Max of magnetization current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.17 | CT Supervision relay details: |  |  |  |  |  |
|  | Type and manufacturer |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Alarm pick up current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Alarm pick up time |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | short circuit CT lead provided | yes/no | yes | yes |  |  |
|  | Blocking trip after a preset time provided | yes/no | yes | yes |  |  |
| 1.18 | Relay allowable saturation factor |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.19 | Hand reset operation indicator provided | yes/no | yes | yes |  |  |
| 1.20 | Mounting position (flush , surface , etc) |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.21 | Rated values of auxiliary energizing quantity & its permissible variation | VDC | 110v DC | 110v DC |  |  |
| 1.22 | Short time rating | KA/sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.23 | Fault setting with maximum number of CTs connected |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.24 | Isolating auxiliary switches provided | yes/no | yes | yes |  |  |
| 1.25 | Accessories (Essential to really performance) provided | yes/no | yes | yes |  |  |
| 1.26 | No of tripping relays |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.27 | Interference test (Mhz) | KV | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.28 | Surge test (12/50 micro second) | KV | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.29 | Self monitoring of its important circuit possible | yes/no | Yes | Yes |  |  |
| 1.30 | Automatic testing is possible | yes/no | Yes | Yes |  |  |
| 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 |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.3 | Rated voltage | V | 110V DC | 110V DC |  |  |
| 2.4 | Rated auxiliary DC voltage | V | 110V DC | 110V DC |  |  |
| 2.5 | Resetting ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.6 | Time delay setting range / step | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.7 | Time characteristic |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.8 | voltage Setting range / step | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.9 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.10 | Mounting arrangement |  | Flush mounted | Flush mounted |  |  |
| 2.11 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 2.12 | Manual blocking possibility | yes/no | yes | yes |  |  |
| **3** | **High Speed Auxiliary Relay (self-reset)** |  |  |  |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.2 | Rated voltage | VDC | 110v DC | 110v DC |  |  |
| 3.3 | Targets | yes/no | yes | yes |  |  |
| 3.4 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.5 | Pick up time: |  |  |  |  |  |
|  | Make Contact (NO) | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Break contact (NC) | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.6 | Pickup/ drop off ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.7 | Permitted ambient temperature - indoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.8 | Permitted ambient temperature - outdoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.9 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Maximum system voltages |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.10 | Current carrying capacity: |  |  |  |  |  |
|  | short time | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | continuously | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Making and conducting capacity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Breaking Capacity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.11 | Type of Mounting |  | Rail mounted | Rail mounted |  |  |
| **\*** | **General Relays** |  |  |  |  |  |
| **1** | **Self Reset Trip Relay** |  | **Heavy Duty** | **High Speed** | **Heavy Duty** | **High Speed** |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.2 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.3 | Pick-up time | msec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.4 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Reset |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.5 | Continuous current carrying capacity of already |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.6 | closed contacts | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.7 | Current breaking capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.8 | Current making capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.9 | Mounting arrangement |  | flush mounted | flush mounted |  |  |
| **2** | **Fuse Failure relay** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.3 | Operating time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.4 | Rated voltage | V | 110v DC | 110v DC |  |  |
| 2.5 | Mounting |  | flush mounted | flush mounted |  |  |
| 2.6 | Monitoring fuse fail of 1, 2 or 3 phase | yes/no | yes | yes |  |  |
| 2.7 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 2.8 | setting range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **3** | **Close Relay** |  |  |  |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.2 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.3 | Pick-up time | msec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.4 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Reset |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.5 | Closed contacts continuous current capacity | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.6 | Current breaking capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.7 | Current making capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.8 | Mounting arrangement |  | flush mounted | flush mounted |  |  |
| **4** | **Lockout Relay** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.2 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.3 | Pick-up time | msec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.4 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Reset |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.5 | Continuous current carrying capacity of already |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.6 | closed contacts | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.7 | Current breaking capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.8 | Current making capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.9 | Hand reset operation indicator | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.10 | Mounting arrangement |  | flush mounted | flush mounted |  |  |
| **5** | **TCS & CCS relay** |  | **TCS** | **CCS** | **TCS** | **CCS** |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.2 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 5.3 | Supervision of CB open and close position | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.4 | Hand reset operation indicator provided | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.5 | Mounting arrangement |  | flush mounted | flush mounted |  |  |
| 5.6 | Circuit breaker trip coil current | mA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.7 | Pick-up time | msec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.8 | Continuous current carrying for closed contacts | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **6** | **Switching Control Relay** |  |  |  |  |  |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.3 | ambient temprature | c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.4 | controlled switching (opening , closing or both of them) |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.5 | operation modes | single mode / double mode | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.6 | adaptation control function | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.7 | targets for controlled switching | rapidmode/ securedmode/ both of them | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.8 | adaptation control function | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.9 | type of controlled load | transmissionline/ powertansformer/ capacitor/reactor | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.10 | analogue inputs: |  |  |  |  |  |
|  | voltage reference input value / range | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | current measuring input value / range | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | control voltage input value / range | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | temperature variation sensor input / range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | pressure variation sensor input / range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.11 | Drop-off / pick-up ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.12 | Hand reset operation indicator | yes/no | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.13 | Mounting arrangement |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.14 | Power Supply | V | 110v DC | 110v DC |  |  |
| 6.15 | Power consumption | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.16 | digital input data: | yes/no | yes | yes |  |  |
|  | Number |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | application |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Continuous rating | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.17 | open/ close power output data: | yes/no | yes | yes |  |  |
|  | Number |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Continuous rating | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Breaking capacity | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | operating time | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.18 | signal output data | yes/no | yes | yes |  |  |
| 6.19 | Number |  |  |  |  |  |
|  | Continuous rating | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Breaking capacity | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.20 | interface communication |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 6.21 | Accessories (if essential to relay performance) provided | yes/no | yes | yes |  |  |
| 6.22 | EMC tests | KV/sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **7** | **Pole Discordance Relay** |  |  |  |  |  |
| 7.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.2 | Applied standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.3 | Rated Value of Current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.4 | Setting range & accuracy of characteristic quantity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.5 | Drop out current as % of pick up current |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.6 | Pick up time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.7 | Resetting time | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.8 | Frequency | Hz | 50 | 50 |  |  |
| 7.9 | Burden |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.10 | Number of timers |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 7.11 | Auxiliary voltage | V | 110v DC | 110v DC |  |  |
| **8** | **Auxiliary Relay With Flag** |  |  |  |  |  |
| 8.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.2 | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.3 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.4 | Pick-up time | msec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.5 | Voltage in percent of rated voltage for : |  |  |  |  |  |
|  | Pick-up |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Reset |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.6 | Continuous current carrying capacity of already |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.7 | closed contacts | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.8 | Current breaking capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.9 | Current making capacity (L/R >10 msec) | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 8.10 | Hand reset operation indicator | yes/no | yes | yes |  |  |
| 8.11 | Mounting arrangement |  | flush mounted | flush mounted |  |  |
| **9** | **Auxiliary relay (self reset)** |  |  |  |  |  |
| 9.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.2 | Rated voltage | VDC | 110v DC | 110v DC |  |  |
| 9.3 | Targets | yes/no | yes | yes |  |  |
| 9.4 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.5 | Pick up time : |  |  |  |  |  |
|  | Make Contact (NO) | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Break contact (NC) | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.6 | Pickup / drop off ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.7 | Permitted ambient temperature - indoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.8 | Permitted ambient temperature - outdoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.9 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Maximum system voltages |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.10 | Current carrying capacity: |  |  |  |  |  |
|  | short time | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | continuously | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Making and conducting capacity | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Breaking Capacity | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 9.11 | Type of Mounting |  | rail mounted | rail mounted |  |  |
| **10** | **High Speed Auxiliary Relay (self reset)** |  |  |  |  |  |
| 10.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.2 | Rated voltage | VDC | 110v DC | 110v DC |  |  |
| 10.3 | Targets | yes/no | yes | yes |  |  |
| 10.4 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.5 | Pick up time: |  |  |  |  |  |
|  | Make Contact (NO) | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Break contact (NC) | ms | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.6 | Pickup/ drop off ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.7 | Permitted ambient temperature - indoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.8 | Permitted ambient temperature - outdoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.9 | Contacts detail: |  |  |  |  |  |
|  | rated voltage (ac/dc) | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Maximum system voltages |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.10 | Current carrying capacity: |  |  |  |  |  |
|  | short time | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | continuously | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Making and conducting capacity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Breaking Capacity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 10.11 | Type of Mounting |  | rail mounted | rail mounted |  |  |
| **11** | **Time Delay Relay** |  |  |  |  |  |
| 11.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.2 | Rated voltage | VDC | 110v DC | 110v DC |  |  |
| 11.3 | Output contact function |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.4 | Reset time |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.5 | Target provided |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.6 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.7 | Consistency in operate time |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.8 | Principle of operation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.9 | Permitted ambient temperature - indoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.10 | Permitted ambient temperature - outdoor | °c | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 11.11 | Type of mounting |  | rail mounted | rail mounted |  |  |
| 11.12 | Setting range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  |  |  |  |  |  |  |
| **12** | **Protection Relay Test Block** |  |  |  |  |  |
| 12.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.2 | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.3 | Rated voltage | V | 110v DC | 110v DC |  |  |
| 12.4 | Rated Current | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.5 | short circuit current capacity | A/s | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.6 | Number of contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.7 | Type of mounting |  | flush mounted | flush mounted |  |  |
| 12.8 | number of current contacts |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.9 | secondary CT contacts are shorted | yes/no | yes | yes |  |  |
| 12.10 | storage/ working temperature range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.11 | impulse withstand voltage | kV | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 12.12 | test plug type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **\*** | **Control System Equipment** |  |  |  |  |  |
| **1** | **Synchronizing Equipment** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.2 | Applicable standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.3 | Rated auxiliary DC voltage | V | 110v DC | 110v DC |  |  |
| 1.4 | Rated frequency | Hz | 50 | 50 |  |  |
| 1.5 | Rated CVT secondary voltage | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.6 | Mounting arrangement |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.7 | Maximum slip frequency at which CB closes | Hz | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.8 | Maximum phase difference at which CB closes |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.9 | Accuracy |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.10 | Continuous over voltage rating | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.11 | Short time rating |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| **2** | **Double voltmeter:** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.2 | Setting Range / step |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.3 | Overall dimensions | mm\*mm | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.4 | Type of mounting |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.5 | Method of mounting |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.6 | Total deflection angle |  | 240 | 240 |  |  |
| 2.7 | Total scale length |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.8 | Burden |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 2.9 | Accuracy |  | 1.5 | 1.5 |  |  |
| **3** | **Double frequency meter:** |  |  |  |  |  |
| 3.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.2 | Range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.3 | Overall dimensions |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.4 | Type of mounting |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.5 | Method of mounting |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.6 | Total deflection angle | deg | 240 | 240 |  |  |
| 3.7 | Total scale length |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.8 | Burden |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.9 | Accuracy |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.10 | Synchroscope: |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.11 | Overall dimensions |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.12 | Type of mounting |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 3.13 | Method of mounting |  | Flush mounted | Flush mounted |  |  |
| **4** | **Synchro-scope meter:** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.2 | Type and manufacturer |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.3 | Rated voltage / frequency |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.4 | Voltage difference setting range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.5 | Phase angle difference setting range |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.6 | Frequency difference setting range (slip) |  |  |  |  |  |
|  | Paralleling |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Synchronizing |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.7 | Operating time |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.8 | Resetting time |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.9 | Duration of output signal |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.10 | Dead voltage limit |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.11 | Live voltage limit |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.12 | Over load capacity |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.13 | Pick-up to drop-off ratio |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.14 | Duration of output signal |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 4.15 | Method of mounting |  | Flush mounted | Flush mounted |  |  |
| **5** | **Synchronizing relay** |  |  |  |  |  |
| 5.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.2 | Applied standard |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.3 | number of auto recloser shots |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.4 | Relay type (microprocessor) |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.5 | whether operation indicator provided | yes/no | yes | yes |  |  |
| 5.6 | provision for blocking and switching in the relay from : |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.7 | control / relay panel | yes/no | yes | yes |  |  |
| 5.8 | remote control | yes/no | yes | yes |  |  |
| 5.9 | range of dead time adjustment | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.10 | range of reclaim time adjustment | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.11 | closing pulse time | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.12 | Method of blocking auto recloser |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.13 | when circuit breaker is open |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.14 | when closing into a fault |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.15 | whether operation counter provided | yes/no | yes | yes |  |  |
| 5.16 | whether following features provided for safe closing |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.17 | synchronizing check in live bus / live line | yes/no | yes | yes |  |  |
| 5.18 | live line / dead bus | yes/no | yes | yes |  |  |
| 5.19 | live bus / dead line | yes/no | yes | yes |  |  |
| 5.20 | dead bus / dead line | yes/no | yes | yes |  |  |
| 5.21 | Time details (rag etc): |  |  |  |  |  |
|  | Number of timer |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Auxiliary voltage | V | 110v DC | 110v DC |  |  |
|  | Timing range | sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.22 | Number of phases |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.23 | Limiting Short time thermal withstand value |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.24 | Values of Auxiliary DC and its permissible variation | V | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.25 | DC consumption | W | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.26 | Contact data: |  |  |  |  |  |
|  | Number |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Continuous rating at 110VDC | A | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.27 | Mounting position | flush/Surface/etc | Flush mounted | Flush mounted |  |  |
| 5.28 | Accessories (if essential to relay performance) provided | yes/no | yes | yes |  |  |
| 5.29 | Hand reset operation indicator with inscription provided | yes/no | yes | yes |  |  |
| 5.30 | Burden | VA | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 5.31 | Dielectric test voltage | KV/sec | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  |  |  |  |  |  |  |
| **\*** | **Annunciators** |  |  |  |  |  |
| **1** | **DC Operated** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Country |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
|  | Type designation |  | Should be Filled By Tenderer | Should be Filled By Tenderer |  |  |
| 1.2 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.3 | Rated auxiliary DC supply voltage |  | 110v DC | 110v DC |  |  |
| 1.4 | Speed of operation msec |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.5 | Dimensions of each window mm |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.6 | Type of reset | manual / auto | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.7 | Urgent and non-urgent alarm discrimination | yes/no | yes | yes |  |  |
| 1.8 | Type of audible alarm for : |  |  |  |  |  |
|  | Urgent cases |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Non-Urgent cases |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.9 | Whether suitable for normally open contacts | yes/no | yes | yes |  |  |
| 1.10 | Type (solid state/digital type ) | solidstate/ digitaltype | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.11 | Total power consumption per alarm point : |  |  |  |  |  |
|  | Normal condition | W | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Flashing condition | W | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Steady condition | W | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.12 | Number of windows : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.13 | On each control panel |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.14 | Total |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.15 | 10% spare windows provided | yes/no | yes | yes |  |  |
| 1.16 | Suitable for normally open contacts | yes/no | yes | yes |  |  |
| 1.17 | Whether lamp test , acknowledge , accept and reset push button is provided for each panel | yes/no | yes | yes |  |  |
| **\*** | **Metering and Measuring equipments** |  |  |  |  |  |
| **1** | **Ammeter (Separate from MC)** |  |  |  |  |  |
| 1.1 | Manufacturer : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.2 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.3 | Type | digital | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.4 | Range | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.5 | Accuracy class |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.6 | Rated frequency | Hz | 50 | 50 |  |  |
| 1.7 | CT secondary current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.8 | Total deflection angle |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.9 | Continuous overload rating of current coil in Percent of rated current |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.10 | Degree scale | Degree | 240 | 240 |  |  |
| 1.11 | Dimensions | mm\*mm | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **2** | **Voltmeters (Separate from MC)** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.2 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.3 | Type | Moving coil / digital | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.4 | Range | kV | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.5 | Accuracy class |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.6 | Rated frequency |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.7 | PT secondary voltage V |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.8 | Total deflection angle Degree |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.9 | Continuous over voltage rating of voltage coil in percent of rated voltage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.10 | Degree scale | Degree | 240 |  |  |  |
| 2.11 | Dimensions | mm\*mm | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  |  |  |  |  |  |  |
| **3** | **PF and Freq. meters (Separate from MC)** |  | **PF** | **Freq** | **PF** | **Freq** |
| 3.1 | Type and manufacturer |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.2 | Accuracy class |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.3 | Permitted ambient temperature C |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.4 | Voltage rating |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.5 | Current rating |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.6 | Total deflection angle |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.7 | Continuous overload rating of current circuit A |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.8 | Continuous overload rating of voltage circuit V |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.9 | Short time overload rating of current circuit(3 sec)A |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.10 | Short time overload rating of voltage circuit (3 sec)V |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.11 | Lead-lag measuring Yes/No |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.12 | Measuring range |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.13 | Wide range between 0/8 to 1 on both sides (lead & leg) with transducer | yes / no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.14 | Output voltage / current range of the transducer |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.15 | Overall dimensions | mm\*mm | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.16 | Rated frequency | Hz | 50 | 50 |  |  |
| 3.17 | Type of mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.18 | Insulation test voltage for one minute | KVrms | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.19 | Low reflection glass | yes / no | yes | yes |  |  |
| 3.20 | Protection degree |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **4** | **MW and MVAR meters (Separate from MC)** |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.1 | Manufacturer : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.2 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.3 | Accuracy |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.4 | Frequency |  | 50 | 50 |  |  |
| 4.5 | Current range A |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.6 | Voltage range V |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.7 | Continuous rating of : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Current circuit | % In | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Voltage circuit | % Vn | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.8 | Dimensions | mm\* mm | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.9 | Mounting arrangement |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.10 | Type (static) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **5** | **Measuring center** |  |  |  |  |  |
| 5.1 | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.2 | Manufacturer : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.3 | Accuracy : |  |  |  |  |  |
|  | Active and reactive energy |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Voltage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Current |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Power |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Frequency |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.4 | Voltage input : |  |  |  |  |  |
|  | Rated voltage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Measuring range with separate auxiliary supply |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Measuring range - self Powered |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Burden with auxiliary supply |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Burden ­- self powered |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Rated frequency |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Frequency range |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Overload capacity |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.5 | Current input : |  |  |  |  |  |
|  | Rated current |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Maximum current |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Burden |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Overload capacity |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.6 | AC auxiliary supply : |  |  |  |  |  |
|  | Auxiliary voltages |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Optional auxiliary voltages |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Supply voltage range |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Burden |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Overload |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.7 | Display : |  |  |  |  |  |
|  | LCD (No of lines) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Number of digits |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Height of digits |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Width of digits |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.8 | Output relays : |  |  |  |  |  |
|  | Contact rating |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Maximum switching power |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Maximum number of pulses |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Pulse duration |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.9 | Design : |  |  |  |  |  |
|  | Degree of protection |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Weight |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Dimensions |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.10 | Ambient conditions : |  |  |  |  |  |
|  | Temperature - operation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Temperature - storage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Humidity |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **6** | **Energy Meters ((Separate from MC)** |  |  |  |  |  |
| 6.1 | Manufacturer : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.2 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.3 | Accuracy |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.4 | Frequency | Hz | 50 | 50 |  |  |
| 6.5 | Current range suitable for | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.6 | Voltage range suitable for | V | 110 | 110 |  |  |
| 6.7 | Reverse running stop provided | yes/no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.8 | Impulse contact provided | yes/no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.9 | Whether test blocks provided | yes/no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.10 | Mounting arrangement |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.11 | power consumption : |  |  |  |  |  |
|  | Current circuit | VA | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Voltage circuit | VA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.12 | Continuous rating of : |  |  |  |  |  |
|  | Current circuit | %In | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Voltage circuit | %Vn | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.13 | Number of digits on the meter |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **\*** | **Transducer** |  |  |  |  |  |
| **1** | **MW/MVAR** |  |  |  |  |  |
| 1.1 | Make and type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.2 | Compliance with IEC 60688 |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.3 | Auxiliary power voltage range | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.4 | Combined or separate units |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.5 | Service conditions (temperature & RH) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.6 | Connections (eg two voltage & two current) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.7 | Input voltage range | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.8 | Input current range | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.9 | Output current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.10 | Accuracy class |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.11 | Burden | VA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.12 | Overload | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.13 | Case or rack mounted |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  |  |  |  |  |  |  |
| **2** | **Voltage** |  |  |  |  |  |
| 2.1 | Make and type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.2 | Compliance with IEC 69688 |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.3 | Auxiliary power voltage range | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.4 | Service conditions (temperature & RH) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.5 | Input current Amps | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.6 | Output current Amps | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.7 | Accuracy class | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.8 | Burden | VA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.9 | Overload | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.10 | Case or rack mounted |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **3** | **Current** |  |  |  |  |  |
| 3.1 | Make and type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.2 | Compliance with IEC 60688 |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.3 | Auxiliary power voltage range | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.4 | Service conditions (temperature & RH) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.5 | Input current range | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.6 | Output current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.7 | Accuracy class | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.8 | Burden | VA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.9 | Overload | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.10 | Case or rack mounted |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **4** | **Frequency** |  |  |  |  |  |
| 4.1 | Make and type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.2 | Compliance with IEC 60688 |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.3 | Auxiliary power voltage rang Watts | W | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.4 | Service conditions (temperature e& RH) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.5 | Input frequency range (eg nominal = 5%) | Hz | 50 | 50 |  |  |
| 4.6 | Output current Amps | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.7 | Accuracy class | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.8 | Burden | VA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.9 | Overload | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.10 | Case or rack mounted |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **5** | **Auxiliary relay (self reset)** |  |  |  |  |  |
| 5.1 | Manufacturer |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.2 | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.3 | Rated voltage | Vdc | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.4 | Targets | yes/no | yes | yes |  |  |
| 5.5 | Number of contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.6 | Pick up time : |  |  |  |  |  |
|  | Make Contact (NO) | ms | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Break contact (NC) | ms | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.7 | Pickup / drop off ratio |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.8 | Permitted ambient temperature - indoor | °c | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.9 | Permitted ambient temperature - outdoor | °c | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.10 | Type of Mounting |  | Rail mounted | Rail mounted |  |  |
| 5.11 | Utilization category |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.12 | Contacts detail: |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | rated voltage (ac/dc) | V | 110 | 110 |  |  |
|  | Maximum system voltages | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Current carrying capacity | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | short time | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | continuously | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Making and conducting capacity | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Breaking Capacity | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **6** | **Time Delay Relay** |  |  |  |  |  |
| 6.1 | Manufacturer/Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.2 | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.3 | Rated voltage | Vdc | 110 | 110 |  |  |
| 6.4 | Output contact function |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.5 | Reset time |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.6 | Target provided |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.7 | Number of contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.8 | Consistency in operate time |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.9 | Principle of operation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.10 | Permitted ambient temperature - indoor | °c | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.11 | Permitted ambient temperature - outdoor | °c | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.12 | Type of mounting |  | Rail mounted | Rail mounted |  |  |
| 6.13 | Setting range / step |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **\*** | **Control Panel Accessories** |  |  |  |  |  |
| **1** | **Discrepancy Control Switches :** |  |  |  |  |  |
| 1.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.2 | Type designation for : |  |  |  |  |  |
|  | CB control switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | DS control switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.3 | Rating of contacts : |  |  |  |  |  |
|  | Voltage | V | 110 | 110 |  |  |
|  | Continuous current carrying | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Make current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Break current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 1.4 | Dimensions : |  |  |  |  |  |
|  | CB control switch | mm\*mm | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | DS control switch | mm\*mm | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **2** | **Position indicators** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **3** | **Selector Switches** |  |  |  |  |  |
| 3.1 | Manufacturer / name / country for : |  |  |  |  |  |
|  | Voltmeter switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Ammeter switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Auto-reclose on / off switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Local supervisory switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.2 | Rating of contacts : |  |  |  |  |  |
|  | Voltage | V | 110 | 110 |  |  |
|  | Make current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Break current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.3 | Sub/SCADA switch for each CB provided | yes/no | yes | yes |  |  |
| **4** | **Indicating lamps** |  |  |  |  |  |
| 4.1 | Manufacturer |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.2 | Type |  | LED | LED |  |  |
| 4.3 | Voltage | V | 110 | 110 |  |  |
| 4.4 | Consumption | W | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.5 | Whether series resistors provided | yes/no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.6 | Permissible voltage variation | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.7 | Type of mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **5** | **Push buttons** |  |  |  |  |  |
| 5.1 | Manufacturer |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.2 | Type |  |  |  |  |  |
| 5.3 | No of NC contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.4 | No of NO contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.5 | Rating of contacts : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Voltage | V | 110 | 110 |  |  |
|  | Make current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Break current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Carry continuously | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **6** | **Current Test Block** |  |  |  |  |  |
| 6.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.2 | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.3 | Rated voltage | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.4 | Rated Current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.5 | short circuit current capacity | A/s | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.6 | Number of contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.7 | Type of mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.8 | number of current contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.9 | secondary CT contacts are shorted | yes/no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.10 | stoage/ working temprature range |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.11 | impulse witstand voltage | kV | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.12 | test plug type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **7** | **Voltage Test Block** |  |  |  |  |  |
| 7.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.2 | Type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.3 | Rated voltage | V | 110 | 110 |  |  |
| 7.4 | Rated Current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.5 | short circuit current capacity | A/s | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.6 | Number of contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.7 | Type of mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.8 | number of current contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.9 | secondary CT contacts are shorted | yes/no | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.10 | storage/ working temperature range |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.11 | impulse withstand voltage | kV | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.12 | test plug type designation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **8** | **Digital Event Recorder** |  |  |  |  |  |
| 8.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.2 | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.3 | No of input channels offered |  | 20 | 20 |  |  |
| 8.4 | Rated value of input voltage and tolerance |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.5 | Self testing facility |  |  |  |  |  |
|  | Manual and automatic initiation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Time between two tests adjustable |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Information about defective parts indicated |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | No of free voltage contacts provided |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.6 | Sampling rate |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.7 | Filtering time |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.8 | Capacity of buffer memory |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.9 | Battery life provided for memories Time Lock : |  |  |  |  |  |
|  | Date/time information |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Accuracy |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Synchronize able |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Battery life |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Master clock for synchronization |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.10 | Display provided : |  |  |  |  |  |
|  | Printer |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type of paper |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Printer faulty alarm/indication provided |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Alarm/indication for paper end approach |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.11 | Possibility for manual recording of : |  |  |  |  |  |
|  | All inputs |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | All inputs which are at 0 status |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | All inputs which are at 1 status |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Every selected input |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.12 | Power supply : |  |  |  |  |  |
|  | Read voltage and tolerance |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Consumption |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Supervision for failure provided |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.13 | Ambient condition : |  |  |  |  |  |
|  | Min-Max Temperature in operation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Min-Max Temperature in storage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Relative humidity max |  |  |  |  |  |
| 8.14 | Type of mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.15 | Ambient condition |  |  |  |  |  |
|  | Min-Max Temperature in operation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Min-Max Temperature in storage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Relative humidity max | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.16 | Type of mounting |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.17 | Synchronizing with other E/R |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.18 | Specification of panel According to item A in Guarantee Table(panels) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **9** | **Digital Fault Recorder** |  |  |  |  |  |
| 9.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.2 | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.3 | Manufacturer/Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.4 | Number of card |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.5 | Number of AC Channels |  | 20 | 20 |  |  |
| 9.6 | Number of DC Channels |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.7 | Date and time range |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.8 | Rated value of the current for Analog channel |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.9 | Rated value of the voltage for Analog channel Permissible |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.10 | over voltage : |  |  |  |  |  |
|  | Continuously |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | During 1 second |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.11 | Permissible over current : |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.12 | Continuously |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.13 | During 1 second |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.14 | Time interval recorded before starting of the recorder |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.15 | Time interval recorded after starting of the recorder |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.16 | Power supply: |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.17 | Rated Voltage and tolerance |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.18 | Consumption |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.19 | Supervision for failure |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.20 | Self Testing |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.21 | Mounting Position |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.22 | Specification of panel According to Item A in Guarantee Table (panels) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.23 | Permissible ambient temperature: |  |  |  |  |  |
|  | For storage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | For correct operation |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.24 | Consumption for analog : |  |  |  |  |  |
|  | Voltage channel |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Current Channel |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.25 | Total recording time |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.26 | Pre fault recording time |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.27 | Event resolution time |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.28 | Synchronizing with other F/R |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.29 | Capacity of hard disk mass storage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.30 | Capacity of floppy disk mass storage |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.31 | Printer specification : |  |  |  |  |  |
|  | Method of printing |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Printing mechanism |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Printing speed |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type of paper |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.32 | Operating system of computer |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.33 | The dialog language |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.34 | Which of the following possibilities provided: |  |  |  |  |  |
|  | Printing of single channel |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Screen printing facility |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Setting and control of acquisition |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Presentation in color |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | List of recorded event |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Magnification of the plot |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Changing of scale |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **10** | **OMICRON 356/256 Three Phase Secondary Injection Test Kit (N/A)** |  |  | |  | |
| 10.1 | Protocols |  | IEC 61850  GOOSE Monitoring  IEC60870-5-104/101  MODBUS serial  MODBUS TCP/IP | |  | |
| 10.2 | Current Amplitudes | 5/1A |  | |  | |
| 10.3 | Features on package: |  |  | |  | |
|  | QuickCMC | Yes/No | Based on bidder’s offer | |  | |
|  | State Sequencer | Yes/No | Based on bidder’s offer | |  | |
|  | TransPlay | Yes/No | Based on bidder’s offer | |  | |
|  | Harmonics | Yes/No | Based on bidder’s offer | |  | |
|  | CB Configuration | Yes/No | Based on bidder’s offer | |  | |
|  | Ramping | Yes/No | Based on bidder’s offer | |  | |
|  | Pulse Ramping | Yes/No | Based on bidder’s offer | |  | |
|  | Overcurrent | Yes/No | Based on bidder’s offer | |  | |
|  | Distance | Yes/No | Based on bidder’s offer | |  | |
|  | Advanced Distance | Yes/No | Based on bidder’s offer | |  | |
|  | VI Starting | Yes/No | Based on bidder’s offer | |  | |
|  | Autoreclosure | Yes/No | Based on bidder’s offer | |  | |
|  | Single-Phase Differential | Yes/No | Based on bidder’s offer | |  | |
|  | Advanced Differential | Yes/No | Based on bidder’s offer | |  | |
|  | Annunciation Checker | Yes/No | Based on bidder’s offer | |  | |
|  | Power analyze | Yes/No | Based on bidder’s offer | |  | |
|  | Advanced Power | Yes/No | Based on bidder’s offer | |  | |
|  | Advanced TransPlay | Yes/No | Based on bidder’s offer | |  | |
|  | Transient Ground Fault | Yes/No | Based on bidder’s offer | |  | |
|  | Synchronizer | Yes/No | Based on bidder’s offer | |  | |
|  | Meter | Yes/No | Based on bidder’s offer | |  | |
|  | Transducer | Yes/No | Based on bidder’s offer | |  | |
|  | PQ Signal Generator | Yes/No | Based on bidder’s offer | |  | |
|  | IEC 61850 Client/Server | Yes/No | Based on bidder’s offer | |  | |
|  | GOOSE Configuration | Yes/No | Based on bidder’s offer | |  | |
|  | Sampled Values Configuration | Yes/No | Based on bidder’s offer | |  | |
|  | CMControl P App | Yes/No | Optional | |  | |
|  | RelaySimTest | Yes/No | Optional | |  | |
|  | CM Engine | Yes/No | Optional | |  | |
|  | EnerLyzer | Yes/No | Optional | |  | |
|  | TransView | Yes/No | Optional | |  | |
|  | ADMO light | Yes/No | Optional | |  | |
|  | IEDScout | Yes/No | Optional | |  | |

l) LOW VOLTAGE AC SYSTEM

| 1. LOW VOLTAGE AC SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| **1** | **General** |  |  |  |
| 1.1 | Rated power of station service transformers | kVA | 500 |  |
| 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 |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 2.2 | Degree of protection of panels: |  |  |  |
|  | -         Indoor |  | IP51 |  |
|  | -         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 |  |
| 2.7 | Continuous rating of busbars | A | 1000 |  |
| 2.8 | Min. power frequency withstand voltage | kV | 2.5 |  |
| 2.9 | Single front /double front |  | Based on bidder’s offer |  |
| 2.10 | Single front /double front |  | Based on bidder’s offer |  |
| 2.11 | Type of insulation on busbars and connections |  | Based on bidder’s offer |  |
| 2.12 | Main and earth busbar type and material |  | Based on bidder’s offer |  |
| 2.13 | Maximum temperature rise inside panel | ̊C | Based on bidder’s offer |  |
| 2.14 | Method of neutral grounding |  | Based on bidder’s offer |  |
| 2.15 | Method of grounding incoming supply circuit |  | Based on bidder’s offer |  |
| 2.16 | Type of protection provided within cubicles (shutters , insulating cover , .....) |  | Based on bidder’s offer |  |
| 2.17 | Rear or front access |  | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 3.2 | Degree of protection | IP | Based on bidder’s offer |  |
| 3.3 | Type of circuit breaker | Drawout/ Plug-in/Fix | Draw out |  |
| 3.4 | Type of mounting |  | Based on bidder’s offer |  |
| 3.5 | Rated voltage | V | 415/240 |  |
| 3.6 | Type of operating mechanism |  | Based on bidder’s offer |  |
| 3.7 | Type of motor |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 3.11 | Rated making current | kA | Based on bidder’s offer |  |
| 3.12 | Number of Air circuit breaker poles |  | 4 |  |
| 3.13 | Breaking current : |  |  |  |
|  | Symmetrical | kA | Based on bidder’s offer |  |
|  | Asymmetrical | kA | Based on bidder’s offer |  |
| 3.14 | Make time with 100% rated making current | ms | Based on bidder’s offer |  |
| 3.15 | Number of N/C auxiliary contact |  | Based on bidder’s offer |  |
| 3.16 | Number of N/O auxiliary contact |  | Based on bidder’s offer |  |
| 3.17 | Operating duty cycle |  | CO-15sec-CO |  |
| 3.18 | Over load relay is required | Yes/No | yes |  |
| 3.19 | Short circuit relay is required | Yes/No | yes |  |
| **4** | **Molded Case Circuit Breaker (MCCB)** |  |  |  |
| 4.1 | Manufacturer of: |  |  |  |
|  | Name |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 4.2 | Degree of protection | IP | Based on bidder’s offer |  |
| 4.3 | Type of MCCB | Drawout/ Plug-in/Fix | Fix |  |
| 4.4 | Rated voltage | V | 415/240 |  |
| 4.5 | Rated current | A | Based on bidder’s offer |  |
| 4.6 | Number of poles |  | 3 |  |
| 4.7 | Type of operating mechanism |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 4.12 | Breaking current : |  |  |  |
|  | Symmetrical | KA | Based on bidder’s offer |  |
|  | Asymmetrical | KA | Based on bidder’s offer |  |
| 4.13 | Make time with 100% rated making current | ms | Based on bidder’s offer |  |
| 4.14 | Number Of N/C auxiliary contact |  | Based on bidder’s offer |  |
| 4.15 | Number of N/O auxiliary contact |  | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 5.2 | Degree of protection | IP | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 5.8 | Service short circuit breaking capacity | kA | Based on bidder’s offer |  |
| 5.9 | Rated short circuit making capacity | kA | Based on bidder’s offer |  |
| 5.10 | Total fault elimination time | ms | Based on bidder’s offer |  |
| 5.11 | Type of MCB characteristic |  | Based on bidder’s offer |  |
| **6** | **Fuse Switches** |  |  |  |
| 6.1 | Manufacturer of : |  |  |  |
|  | Name |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 6.2 | Degree of protection | IP | Based on bidder’s offer |  |
| 6.3 | Type of mounting | Fix/plugin/ Drawable | Based on bidder’s offer |  |
| 6.4 | Rated voltage | V | 415/240 |  |
| 6.5 | Rated current | A |  |  |
| 6.6 | Max. load break capacity |  | Based on bidder’s offer |  |
| 6.7 | Making capacity | kA | Based on bidder’s offer |  |
| 6.8 | Breaking capacity | kA | Based on bidder’s offer |  |
| 6.9 | Type of operating mechanism |  | Based on bidder’s offer |  |
| 6.10 | Number of N/C auxiliary contact |  | Based on bidder’s offer |  |
| 6.11 | Number of N/O auxiliary contract |  | Based on bidder’s offer |  |
| **7** | **Fuses** |  |  |  |
| 7.1 | Manufacturer of : |  |  |  |
|  | Name |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 7.2 | Rated voltage | V | 415/240 |  |
| 7.3 | Rated current | A | Based on bidder’s offer |  |
| 7.4 | Max. breaking capacity | kA | Based on bidder’s offer |  |
| 7.5 | Operation indicator | Yes/No | Based on bidder’s offer |  |
| 7.6 | Bases, carrier and holder required | Yes/No | Based on bidder’s offer |  |
| **8** | **Load Breaker Switch (LBS)** |  |  |  |
| 8.1 | Manufacturer of : |  |  |  |
|  | Name |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 8.2 | Rated voltage | V | 415/240 |  |
| 8.3 | Rated current | A |  |  |
| 8.4 | Max. breaking capacity | KA | Based on bidder’s offer |  |
| 8.5 | Operation indicator | Yes/No | YES |  |
| 8.6 | Bases, carrier and holder required | Yes/No | YES |  |
| 8.7 | Number of poles |  | Based on bidder’s offer |  |
| **9** | **Contactors** |  | Based on bidder’s offer |  |
| 9.1 | Manufacturer of: |  | Based on bidder’s offer |  |
|  | Name |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Country |  | Based on bidder’s offer |  |
| 9.2 | Type of mounting | Fix/plugin/Drawable | Based on bidder’s offer |  |
| 9.3 | Rated voltage | V | Based on bidder’s offer |  |
| 9.4 | Contact rating | A | Based on bidder’s offer |  |
| 9.5 | Number of auxiliary contacts |  | Based on bidder’s offer |  |

m) LOW VOLTAGE DC SYSTEM

| 1. LOW VOLTAGE DC SYSTEM | | **UNIT** | **DATA** | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | | **OFFERED** | |
| **1** | **GENERAL** |  | **110V** | **48V** | **110V** | **48V** |
| 1.1 | Variation of DC voltage | % | -15 , +10 | -15 , +10 |  |  |
| 1.2 | Grounding of DC system |  | High Resistance | Positive to Earth |  |  |
| **2** | **DC MAIN AND DISTRIBUTION PANEL** |  |  |  |  |  |
| 2.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.2 | Type of cubicles construction |  | Free standing front and rear acces | Free standing front and rear acces |  |  |
| 2.3 | Finishing colour |  | RAL7035 | RAL7035 |  |  |
| 2.4 | Continuous rating of busbars | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.5 | Continuous rating of incoming/bus coupler CBs | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.6 | Short circuit current/time | kA/S | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.7 | Applicable standards |  | IEC 61439 | IEC 61439 |  |  |
| 2.8 | Rated current of main indoor DC panel | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 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 | 40 | 40 |  |  |
| 2.14 | Altitude above sea level | m | 1850 | 1850 |  |  |
| 2.15 | Padlocking facility for switches required | Yes/No | No | No |  |  |
| 2.16 | Rated short time withstand of busbars and connections (1 sec) | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.17 | Type of insulation on busbars and connections |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.18 | Whether down dropper connections segregated from incoming/outgoing connections | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.19 | Automatic changeover operation provided in DC main panel | Yes/No | Yes | Yes |  |  |
| 2.20 | Main and earth busbar type and material |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.21 | Maximum temperature rise inside panel | ⁰C | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.22 | Method of neutral grounding |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.23 | Method of grounding incoming supply circuit |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.24 | Type of protection provided within cubicles (shutters, insulating cover....) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 2.25 | Rear or front access |  | rear and front acces | Rear and 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 |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.2 | Battery voltage : |  |  |  |  |  |
|  | Normal | V | 110 | 48 |  |  |
|  | Float | V | 128.8 | 56 |  |  |
|  | Boost | V | 147 | 64 |  |  |
|  | Min. after 10 hr discharge period | V |  |  |  |  |
| 3.3 | Rated discharge capacity : |  |  |  |  |  |
|  | 1 hr rate | Ah | Discharge characteristic to be provided by manufacturer | Discharge characteristic to be provided by manufacturer |  |  |
|  | 10 hr rate | Ah | Min 250Ah | Min 200 Ah |  |  |
| 3.4 | Type of cells | - | 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 | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.6 | Amper hour capacity of each battery at max temp, 10 hr rate to give final cell voltage | Ah | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.7 | Charging current (continuous) | A | 2% to 8% of the battery capacity, C (AH) | 2% to 8% of the battery capacity, C (AH) |  |  |
| 3.8 | Discharge duty : |  |  |  |  |  |
|  | Continuous load/duration |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Emergency load/duration |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Momentary load/duration |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.9 | Voltage per cell at end of 10 hr discharge period | V | 1.0 | 1.0 |  |  |
| 3.10 | Min. temperature | °C | Based on bidder’s offer | Based on bidder’s offer- |  |  |
| 3.11 | Max. temperature | °C | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.12 | Quantity of cells |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.13 | Quantity of cell per battery |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.14 | Quantity of cells per battery set |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.15 | Type of positive plate |  | Pocket Plate | Pocket Plate |  |  |
| 3.16 | Type of negative plate |  | Pocket Plate | Pocket Plate |  |  |
| 3.17 | Weight of one battery with electrolyte | Kg | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.18 | Complete mass of battery set | Kg | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.19 | Complete battery set dimensions |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 3.20 | Expected life of battery | Year | 20 | 20 |  |  |
| 3.21 | Method of battery charging |  | Boost / Float | Boost / Float |  |  |
| 3.22 | Rated discharge capacity of batteries | Ah |  |  |  |  |
| 3.23 | Number of battery set |  | 2 | 2 |  |  |
| 3.24 | Number of cells |  | 92 | 40 |  |  |
| 3.25 | Cell nominal voltage |  | 1.2 | 1.2 |  |  |
| 3.26 | Min. final cell voltage | V | 1.14 | 1.14 |  |  |
| 3.27 | Material of stands |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **4** | **Battery chargers** |  |  |  |  |  |
| 4.1 | Manufacturer : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.2 | Type |  | Solid State | Solid State |  |  |
| 4.3 | Number of battery charger set |  | 2 | 2 |  |  |
| 4.4 | Input voltage | V | 415/240 | 415/240 |  |  |
| 4.5 | Maximum current rating | A |  |  |  |  |
| 4.6 | Voltage ripple when charging battery | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 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 | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Short circuit level for AC supply at charger terminals for 3 Sec./1 Sec | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.8 | Load current limiter provided | Yes/No | Yes | Yes |  |  |
| 4.9 | Float charging current of the battery | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.10 | Equalize charging current of the battery | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.11 | Initial charging current of the battery | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.12 | Voltage rating : |  |  |  |  |  |
|  | Input voltage | V(AC) | 415 | Based on bidder’s offer |  |  |
|  | Output voltage | V(AC) | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Rated output voltage (float) | V | 128.8 | 56 |  |  |
|  | Rated output voltage (boost) | V | 147 | 64 |  |  |
| 4.13 | Method of cooling |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.14 | Permissive ripple of battery charger | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.15 | Type of outgoing feeder short circuit protection |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.16 | Boost charge with relevant timer provided | Yes/No | yes | Yes |  |  |
| 4.17 | Ground fault protection provided | Yes/No | yes | Yes |  |  |
| 4.18 | Percent of regulation with AVR for float charge |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.19 | Rectifier transformer : |  |  |  |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Rating |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.20 | Semi-conductor rectifiers : |  |  |  |  |  |
|  | Manufacture |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type of cooling |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type of voltage surge suppression |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.21 | Ambient conditions : |  |  |  |  |  |
| 4.22 | Temperature | °C | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.23 | Altitude | m | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.24 | Humidity | % | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.25 | Type of protections : |  |  |  |  |  |
|  | AC phase failure | Yes/No | yes | yes |  |  |
|  | AC phase sequence | Yes/No | yes | yes |  |  |
|  | Blocking diode | Yes/No | yes | yes |  |  |
| 4.26 | Dropper | Yes/No | yes | yes |  |  |
|  | Inrush current | Yes/No | yes | yes |  |  |
|  | Battery reverse | Yes/No | yes | yes |  |  |
| 4.27 | Alarm & Indications : |  |  |  |  |  |
|  | Over voltage alarm for AC/ DC |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Under voltage alarm for AC/ DC |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Earth fault alarm for AC/ DC |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Current indication for AC/ DC |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.28 | Diode Dropper for Load Voltage Regulator | Yes/No | No | No |  |  |
| 4.29 | IGBT Switch for Load Voltage Regulator | Yes/No | Yes | Yes |  |  |
| 4.30 | Rated discharge period hours |  | 10 | 10 |  |  |
| 4.31 | Type |  | Solid State | Solid State |  |  |
| 4.32 | Number of battery charger set |  | 2 | 2 |  |  |
| 4.33 | Automatic changeover operation provided in charger | Yes/No | Yes | Yes |  |  |
| 4.34 | Charger can be parallel to another | Yes/No | Yes | Yes |  |  |
| 4.35 | Panel : |  |  |  |  |  |
| 4.36 | Total weight | Kg | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.37 | Dimensions (WxHxD) | cm | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 4.38 | Color | RAL | 7035 | 7035 |  |  |
| 4.39 | protection degree | IP | IP51 | IP51 |  |  |
| 4.40 | Rear or front access |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  |  |  |  |  |  |  |
| **5** | **Molded Case Circuit Breaker (MCCB)** |  |  |  |  |  |
| 5.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.2 | Type of mounting | Fix/plugin/ Drawable | Fix | Fix |  |  |
| 5.3 | Degree of protection | IP | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.4 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.5 | Rated voltage | V | 110 | 48 |  |  |
| 5.6 | Rated current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.7 | Rated short time withstand current (1 sec.) | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.8 | Number of poles |  | 2 | 2 |  |  |
| 5.9 | Type of operating mechanism |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.10 | Type of motor |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.11 | One minute power frequency withstand level | KV | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.12 | Whether circuit breakers are motorized | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 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 | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.16 | Breaking current : |  |  |  |  |  |
|  | Symmetrical | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Asymmetrical | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.17 | Make time with 100% rated making current | ms | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.18 | Design: | Fix/plugin/ Drawable | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.19 | Number Of N/C auxiliary contact |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.20 | Number of N/O auxiliary contact |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.21 | Antipumping feature is required | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.22 | Over load relay is required | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 5.23 | Short circuit relay is required | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **6** | **Miniature Circuit Breakers (MCB)** |  |  |  |  |  |
| 6.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.2 | Type of mounting (Fix/plug in/Drawable) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.3 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.4 | Rated voltage | V | 110 | 48 |  |  |
| 6.5 | Rated current | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.6 | Rated short time withstand current (1 sec.) | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.7 | Number of poles |  | 2 | 2 |  |  |
| 6.8 | Service short circuit breaking capacity | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.9 | Rated short circuit making capacity | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.10 | Total fault elimination time | ms | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.11 | Type of MCB characteristic |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 6.12 | Degree of protection | IP | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **7** | **Fuse Switches** |  |  |  |  |  |
| 7.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.2 | Type of mounting | Fix/plugin/ Drawable | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.3 | Degree of protection | IP | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.4 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.5 | Rated voltage | V | 110 | 48 |  |  |
| 7.6 | Rated current | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.7 | Max. load break capacity |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.8 | Making capacity | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.9 | Breaking capacity | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.10 | Type of operating mechanism |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.11 | Number of N/C auxiliary contact |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 7.12 | Number of N/O auxiliary contract |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **8** | **Fuses** |  |  |  |  |  |
| 8.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.2 | Type of mounting (Fix/plug in/Drawable) | Fix/plugin/ Drawable | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.3 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.4 | Rated voltage | V | 110 | 48 |  |  |
| 8.5 | Rated current | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.6 | Rated frequency | Hz | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.7 | Max. breaking capacity | KA | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.8 | Operation indicator | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 8.9 | Bases, carrier and holder required | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **9** | **Load Breaker Switch (LBS)** |  |  |  |  |  |
| 9.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.2 | Type of mounting (Fix/plug in/Drawable) |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.3 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.4 | Rated voltage | V | 110 | 48 |  |  |
| 9.5 | Rated current | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.6 | Rated frequency | Hz | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.7 | Max. breaking capacity |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.8 | Operation indicator | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.9 | Bases, carrier and holder required | Yes/No | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 9.10 | Number of poles |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **10** | **Contactors** |  |  |  |  |  |
| 10.1 | Manufacturer of : |  |  |  |  |  |
|  | Name |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Type |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
|  | Country |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 10.2 | Type of mounting | Fix/plugin/ Drawable | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 10.3 | Applicable standard |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 10.4 | Rated voltage | V | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 10.5 | Contact rating | A | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 10.6 | Number of auxiliary contacts |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| **11** | **UPS System** |  |  |  |  |  |
| 11.1 | Manufacturer/model |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.2 | Type of switch |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.3 | Type of MCB |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.4 | Distribution circuits (numbers and ratings) |  | 1No. min 6000 VA | N/A |  |  |
| 11.5 | Nomber of cubicles |  | Based on bidder’s offer | N/A |  |  |
| 11.6 | Forced limits at one meter |  | Based on bidder’s offer | N/A |  |  |
| 11.7 | Noise limits at one meter |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.8 | Instrumention |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.9 | Alarms |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.10 | Efficiency and power factor at 25.50% & 100% outputs |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.11 | Modular desing/system extention facilities |  | Based on bidder’s offer | Based on bidder’s offer |  |  |
| 11.12 | Provision of maintenance switch |  | Yes | N/A |  |  |
| 11.13 | Radio ferquency interference |  | Based on bidder’s offer | Based on bidder’s offer |  |  |

n) 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 |  | IEC61850/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 |  | PRP |  |
| 1.8 | Monitoring protocol in station level |  | SNMP |  |
| 1.9 | Supported protocol for time synchronizing |  | SNTP/NTP |  |
| 1.10 | Redundant configuration |  | PRP |  |
| 1.11 | Number of server | No. | 2 |  |
| 1.12 | Number of monitor for each workstation | No. | 2 |  |
| 1.13 | Number of gateway |  | Two |  |
| 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 (in station level) |  |
| 1.24 | SCADA remote center |  | R.C.C , N.S.C.C , N.C.C |  |
| 1.25 | SCADA remote center protocols |  | Acc. to DWGs |  |
| **2** | **Substation Automation System (SAS) Design** |  |  |  |
| 2.1 | Manufacturer's Name |  | Based on bidder’s offer |  |
| 2.2 | Manufacturer's Country |  | Based on bidder’s offer |  |
| 2.3 | Type designation |  | Based on bidder’s offer |  |
| 2.4 | No. of references, indicating similar transmission level projects included in the reference list ( Manufacturer's Reference list) |  | As per EQC |  |
| 2.5 | No. of references in similar transmission level projects included in the reference list |  | As per EQC |  |
| 2.6 | User friendly Software (As generally accepted, comparing MicroSoft products) |  | Yes |  |
| 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 SAS | Yes/No | yes |  |
| 2.10 | Analysis software for protection relays provided | Yes/No | yes |  |
| 2.11 | Years of experience in design and supply of numerical equipment related to SAS |  | 15 |  |
| 2.12 | Specify the Kind of LAN used for IED & protection level |  | PRP |  |
| 2.13 | Specify Data exchange rate between the electronic devices on IED level LAN (Preferably at 10/100 M bit/s) |  | 100 |  |
| 2.14 | Ethernet LAN used for Station level |  | PRP |  |
| 2.15 | Data exchange between the electronic devices on Station level shall take place via LAN at 10/100 M bit/s |  | 100 |  |
| 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/No | 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 |  |
| 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/No | yes |  |
| 2.22 | Alarm processing facility | Yes/No | yes |  |
| 2.23 | Separate loud ringing audible alarm | Yes/No | 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 |  | Based on bidder’s offer |  |
| 2.31 | Trend displays of analogues |  | Yes |  |
| 2.32 | Plant database schedule |  | Yes |  |
| 2.33 | Record of number of operations of plant |  | ≥1000 |  |
| 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/No | yes |  |
| 2.47 | Possibility of displaying of all substation and AC interlocking by the special picture |  | Yes |  |
| 2.48 | IEC61850 Standard Protocol Supporting | Yes/No | 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 |  | Based on bidder’s offer |  |
| 3.2 | Design life, in service experience, design history and future development plans |  | Based on bidder’s offer |  |
| 3.3 | Computer equipping for ultimate system |  | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 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 |  | Yes |  |
| 3.12 | Fault / event record files auto upload to SCMS |  | Yes |  |
| 3.13 | No. of levels of system access protection |  | Based on bidder’s offer |  |
| 3.14 | Multiple passwords available within each level of system access | Yes/No | yes |  |
| 3.15 | Any specified SCS & SMS function propose |  | Yes |  |
| 3.16 | System redundancy in station computer configuration |  | Yes, PRP |  |
| 3.17 | System redundancy in LAN communication configuration |  | Yes, PRP |  |
| 3.18 | System redundancy in communication server configuration |  | Yes, PRP |  |
| 3.19 | Communication between bay level and station level |  | Yes, PRP |  |
| **4** | **Station Computer (Server)** |  |  |  |
| 4.1 | Manufacturer / model |  | Based on bidder’s offer |  |
| 4.2 | Type | Industrial/Commercial | Industrial |  |
| 4.3 | Real time industrial strength equipment |  | Based on bidder’s offer |  |
| 4.4 | AC voltage working range. | V | 240 |  |
| 4.5 | Service conditions (temperature & RH) |  | Based on bidder’s offer |  |
| 4.6 | Power consumption. | W | Based on bidder’s offer |  |
| 4.7 | Architecture |  | PRP |  |
| 4.8 | Individual processors for each function |  | Based on bidder’s offer |  |
| 4.9 | Operating system software |  | Windows 11 |  |
| 4.10 | Method of processor Expansion (e.g. Number of free slots when supplied) |  | Based on bidder’s offer |  |
| 4.11 | Main (semiconductor) memory |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Supplied size |  | 16 GB |  |
|  | Maximum size |  | 16 GB |  |
| 4.12 | Hard Disc storage |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Supplied size |  | 1 TB |  |
|  | Maximum size |  | 1 TB |  |
| 4.13 | Clock |  | Based on bidder’s offer |  |
| 4.14 | Type |  |  |  |
|  | Drift per day (when not synchronized to master clock) |  | Based on bidder’s offer |  |
|  | Method of synchronization with master clock |  | Based on bidder’s offer |  |
|  | Battery back up |  | Based on bidder’s offer |  |
| 4.15 | Details of mass storage devices and data archiving devices |  | Based on bidder’s offer |  |
| **5** | **Operator/Engineering Workstation (MMI)** |  |  |  |
| 5.1 | Manufacturer / model |  | Based on bidder’s offer |  |
| 5.2 | Type | Industrial/Commercial | Industrial |  |
| 5.3 | AC voltage working range | V | 240 |  |
| 5.4 | Service conditions (temperature and RH) |  | Based on bidder’s offer |  |
| 5.5 | Power consumption | W | Based on bidder’s offer |  |
| 5.6 | Architecture |  | PRP |  |
| 5.7 | Operating system software |  | Windows 11 |  |
| 5.8 | Method of processor expansion (e.g. number of free slots when supplied) |  | Based on bidder’s offer |  |
| 5.9 | Main (semiconductor) memory |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Supplied size |  | 16 GB |  |
|  | Maximum size |  | 16 GB |  |
| 5.10 | Hard Disc storage |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Supplied size |  | 1`TB |  |
|  | Maximum size |  | 1 TB |  |
| 5.11 | Clock |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Drift per day (when not synchronized to master clock) |  | Based on bidder’s offer |  |
|  | Method of synchronization with master clock |  | Based on bidder’s offer |  |
| 5.12 | Processing system intercommunications interface |  |  |  |
|  | Number supported |  | Based on bidder’s offer |  |
|  | Type (e.g. LAN etc.) |  | Based on bidder’s offer |  |
|  | Speed |  | Based on bidder’s offer |  |
| 5.13 | Video Display Unit (VDU) |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Number to be supplied at a workstation |  | 4 |  |
|  | Screen size |  | 30 inch |  |
|  | Screen pixel resolution |  | Based on bidder’s offer |  |
|  | Compliance with recognized EMC and safety standards |  | Based on bidder’s offer |  |
|  | Type of interface |  | Based on bidder’s offer |  |
| 5.14 | Keyboard |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Number to be supplied |  | 4 |  |
|  | Total number of keys |  | Based on bidder’s offer |  |
|  | Alphanumeric character key set |  | Based on bidder’s offer |  |
|  | Control keys provided |  | Based on bidder’s offer |  |
|  | Number of special function keys |  | Based on bidder’s offer |  |
|  | Type of interface |  | Based on bidder’s offer |  |
| 5.15 | Cursor control device (Mouse) |  |  |  |
|  | Number to be supplied |  | 4 |  |
|  | Number of buttons |  | Based on bidder’s offer |  |
|  | Type (e.g. optical) |  | Based on bidder’s offer |  |
|  | Mat |  | Yes |  |
|  | Type of interface |  | Based on bidder’s offer |  |
| 5.16 | C.D Writer |  | Yes |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | Speed |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
| 5.17 | D.V.D Writer |  |  |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | Speed |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
| **6** | **Event/Operator Log Printer** |  |  |  |
| 6.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 6.2 | Type | Dot matrix/Other type | other |  |
| 6.3 | AC voltage working range. | V | 240 |  |
| 6.4 | Power consumption. | W | Based on bidder’s offer |  |
| 6.5 | Service conditions (temperature & RH) |  | Based on bidder’s offer |  |
| 6.6 | Print speed | ppm. | Based on bidder’s offer |  |
| 6.7 | Printing pitch/width |  | Based on bidder’s offer |  |
| 6.8 | No. of print pins/jets or resolution |  | Based on bidder’s offer |  |
| 6.9 | No. of fonts/character sets |  | Based on bidder’s offer |  |
| 6.10 | Paper feed proposed/width |  | A3 |  |
| 6.11 | Self-test facility |  | Based on bidder’s offer |  |
| 6.12 | Number of colors |  | Based on bidder’s offer |  |
| 6.13 | Type of interface |  | Based on bidder’s offer |  |
| 6.14 | Stand/trays |  | Based on bidder’s offer |  |
| 6.15 | Acoustic noise at one meter | dB | Based on bidder’s offer |  |
| 6.16 | Alarms local and remote |  | Based on bidder’s offer |  |
| 6.17 | Configuration/dual network connection |  | Based on bidder’s offer |  |
| **7** | **Hard Copy Color Laser Printer** |  |  |  |
| 7.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 7.2 | Type |  | Printer + Scanner |  |
| 7.3 | AC voltage working range | V | 240 |  |
| 7.4 | Power consumption | W | Based on bidder’s offer |  |
| 7.5 | Service conditions (temperature & RH). |  | Based on bidder’s offer |  |
| 7.6 | Print speed for color graphics printing (PPM) | Ppm. | Based on bidder’s offer |  |
| 7.7 | No. of colors/toners |  | Based on bidder’s offer |  |
| 7.8 | Resolution |  | Based on bidder’s offer |  |
| 7.9 | Paper handling |  | Based on bidder’s offer |  |
| 7.10 | Paper size |  | A3 and A4 |  |
| 7.11 | Type of interface |  | Based on bidder’s offer |  |
| 7.12 | Stand / trays |  | Based on bidder’s offer |  |
| 7.13 | Acoustic noise at one meter | dB | Based on bidder’s offer |  |
| 7.14 | Alarms local and remote |  | Based on bidder’s offer |  |
| 7.15 | Configuration/dual network connection |  | Based on bidder’s offer |  |
| **8** | **Master Clock/G.P.S** |  |  |  |
| 8.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 8.2 | Type |  | Based on bidder’s offer |  |
| 8.3 | AC/DC voltage working range | V | 110 V DC |  |
| 8.4 | Power consumption | W | Based on bidder’s offer |  |
| 8.5 | Service conditions (temperature & RH) |  | Based on bidder’s offer |  |
| 8.6 | Battery standby capacity |  | Based on bidder’s offer |  |
| 8.7 | Type, speed and no. of output interfaces |  | As per technical requirements |  |
| 8.8 | Time and date facility |  | Based on bidder’s offer |  |
| 8.9 | Seasonal changeover/automatic |  | Based on bidder’s offer |  |
| 8.10 | Local display |  |  |  |
|  | Day : Mon : Yr |  | Yes |  |
|  | HH : MM : SS |  | Yes |  |
| 8.11 | Drift per day (when not synchronized to radio signal) |  | Based on bidder’s offer |  |
| 8.12 | Receiver for UT from NVASTAR satellites |  | Based on bidder’s offer |  |
| 8.13 | Loss of radio synch alarm |  | Based on bidder’s offer |  |
| 8.14 | Other alarms |  | Based on bidder’s offer |  |
| 8.15 | Local alarms and contacts for alarms to SCMS |  | Based on bidder’s offer |  |
| 8.16 | Synchronization of station server with G.P.S |  | NTP, Network-Link status |  |
| 8.17 | Accuracy class |  | Based on bidder’s offer |  |
| **9** | **Furniture** |  |  |  |
| 9.1 | Workstation desk |  | 1 |  |
| 9.2 | Material of desk |  | Based on bidder’s offer |  |
| 9.3 | Durable desk top surface |  | Yes |  |
| 9.4 | Writing area |  | Yes |  |
| 9.5 | Drawers/shelves |  | Minimum 2 drawers and 2 shelves |  |
| 9.6 | Support for VDUs |  | Yes |  |
| 9.7 | Size |  | Minimum 2.4 meters |  |
| 9.8 | Height | m | 0.8 |  |
| 9.9 | Workstation chair |  | Minimum 6 |  |
| 9.10 | Material |  | Based on bidder’s offer |  |
| 9.11 | Swivel and castor action |  | Yes |  |
| 9.12 | High backed design |  | Yes |  |
| 9.13 | Arm rests |  | Yes |  |
| 9.14 | Desk lighting |  | Yes |  |
| 9.15 | Window blinds |  | Yes |  |
| **10** | **Workstation LAN** |  |  |  |
| 10.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 10.2 | Type |  | Based on bidder’s offer |  |
| 10.3 | Coaxial / optical fiber cable |  | Based on bidder’s offer |  |
| 10.4 | Operating speed. | Hz | Based on bidder’s offer |  |
| 10.5 | Protocols/compliance with IEC Standard- |  | Based on bidder’s offer |  |
| 10.6 | Media connection |  | Based on bidder’s offer |  |
| 10.7 | Network functionality |  | Based on bidder’s offer |  |
| 10.8 | Network management software |  | Based on bidder’s offer |  |
| 10.9 | Software packages |  | Based on bidder’s offer |  |
| 10.10 | Dual redundant configuration |  | PRP |  |
| **11** | **Real Time LAN** |  |  |  |
| 11.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 11.2 | Type |  | Based on bidder’s offer |  |
| 11.3 | Coaxial/optical fiber cable |  | Based on bidder’s offer |  |
| 11.4 | Operating speed. | Hz | Based on bidder’s offer |  |
| 11.5 | Protocols/compliance with IEC Standard |  | Based on bidder’s offer |  |
| 11.6 | Media connection |  | Based on bidder’s offer |  |
| 11.7 | Network functional |  | Based on bidder’s offer |  |
| 11.8 | Network management |  | Based on bidder’s offer |  |
| 11.9 | Software packages |  | Based on bidder’s offer |  |
| 11.10 | Dual redundant configuration |  | PRP |  |
| 11.11 | Deterministic operational behavior |  | Based on bidder’s offer |  |
| 11.12 | Peer to peer communications |  | Based on bidder’s offer |  |
| **12** | **Communications** |  |  |  |
| 12.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 12.2 | Type |  | Based on bidder’s offer |  |
| 12.3 | Protocol/between station computer and BCU/BCPU |  | IEC61850 |  |
|  | Manufacturer/model |  | Based on bidder’s offer |  |
|  | Compliant with IEC 60870-5-101 and IEC61850 |  | Based on bidder’s offer |  |
|  | Info transfer efficiency | data bits/total bits | Based on bidder’s offer |  |
|  | Hamming distance |  | Based on bidder’s offer |  |
|  | Security of control messages |  | Based on bidder’s offer |  |
|  | Interface |  | Based on bidder’s offer |  |
|  | Transmission rate |  | Based on bidder’s offer |  |
| 12.4 | Type and no. of communication cables to BCU/BCPU |  | Based on bidder’s offer |  |
| 12.5 | Type & no. of communications cables to protection relay and disturbance recorder |  | Based on bidder’s offer |  |
| 12.6 | Peer to Peer signaling/client server architecture |  | Based on bidder’s offer |  |
| 12.7 | Cyclic & event initiated transmissions initiated by BCU/BCPU |  | Based on bidder’s offer |  |
| 12.8 | Continued functioning of station computer and data management in the event of workstations out of service. Limitations applicable |  | Based on bidder’s offer |  |
| 12.9 | Protocol between SCMS and SCADA |  |  |  |
|  | Emulation of functionality of existing SCADA RTU |  | Based on bidder’s offer |  |
|  | Support Protocol Indactic 33 |  | Based on bidder’s offer |  |
|  | Support Protocol HDLC |  | Based on bidder’s offer |  |
|  | Support Protocol IEC101 |  | Based on bidder’s offer |  |
|  | Download of database from SCADA control center |  | Based on bidder’s offer |  |
| 12.10 | LDC modem |  |  |  |
|  | Manufacturer and model |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | DC voltage working range. | V | Based on bidder’s offer |  |
|  | Service conditions (temperature and RH). |  | Based on bidder’s offer |  |
|  | Signaling method |  | Based on bidder’s offer |  |
|  | Transmission rate and frequency |  | Based on bidder’s offer |  |
|  | Range of transmitter output |  | Based on bidder’s offer |  |
|  | Range of receiver input |  | Based on bidder’s offer |  |
|  | Low level receive alarm |  | Based on bidder’s offer |  |
|  | Compliant with ITU-T recommendations |  | Based on bidder’s offer |  |
|  | Modem switchover |  | Based on bidder’s offer |  |
| 12.11 | Laptop workstation and SCMS fault analysis |  |  |  |
|  | Modem manufacturer and model |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | DC voltage working range | V | Based on bidder’s offer |  |
|  | Service conditions (temperature and RH) |  | Based on bidder’s offer |  |
|  | Signaling method |  | Based on bidder’s offer |  |
|  | Transmission rate and frequency |  | Based on bidder’s offer |  |
|  | Range of transmitter output |  | Based on bidder’s offer |  |
|  | Range of receiver input |  | Based on bidder’s offer |  |
|  | Low level receive alarm |  | Based on bidder’s offer |  |
|  | Compliant with ITU-T recommendations |  | Based on bidder’s offer |  |
| 12.12 | Communications with adjacent SCMS system |  |  |  |
|  | Details of gateway |  | Based on bidder’s offer |  |
|  | Provision of optical fiber link |  | Based on bidder’s offer |  |
|  | Protocol |  | Based on bidder’s offer |  |
|  | Transmission rate |  | Based on bidder’s offer |  |
| **13** | **BCU/BCPU** |  |  |  |
| 13.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 13.2 | Type |  | Based on bidder’s offer |  |
| 13.3 | DC voltage working range | V | 110 |  |
| 13.4 | Service conditions (temperature) |  | Based on bidder’s offer |  |
| 13.5 | Power consumption | W | Based on bidder’s offer |  |
| 13.6 | Architecture |  | PRP |  |
| 13.7 | Memory type |  | Based on bidder’s offer |  |
| 13.8 | Memory maximum |  | Based on bidder’s offer |  |
| 13.9 | Memory supplied |  | Based on bidder’s offer |  |
| 13.10 | System bus interface/speed |  | Based on bidder’s offer |  |
| 13.11 | Provision of two redundant interfaces to LANs. |  | Based on bidder’s offer |  |
| 13.12 | Method of loading/extending database |  | Based on bidder’s offer |  |
| 13.13 | Logic functions & sequences |  | Based on bidder’s offer |  |
| 13.14 | Clock |  |  |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Drift per day (when not synchronized to master clock) |  | Based on bidder’s offer |  |
|  | Method of synchronization to master clock |  | Based on bidder’s offer |  |
| 13.15 | I/O equipping including 10% spare provided |  | Based on bidder’s offer |  |
| 13.16 | Method of data exchange with station computer (e.g. peer to peer). |  | Based on bidder’s offer |  |
| 13.17 | Provision of logic functions and sequences |  | Based on bidder’s offer |  |
| 13.18 | Direct AC input from CT/VT for analogue values |  |  |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Maximum no. inputs per card |  | Based on bidder’s offer |  |
|  | Outputs available per input |  | Based on bidder’s offer |  |
|  | Resolution/accuracy |  | Based on bidder’s offer |  |
|  | Scan cycle |  | Based on bidder’s offer |  |
|  | Burden | VA | Based on bidder’s offer |  |
|  | Input CT/VT range |  | Based on bidder’s offer |  |
|  | Input isolation |  | Based on bidder’s offer |  |
|  | Analogue limit monitoring facility at BCU |  | Based on bidder’s offer |  |
|  | No. of limits per analogue |  | Based on bidder’s offer |  |
|  | Analogue threshold monitoring range/steps available |  | Based on bidder’s offer |  |
| 13.19 | Transducer |  |  |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Maximum no. inputs per card |  | Based on bidder’s offer |  |
|  | Outputs available per input |  | Based on bidder’s offer |  |
|  | Resolution/accuracy |  | Based on bidder’s offer |  |
|  | Scan cycle |  | Based on bidder’s offer |  |
|  | Burden | VA | Based on bidder’s offer |  |
|  | Input CT/VT range |  | Based on bidder’s offer |  |
|  | Input isolation |  | Based on bidder’s offer |  |
|  | Analogue limit monitoring facility at BCU |  | Based on bidder’s offer |  |
|  | No. of limits per analogue |  | Based on bidder’s offer |  |
|  | Analogue threshold monitoring range/steps available |  | Based on bidder’s offer |  |
| 13.20 | Conventional DC analogue inputs |  |  |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Maximum no. of inputs per card |  | Based on bidder’s offer |  |
|  | ADC resolution/accuracy |  | Based on bidder’s offer |  |
|  | Current input values supported |  | Based on bidder’s offer |  |
|  | Solid state switching of inputs to ADC |  | Based on bidder’s offer |  |
|  | Scan cycle per ADC |  | Based on bidder’s offer |  |
|  | Input isolation (common/series mode) |  | Based on bidder’s offer |  |
|  | Series and common mode noise rejection |  | Based on bidder’s offer |  |
|  | Analogue limit monitoring facility at BCU |  | Based on bidder’s offer |  |
|  | No. of limits per analogue |  | Based on bidder’s offer |  |
|  | Analogue threshold monitoring range/steps available |  | Based on bidder’s offer |  |
| 13.21 | Digital inputs |  | Based on bidder’s offer |  |
|  | Number of inputs per module |  | Based on bidder’s offer |  |
|  | Digital/software filtering to suppress plant contact bounce |  | Based on bidder’s offer |  |
|  | Plant common connection at +48V (earth) |  | Based on bidder’s offer |  |
|  | Maximum input contact frequency |  | Based on bidder’s offer |  |
|  | Minimum contact closure capture time |  | Based on bidder’s offer |  |
|  | Time tagging resolution |  | Based on bidder’s offer |  |
|  | Isolation withstand |  | Based on bidder’s offer |  |
| 13.22 | Pulse counter signal inputs |  |  |  |
|  | Number of inputs per module |  | Based on bidder’s offer |  |
|  | Digital / software filtering to suppress plant contact bounce |  | Based on bidder’s offer |  |
|  | Plant common connection at +48V (earth) |  | Based on bidder’s offer |  |
|  | Maximum input contact frequency |  | Based on bidder’s offer |  |
|  | Minimum contact closure capture time |  | Based on bidder’s offer |  |
|  | Time tagging resolution |  | Based on bidder’s offer |  |
|  | Isolation withstand |  | Based on bidder’s offer |  |
| 13.23 | Digital outputs |  |  |  |
|  | Number of outputs per module |  | Based on bidder’s offer |  |
|  | Select/check back/execute facility |  | Based on bidder’s offer |  |
|  | Measurement of output circuit facility |  | Based on bidder’s offer |  |
|  | Double pole switching of output |  | Based on bidder’s offer |  |
|  | Output rating (VER) |  | Based on bidder’s offer |  |
|  | Range of output pulse |  | Based on bidder’s offer |  |
|  | Isolation withstand |  | Based on bidder’s offer |  |
| 13.24 | Set point outputs |  |  |  |
|  | Maximum numbers |  | Based on bidder’s offer |  |
|  | Number of outputs per module |  | Based on bidder’s offer |  |
|  | Output rating |  | Based on bidder’s offer |  |
|  | Digital set point / number of digits possible |  | Based on bidder’s offer |  |
|  | Analogue set point/output values |  | Based on bidder’s offer |  |
|  | Isolation withstand |  | Based on bidder’s offer |  |
| 13.25 | Serial link to protection relay |  |  |  |
|  | Protocols supported |  | Based on bidder’s offer |  |
|  | Protocols required for this project |  | Based on bidder’s offer |  |
|  | Interface |  | Based on bidder’s offer |  |
|  | Transmission rate |  | Based on bidder’s offer |  |
|  | Optical fiber cable |  | Based on bidder’s offer |  |
| 13.26 | Hardware interlocking with backup mimic (if the BCU fail) |  | Based on bidder’s offer |  |
| **14** | **Gateway** |  |  |  |
| 14.1 | Manufacturer / model |  | Based on bidder’s offer |  |
| 14.2 | Type |  | Based on bidder’s offer |  |
| 14.3 | Service conditions (temperature, RH) |  | Based on bidder’s offer |  |
| 14.4 | Protocol supporting | IEC101/103/DNO3/HDLC/INDUCTIC33 | IEC104 |  |
| 14.5 | Designation type (Hardware/Software) |  | Based on bidder’s offer |  |
| 14.6 | Processor speed |  | Based on bidder’s offer |  |
| 14.7 | Size of hard disc |  | Based on bidder’s offer |  |
| 14.8 | Size of RAM |  | Based on bidder’s offer |  |
| 14.9 | Operating system |  | Based on bidder’s offer |  |
| 14.10 | Modem / speed / connecting lead |  | Based on bidder’s offer |  |
| **15** | **External Modem** |  |  |  |
| 15.1 | Manufacturer / model |  | Based on bidder’s offer |  |
| 15.2 | Type |  | Based on bidder’s offer |  |
| 15.3 | Service conditions |  | Based on bidder’s offer |  |
| 15.4 | Speed |  | Based on bidder’s offer |  |
| 15.5 | Connecting lead |  | Based on bidder’s offer |  |
| 15.6 | Software and provide compatible with AT & T , |  | Based on bidder’s offer |  |
| **16** | **System Software** |  |  |  |
| 16.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 16.2 | Type |  | Based on bidder’s offer |  |
| 16.3 | Make and version of operating systems |  | Based on bidder’s offer |  |
| 16.4 | Details of programming languages |  | Based on bidder’s offer |  |
| 16.5 | Release versions of software |  | Based on bidder’s offer |  |
| 16.6 | Details of any software development |  | Based on bidder’s offer |  |
| 16.7 | Software licensing details |  | Based on bidder’s offer |  |
| 16.8 | Fault and event analysis software |  | Based on bidder’s offer |  |
| 16.9 | SCADA protocol |  | Based on bidder’s offer |  |
| 16.10 | SCMS protocol to BCUs/BCPUs and speed |  | Based on bidder’s offer |  |
| 16.11 | Reconfiguration system software (Yes/No) |  | Based on bidder’s offer |  |
| 16.12 | Supporting Future extension according to SLD |  | Based on bidder’s offer |  |
| 16.13 | Geographical information system software |  | Based on bidder’s offer |  |
| 16.14 | Diagnose software |  | Based on bidder’s offer |  |
| **17** | **LAPTOP** |  |  |  |
| 17.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 17.2 | Type |  | Based on bidder’s offer |  |
| 17.3 | Service conditions |  | Based on bidder’s offer |  |
| 17.4 | Method of processor expansion (e.g. number of free slots when supplied). |  | Based on bidder’s offer |  |
| 17.5 | Amount of main memory |  | 16 GB |  |
| 17.6 | Size of hard disc. |  | 1 TB |  |
| 17.7 | Processor speed |  | Based on bidder’s offer |  |
| 17.8 | Size of color display |  | 17.3 Inches |  |
| 17.9 | Build in mouse |  | Yes |  |
| 17.10 | Operating system software |  | Windows 11 |  |
| 17.11 | SCMS application software |  | Yes |  |
| 17.12 | Relay and fault recorder analysis software |  | Yes |  |
| 17.13 | Mains power supply unit |  | Yes |  |
| 17.14 | Battery backup period |  | 18 hours |  |
| 17.15 | Carry case |  | Yes |  |
| 17.16 | Modem/speed/connecting lead |  | Yes |  |
| 17.17 | Other Accessories |  | Yes |  |
| **18** | **Performance/Availability** |  |  |  |
| 18.1 | Compliance with performance requirements (start and restart) |  |  |  |
|  | Time for redundant station computer to assume online duties |  | Based on bidder’s offer |  |
|  | Time for full updating of information |  | Based on bidder’s offer |  |
|  | Confirmation the redundant station computer database is in step with the one line computer |  | Based on bidder’s offer |  |
| 18.2 | Inclusion of availability calculations |  | Based on bidder’s offer |  |
| **19** | **Inverter System** |  |  |  |
| 19.4 | Manufacturer/model |  | Based on bidder’s offer |  |
| 19.5 | Type |  | Based on bidder’s offer |  |
| 19.6 | Input DC voltage and range | V | 110V DC ±10% |  |
| 19.7 | Input AC voltage and range | V | 240 V DC ±10% |  |
| 19.8 | Service conditions (temperature and RH) |  | Based on bidder’s offer |  |
| 19.9 | Output AC voltage | V | 415V |  |
| 19.10 | Output AC voltage dynamic response | V | Based on bidder’s offer |  |
| 19.11 | Output AC voltage and static regulation | % | ±5 |  |
| 19.12 | Output frequency regulation (unsynchronized) | % | Based on bidder’s offer |  |
| 19.13 | Output AC voltage harmonic distortion | V | Based on bidder’s offer |  |
| 19.14 | Output rating | VA | Min 6000 |  |
| 19.15 | Output current overload | A | Based on bidder’s offer |  |
| 19.16 | Output frequency tracking range | Hz | Based on bidder’s offer |  |
| 19.17 | Thermal trip | A | Based on bidder’s offer |  |
| 19.18 | Output load power factor |  | Based on bidder’s offer |  |
| 19.19 | Efficiency at 25, 50, 75 and 100% output |  | Based on bidder’s offer |  |
| **20** | **AC Main Power Transient Protector** |  |  |  |
| 20.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 20.2 | Type |  | Based on bidder’s offer |  |
| 20.3 | Nominal AC voltage and range. | V | Based on bidder’s offer |  |
| 20.4 | Input AC frequency and range | Hz | Based on bidder’s offer |  |
| 20.5 | Service conditions (temperature and RH). |  | Based on bidder’s offer |  |
| 20.6 | Power factor |  | Based on bidder’s offer |  |
| 20.7 | Peak discharge current | A | Based on bidder’s offer |  |
| 20.8 | Leakage current |  | Based on bidder’s offer |  |
| 20.9 | Connection details |  | Based on bidder’s offer |  |
| 20.10 | Dimensions/housing |  | Based on bidder’s offer |  |
| **21** | **Inverter Distribution** |  |  |  |
| 21.1 | Manufacturer/model |  | Based on bidder’s offer |  |
| 21.2 | Type of switch |  | Based on bidder’s offer |  |
| 21.3 | Type of MCB |  | Based on bidder’s offer |  |
| 21.4 | Distribution circuits (numbers and ratings) |  | Based on bidder’s offer |  |
| 21.5 | Number of cubicles |  | Based on bidder’s offer |  |
| 21.6 | Forced limits at one meter |  | Based on bidder’s offer |  |
| 21.7 | Noise limits at one meter |  | Based on bidder’s offer |  |
| 21.8 | Instrumentation |  | Based on bidder’s offer |  |
| 21.9 | Alarms |  | Based on bidder’s offer |  |
| 21.10 | Efficiency and power factor at 25.50% & 100% outputs |  | Based on bidder’s offer |  |
| 21.11 | Modular tesing/system extension facilities |  | Based on bidder’s offer |  |
| 21.12 | Provision of maintenance switch |  | Based on bidder’s offer |  |
| 21.13 | Radio frequency interference |  | Based on bidder’s offer |  |

o) FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT

| 1. FAULT MONITORING SYSTEM & PHASOR MEASUREMENT UNIT | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **Required** | **Offered** |
| 1. | FAULT MONITORING SYSTEM |  |  |  |
| 1.1 | Manufacturer |  | Based on bidder’s offer |  |
| 1.2 | Type reference |  |  |  |
|  | * DAU unit type |  | Based on bidder’s offer |  |
|  | * Master Station type |  | Based on bidder’s offer |  |
|  | * HMI type |  | Based on bidder’s offer |  |
|  | * Printer type |  | Based on bidder’s offer |  |
| 1.3 | Auxiliary voltage range (Vn = 110Vdc) | Vdc | Based on bidder’s offer |  |
| 1.4 | Analogue Inputs |  | Based on bidder’s offer |  |
| 1.5 | Binary inputs |  | Based on bidder’s offer |  |
| 1.6 | A/D converter | bit | Based on bidder’s offer |  |
| 1.7 | Current input max amplitude | In | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
|  | * Event | ms | Based on bidder’s offer |  |
| 1.13 | Memory |  |  |  |
|  | * RAM (Non Volatile) | GB | >16 |  |
|  | * HDD | Terabyte | >1 |  |
| 1.14 | Battery back-up duration | days | ≥14 |  |
| 1.15 | GPS clock input | Yes/No | Yes |  |
| 1.16 | System software |  | Based on bidder’s offer |  |
| 1.17 | Self-monitoring and alarm facility | Yes/No | Yes |  |
| 1.18 | Communications |  |  |  |
|  | * Communication ports (Front/rear etc.) |  |  |  |
|  | RS232 | Yes/No | Based on bidder’s offer |  |
|  | RS485 | Yes/No | Based on bidder’s offer |  |
|  | RJ45 | Yes/No | Based on bidder’s offer |  |
|  | Other | Yes/No | Based on bidder’s offer |  |
|  | * Protocols supported |  | Based on bidder’s offer |  |
|  | IEC 61850 | Yes/No | Based on bidder’s offer |  |
|  | Others (please list) |  | Based on bidder’s offer |  |
|  | * 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 |  | Based on bidder’s offer |  |
|  | 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 |  |
|  |  |  |  |  |
| 2. | PHASOR MEASUREMENT UNIT |  |  |  |
| 2.1 | Applicable Standards |  | IEEE C37.118  IEC 61850 |  |
| 2.2 | Environmental Conditions |  |  |  |
| 2.2.1 | Working Temperature | ⁰C | Based on bidder’s offer |  |
| 2.2.2 | Storage Temperature | ⁰C | Based on bidder’s offer |  |
| 2.2.3 | Maximum Humidity | % | < 90% |  |
| 2.3 | Type |  |  |  |
| 2.3.1 | Phasor Measurement Unit |  | Based on bidder’s offer |  |
| 2.3.2 | GPS Clock |  | Based on bidder’s offer |  |
| 2.3.4 | Ethernet Switch |  | Based on bidder’s offer |  |
| 2.3.5 | Industrial PC 4U Rack |  | Based on bidder’s offer |  |
| 2.3.6 | Laser Printer |  | Based on bidder’s offer |  |
| 2.3.7 | LED Monitor+Keyborad+Mouse |  | Based on bidder’s offer |  |
| 2.4 | Model |  |  |  |
| 2.4.1 | Phasor Measurement Unit |  | Based on bidder’s offer |  |
| 2.4.2 | GPS Clock |  | Based on bidder’s offer |  |
| 2.4.3 | Ethernet Switch |  | Based on bidder’s offer |  |
| 2.4.4 | Industrial PC 4U Rack |  | Based on bidder’s offer |  |
| 2.4.5 | Laser Printer |  | Based on bidder’s offer |  |
| 2.4.6 | LED Monitor+Keyborad+Mouse |  | Based on bidder’s offer |  |
| 2.5 | Make |  |  |  |
| 2.5.1 | Phasor Measurement Unit |  | Based on bidder’s offer |  |
| 2.5.2 | GPS Clock |  | Based on bidder’s offer |  |
| 2.5.3 | Ethernet Switch |  | Based on bidder’s offer |  |
| 2.5.4 | Industrial PC 4U Rack |  | Based on bidder’s offer |  |
| 2.5.5 | Laser Printer |  | Based on bidder’s offer |  |
| 2.5.6 | LED Monitor+Keyborad+Mouse |  | Based on bidder’s offer |  |
| 2.6 | Cabinet |  |  |  |
| 2.6.1 | Mounting |  | Based on bidder’s offer |  |
| 2.6.2 | Case type |  | Based on bidder’s offer |  |
| 2.6.3 | IP degree |  | Based on bidder’s offer |  |
| 2.6.4 | Weight |  | Based on bidder’s offer |  |
| 2.6.5 | Dimensions in mm (w x h x l) |  | Based on bidder’s offer |  |
| 2.6.6 | Isolation withstand |  | Based on bidder’s offer |  |
| 2.6.7 | Fan | Yes/No | Based on bidder’s offer |  |
| 2.6.8 | AC Socket | Yes/No | Based on bidder’s offer |  |
| 2.6.9 | Fuses | Yes/No | Based on bidder’s offer |  |
| 2.6.10 | Terminals with Labels | Yes/No | Based on bidder’s offer |  |
| 2.6.11 | Wire Marks | Yes/No | Based on bidder’s offer |  |
| 2.6.12 | Door Micro Switch | Yes/No | Based on bidder’s offer |  |
| 2.6.13 | Swing Door Lock | Yes/No | Based on bidder’s offer |  |
| 2.6.14 | Lighting | Yes/No | Based on bidder’s offer |  |
| 2.6.15 | Loop Test Switch | Yes/No | Based on bidder’s offer |  |
| 2.6.16 | Thermostat | Yes/No | Based on bidder’s offer |  |
| 2.7 | PMU |  |  |  |
| 2.7.1 | Power Supply Unit |  | Based on bidder’s offer |  |
| 2.7.2 | Central Processor Unit board |  | Based on bidder’s offer |  |
| 2.7.3 | Digital Signal Processing board |  | Based on bidder’s offer |  |
| 2.7.4 | Backplain board |  | Based on bidder’s offer |  |
| 2.7.5 | Network interface board |  | Based on bidder’s offer |  |
| 2.7.6 | Analog acquisition board |  | Based on bidder’s offer |  |
| 2.7.7 | Digital inputs and alarm board |  | Based on bidder’s offer |  |
| 2.7.8 | RS232 serial links |  | Based on bidder’s offer |  |
| 2.7.9 | RJ45 Copper Ethernet links |  | Based on bidder’s offer |  |
| 2.7.10 | Internal GPS / External GPS |  | Based on bidder’s offer |  |
| 2.7.11 | GPS ports |  | Based on bidder’s offer |  |
| 2.7.12 | Memory Type and Capacity |  | >1TB |  |
| 2.7.13 | Current Inputs Board |  | Based on bidder’s offer |  |
| 2.7.14 | Voltage Inputs Board |  | Based on bidder’s offer |  |
| 2.7.15 | Digital inputs Board |  | Based on bidder’s offer |  |
| 2.7.16 | System bus interface/speed |  | Based on bidder’s offer |  |
| 2.7.17 | Provision of two redundant interfaces to LANs |  | Based on bidder’s offer |  |
| 2.7.18 | Test block /test plug for secondary injection test |  | Based on bidder’s offer |  |
| 2.7.19 | Data measurement/calculation such as V,I,F, ROCOF, P ,Q , Wh , Varh, power factor, THD ,harmonics up to 11th , … |  | Based on bidder’s offer |  |
| 2.7.20 | Time tag accuracy |  | 1 µS |  |
| 2.7.21 | Support class | P | Based on bidder’s offer |  |
| 2.7.22 | Reporting rate | Frame /sec | 60 |  |
| 2.7.23 | Rated voltage | V | Based on bidder’s offer |  |
| 2.7.24 | Rated current | A | Based on bidder’s offer |  |
| 2.7.25 | Nominal frequency | Hz | 50 |  |
| 2.7.26 | Operating frequency | Hz | 45-55 |  |
| 2.7.27 | Auxiliary DC Voltage | V DC | Based on bidder’s offer |  |
| 2.7.28 | Auxiliary AC Voltage | V AC | Based on bidder’s offer |  |
| 2.7.29 | Power consumption | W | Based on bidder’s offer |  |
| 2.7.30 | Total Vector Error (TVE) |  | <1% |  |
| 2.7.31 | Number of analog channels for synchrophasor measurement |  | Based on bidder’s offer |  |
| 2.7.32 | Number of opto – insolated digital channels voltage range 24-240 |  | Based on bidder’s offer |  |
| 2.7.33 | Number of digital output contacts |  | Based on bidder’s offer |  |
| 2.7.34 | Digital output contacts making/breaking capacity for DC with DR<40 ms |  | Based on bidder’s offer |  |
| 2.7.35 | Voltage measuring rang | V | Based on bidder’s offer |  |
| 2.7.36 | Over voltage capability | V | Based on bidder’s offer |  |
| 2.7.37 | Current measuring range | A | Based on bidder’s offer |  |
| 2.7.38 | Over current capability | A | 100A, 1Sec |  |
| 2.7.39 | Min voltage measurement resolution /accuracy |  |  |  |
| 2.7.40 | Phase measurement accuracy |  | Based on bidder’s offer |  |
| 2.8 | Time synchronization (GPS) |  | Based on bidder’s offer |  |
| 2.8.1 | Type |  | Based on bidder’s offer |  |
| 2.8.2 | Internal GPS card/External GPS |  | Based on bidder’s offer |  |
| 2.8.3 | AC/DC voltage working range | V | Based on bidder’s offer |  |
| 2.8.4 | Power consumption | W | Based on bidder’s offer |  |
| 2.8.5 | Battery standby |  | Based on bidder’s offer |  |
| 2.8.6 | Type, speed and no. of output interfaces |  | Based on bidder’s offer |  |
| 2.8.7 | Time and data facility |  | Based on bidder’s offer |  |
| 2.8.8 | Local time compensation |  | Based on bidder’s offer |  |
| 2.8.9 | Seasonal changeover/automatic |  | Based on bidder’s offer |  |
| 2.8.10 | Synchronizing time accuracy |  | 1µs |  |
| 2.8.11 | GPS ports |  | Based on bidder’s offer |  |
| 2.8.12 | GPS Antenna type |  | Based on bidder’s offer |  |
| 2.8. 13 | GPS antenna connector type |  | Based on bidder’s offer |  |
| 2.8.14 | Cable length and type |  | Based on bidder’s offer |  |
| 2.9 | Analog to Digital converter |  | Based on bidder’s offer |  |
| 2.9.1 | Model |  | Based on bidder’s offer |  |
| 2.9.2 | Maximum no inputs per card |  | Based on bidder’s offer |  |
| 2.9.3 | Outputs available per input |  | Based on bidder’s offer |  |
| 2.9.4 | Resolution/accuracy |  | Based on bidder’s offer |  |
| 2.9.5 | Sampling rate |  | Based on bidder’s offer |  |
| 2.9.6 | Burden | VA | Based on bidder’s offer |  |
| 2.9.7 | Input CT/VT range |  | Based on bidder’s offer |  |
| 2.9.8 | Analogue limit monitoring facility at PMU |  | Based on bidder’s offer |  |
| 2.9.9 | No of input analog quantity per board |  | Based on bidder’s offer |  |
| 2.9.10 | Digital inputs |  | Based on bidder’s offer |  |
| 2.9.11 | Number of inputs |  | Based on bidder’s offer |  |
| 2.9.12 | Rated nominal voltage | V | Based on bidder’s offer |  |
| 2.9.13 | Operating range | V | Based on bidder’s offer |  |
| 2.9.14 | Digital/software filtering to suppress plant contact |  | Based on bidder’s offer |  |
| 2.9.15 | Maximum input contact frequency |  | Based on bidder’s offer |  |
| 2.9.16 | Minimum contact closure capture time |  | Based on bidder’s offer |  |
| 2.9.17 | Time tagging resolution |  | Based on bidder’s offer |  |
| 2.9.18 | Isolation withstand |  | Based on bidder’s offer |  |
| 2.10 | Digital outputs |  | Based on bidder’s offer |  |
| 2.10.1 | Number of outputs |  | Based on bidder’s offer |  |
| 2.10.2 | Rated nominal voltage | V | Based on bidder’s offer |  |
| 2.10.3 | Operating range | V | Based on bidder’s offer |  |
| 2.10.4 | Double pole switching of output |  | Based on bidder’s offer |  |
| 2.11 | Software |  |  |  |
| 2.11.1 | Monitoring and configuration software |  | Based on bidder’s offer |  |
| 2.11.2 | Configure all PMU parameters by connecting directly (local /remote) |  | Based on bidder’s offer |  |
| 2.11.3 | Adding /relocation/rename of PMUs and feeders. |  | Based on bidder’s offer |  |
| 2.11.4 | Deliver real time measurement and real time waveforms and harmonic up to 11th V ,I , F, E, P , Q, angle difference. |  | Based on bidder’s offer |  |
| 2.11.5 | Event monitoring |  | Based on bidder’s offer |  |
| 2.11.6 | Recording and download |  | Based on bidder’s offer |  |
| 2.11.7 | Installation utility |  | Based on bidder’s offer |  |
| 2.11.8 | Network server configuration |  | Based on bidder’s offer |  |
| 2.11.9 | Communication configuration |  | Based on bidder’s offer |  |
| 2.11.10 | Dynamic Analyzer software |  | Based on bidder’s offer |  |
| 2.11.11 | Recording software |  | Based on bidder’s offer |  |
| 2.11.12 | Self-monitoring and problem reporting /alarming |  | Based on bidder’s offer |  |
| 2.11.13 | Security requirements |  | Based on bidder’s offer |  |
| 2.12 | WAMPAC infrastructure |  |  |  |
| 2.12.1 | Interface type for Ethernet communication |  | Based on bidder’s offer |  |
| 2.12.2 | Supported protocol |  | Based on bidder’s offer |  |
| 2.12.3 | Number of normally open contacts |  | Based on bidder’s offer |  |
| 2.13 | Communication to PDC |  | Based on bidder’s offer |  |
| 2.13.1 | Compliant with IEEE C37.118 |  | Based on bidder’s offer |  |
| 2.13.2 | Communication mode |  | Based on bidder’s offer |  |
| 2.13.3 | Media |  | Based on bidder’s offer |  |
| 2.13.4 | Type of ports |  | Based on bidder’s offer |  |
| 2.13.5 | Transfer rate |  | Based on bidder’s offer |  |
| 2.14 | Communication to Control Centers |  |  |  |
| 2.14.1 | Compliant with IEEE C37.118 |  | Based on bidder’s offer |  |
| 2.14.2 | Communication mode |  | Based on bidder’s offer |  |
| 2.14.3 | Media |  | Based on bidder’s offer |  |
| 2.14.4 | Type of ports |  | Based on bidder’s offer |  |
| 2.14.5 | Transfer rate |  | Based on bidder’s offer |  |

p) SDH AND MULTIPLEXER

| 1. SDH AND MULTIPLEXER | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| **1** | **SDH** |  |  |  |
| 1.1 | Manufacturer's name |  | Based on bidder’s offer |  |
| 1.2 | Product Trade Name |  | Based on bidder’s offer |  |
| 1.3 | Type of Model /Version Number |  | Based on bidder’s offer |  |
| 1.4 | Production Number |  | Based on bidder’s offer |  |
| 1.5 | FAT Location |  | Based on bidder’s offer |  |
| 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 | mm | To be defined |  |
| 1.13.3 | Rack Dimension | mm | 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 | VDC | (-48 VDC) |  |
| 1.13.7 | Numbers of Slots (Total & Traffic) |  | To be defined |  |
| 1.13.8 | Numbers 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%) | % | (0% to 90%) |  |
| **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 STM16 (G.841 - clause 7.1) |  | 1+1 Linear MSP(G.841 - clause 7.1) |  |
| **1.17** | **Network Side Protection** |  |  |  |
| 1.17.1 | 1+1 Linear MSP |  | Yes |  |
| 1.17.2 | SNCP |  | Yes |  |
| **1.18** | **Switch Capacity Centralized architecture** |  |  |  |
| 1.18.1 | TDM- STM 16 system | Gigab/s | Min 20 |  |
| 1.18.2 | TDM- STM 1 system | Gigab/s | Min 10 |  |
| 1.18.3 | Packet |  | Yes |  |
| **1.19** | **Ethernet interfaces** |  |  |  |
| 1.19.1 | 10/100 Base-TX L2 switching Ethernet port |  | Yes |  |
| 1.19.2 | Auto-negotiation |  | Yes |  |
| 1.19.3 | Auto-crossover |  | Yes |  |
| 1.19.4 | Unique MAC address to each Ethernet port |  | Yes |  |
| **1.20** | **Ethernet services** |  |  |  |
| 1.20.1 | E-Line |  | Yes |  |
| 1.20.2 | E-LAN |  | Yes |  |
| **1.21** | **Ethernet protection** |  |  |  |
| 1.21.1 | Spanning Tree Protocol |  | Yes |  |
| 1.21.2 | Rapid Spanning Tree Protocol |  | Yes |  |
| **1.22** | **NG-SDH Management LCT Functionalities** |  |  |  |
| 1.22.1 | local and remote management of NE's over the network |  | Yes |  |
| 1.22.2 | Alarm display |  | Yes |  |
| 1.22.3 | Fault Management |  | Yes |  |
| 1.22.4 | Performance Monitoring and Management |  | Yes |  |
| 1.22.5 | Configuration Management |  | Yes |  |
| 1.22.6 | Remote operation |  | Yes |  |
| 1.22.7 | Access and testing functions |  | Yes |  |
| 1.22.8 | Graphical view of entire network |  | Yes |  |
| 1.22.9 | Local Craft terminal Port |  | Yes |  |
| **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 Multiplexer** |  |  |  |
| **2.1** | **GENERAL** |  |  |  |
| 2.1.1 | Manufacturer name |  | Based on bidder’s offer |  |
| 2.1.2 | Product trade name |  | Based on bidder’s offer |  |
| 2.1.3 | Type of Model/Version Number |  | Based on bidder’s offer |  |
| 2.1.4 | FAT location |  | Based on bidder’s offer |  |
| 2.1.5 | Applicable Standard(s) |  | ITU-T |  |
| 2.1.6 | Type tests reports and certification documents |  | To be defined |  |
| 2.1.7 | Availability (based on MTBF) |  | To be defined |  |
| 2.1.8 | Flexibility |  | Yes |  |
| 2.1.9 | Expandability |  | Yes |  |
| **2.2** | **Rack and shelf information** |  |  |  |
| 2.2.1 | 19" or ETSI rack mounting |  | Yes |  |
| 2.2.2 | Shelf Dimension (height x width x length) | mm | Yes |  |
| 2.2.3 | Shelf Weight(fully populated) | kg | Yes |  |
| 2.2.4 | Power Consumption(fully populated) | watt | Yes |  |
| 2.2.5 | Power Supply | V Dc | Yes |  |
| 2.2.6 | Numbers of Slots (Total & Traffic) |  | Yes |  |
| 2.2.7 | Numbers of Traffic Slots |  | Yes |  |
| **2.3** | **General Functionality** |  |  |  |
| 2.3.1 | Time multiplexing/ de-multiplexing  of all voice and data channels |  | Yes |  |
| 2.3.2 | Sub rate data multiplexing based on  ITU-T V-Series synch/a synch data |  | Yes |  |
| 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 |  | Yes |  |
| 2.3.6 | IP routing |  | Optional |  |
| 2.3.7 | VF operation |  | Yes |  |
| 2.3.8 | Signaling |  | To be defined |  |
| 2.3.9 | Transmission delay | µs | <250 |  |
| **2.4** | **Line Interface** |  |  |  |
| 2.4.1 | E1 |  | Yes |  |
| 2.4.2 | STM1 |  | Advantage |  |
| **2.5** | **Interfaces** |  |  |  |
| 2.5.1 | 6 wire E&M signaling with ring generator |  | Yes |  |
| 2.5.2 | 2 wire voice channel |  | Yes |  |
| 2.5.3 | FXO/FXS |  | Yes |  |
| 2.5.4 | 0.3-64 Kbps Sync. /A sync. V.24/V.28 |  | Yes |  |
| 2.5.5 | N × 64 Kbps Sync. /A sync. |  | Yes |  |
| 2.5.6 | RS-232, RS-485 |  | Yes |  |
| 2.5.7 | Ethernet |  | Yes |  |
| **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 |  | Yes |  |
| 2.8.2 | ADM in Linear & Ring |  | Yes |  |
| 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 |  | Yes |  |
| 2.9.2 | Alarm display |  | Yes |  |
| 2.9.3 | Fault Management |  | Yes |  |
| 2.9.4 | Performance Monitoring and Management |  | Yes |  |
| 2.9.5 | Configuration Management |  | Yes |  |
| 2.9.6 | Remote operation |  | Yes |  |
| 2.9.7 | Access and testing functions |  | Yes |  |
| 2.9.8 | Graphical view of entire network |  | Yes |  |

q) TPS SYSTEM

| 1. TPS SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | **OFFERED** |
| 1 | MANUFACTURER |  | Based on bidder’s offer |  |
| 1.1 | NAME AND COUNTRY |  | Based on bidder’s offer |  |
| 1.2 | TYPE REFERENCE |  | Based on bidder’s offer |  |
| 2 | COMMANDS |  | 4 or Upper |  |
| 2.1 | COMMANDS PRIORITY |  | Yes |  |
| 2.2 | TYPE OF COMMAND TRANSMISSION: |  |  |  |
| 2.2.1 | CODED |  | Yes |  |
| 2.2.2. | NONCODED |  | Yes |  |
| 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 |  | 48 -220 VDC |  |
| 5.1 | Type of command contacts |  | To be defined |  |
| 5.2 | Type of alarm contacts |  | To be defined |  |
| 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 : |  |  |  |
| 8.1.1 | Command | dBm | -15 to 0 |  |
| 8.1.2 | 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 : |  |  |  |
| 9.1.1 | Command | dBm | -15 to 0 |  |
| 9.1.2 | 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 | Based on bidder’s offer |  |
| 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 |  |
|  |

r) FIREWALL & SWITCH

| 1. FIREWALL & SWITCH | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
| **REQUIRED** | **OFFERED** |
| A | Switch |  |  |  |
| 1 | Manufacturer name |  |  |  |
| 2 | Manufacturer part number |  |  |  |
| 3 | Form Factor |  | Fixed, Rack mutable 1u, stackable/Clustering |  |
| 4 | Specifications |  |  |  |
| 4.1 | Standards |  | ● IE10Base-T /100Base-TX and 100Base-FX/1000Base-T/Gigabit Fiber ● IEEE 802.11n, 802.11g, 802.11b, ● 802.3, 802.3/3u/3ab/3z ● 802.1X (security authentication) ● 802.1Q (VLAN) Tagging ● 802.1w Rapid Spanning Tree Protocol ● 802.3ad LACP ● 802.11i (Wi-Fi Protected Access [WPA2] security) ● 802.11e (wireless quality of service [QoS]) ● IPv4 (RFC 791), IPv6 (RFC 2460) ● Routing Information Protocol (RIP) v1 (RFC 1058), RIP v2 (RFC 1723) |  |
| 4.2 | Features |  | ●Flow control ●Full Duplex capability ●Layer 3 Switching ●Auto sensing per divice ●IP routing ● DHCP support ●Auto-negotiating ●ARP support ●RSTP support ●MSTP support ●ACL ●Qos  ●RADIUS ●TFTP ●DTP ●PAgP ●LACP ●RSPAN ● Static IP ● PPPoE ● PPTP ● L2TP ● STP ● DDNS |  |
| 4.3 | Routing protocols |  | ● Static ● RIP |  |
| 4.4 | NAT protocol |  | ●PAT ●NAPT ●SIP ALG |  |
| 4.5 | IPv6 / IPv4 |  | Yes |  |
| 4.6 | Network edge (DMZ) |  | Yes |  |
| 4.7 | VLAN support |  | Yes |  |
| 5 | Performance and Scalability |  |  |  |
| 5.1 | Switch port density Uplink | Port/Gbps | At least 4x 1G fixed uplinks |  |
| 5.2 | Forwarding bandwidth | Gbps | 17.8 Mpps or Higher |  |
| 5.3 | Switching Bandwidth | Gbps | Based on bidder’s offer |  |
| 5.4 | Maximum active VLANs |  | Based on bidder’s offer |  |
| 5.5 | MAC Address Table Size |  | 12K entries |  |
| 5.6 | VLAN IDs available |  | 1K |  |
| 5.7 | Maximum transmission unit (MTU)-L3 packet | bytes | Based on bidder’s offer |  |
| 5.8 | Jumbo frame -Ethernet frame Support | bytes | Yes |  |
| 6 | Security |  | Based on bidder’s offer |  |
| 6.1 | Firewall |  | Yes /No |  |
| 6.2 | Access control |  | Yes |  |
| 6.3 | Content filtering |  | Yes |  |
| 7 | Secure management |  |  |  |
| 7.1 | 802.1x supplicant |  | Yes |  |
| 7.2 | 802.3x flow control support |  | Yes |  |
| 7.3 | Certificates |  | Yes |  |
| 7.4 | VPN |  | Yes |  |
| 7.5 | IP sec |  | Yes |  |
| 7.6 | QuickVPN |  | Yes |  |
| 7.7 | SSL VPN |  | Yes |  |
| 7.8 | SSL VPN platforms | Gbps | Based on bidder’s offer |  |
| 7.9 | PPTP |  | Yes |  |
| 7.10 | Encryption |  | DES 3DES AES |  |
| 7.11 | Authentication |  | Yes |  |
| 7.12 | VPN pass-through |  | PPTP, L2TP, Ipsec |  |
| 7.13 | Advanced VPNs |  | DPD Ipsec Group VPN |  |
| 7.14 | Quality of Service |  | Yes |  |
| 7.15 | Prioritization types |  | Yes |  |
| 7.16 | Queues |  | Yes |  |
| 7.17 | Performance |  | Yes |  |
| 7.18 | NAT throughput | Mbps | To be determined |  |
| 7.19 | Concurrent sessions |  | Yes |  |
| 7.20 | IPsec VPN throughput (3DES / AES) | Mbps | To be determined |  |
| 7.21 | SSL VPN throughput | Mbps | To be determined |  |
| 7.22 | Configuration |  | Yes |  |
| 7.23 | Web user interface |  | HTTP/HTTPS |  |
| 8 | Management |  |  |  |
| 8.1 | Management protocols |  | SNMP UPnP SNTP SSH Syslog RMON CLI |  |
| 8.2 | Event logging |  | Yes |  |
| 8.3 | Upgradability |  | Yes |  |
| 8.4 | Wireless LAN Specification |  | Yes |  |
| 8.5 | Recovery Time |  | < 50 ms |  |
| 9 | Interface |  |  |  |
| 9.1 | RJ45 Ports | Ports | At least 24 ports 10/100/1000 Mbps  Cat 3,4,5,6 Cable |  |

s) 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 |  | 4/5 |  |
| 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 | IP55 |
| 2.2 | Indoor equipment | IP | IP52 | IP52 |
| **3** | **Normal illumination level:** |  |  |  |
| 3.1 | Control areas/room | Lux | 350 |  |
| 3.2 | Data printers | Lux | 300 |  |
| 3.3 | Project Managers/offices | Lux | 400 |  |
| 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 | 200 |  |
| 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 | 40 |  |
| 3.30 | Transformer area | Lux | 40 |  |
| 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 | 20 |  |
| **4** | **Minimum illumination level (emergency lighting):** |  |  |  |
| 4.1 | Control room | Lux | 100 |  |
| 4.2 | AC/DC room | Lux | 100 |  |
| 4.3 | Relay room | Lux | 100 |  |
| 4.4 | Battery room | Lux | 100 |  |
| 4.5 | Transformers and circuit breakers | Lux | 100 |  |
| **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 |  | Based on bidder’s offer |  |
| 6.2 | Type of fixture |  | Flood light |  |
| 6.3 | Type and power of lamp | w | (LED) |  |
| 6.4 | Type of fixture mounting |  | Structure mounted |  |
| 6.5 | lamp life | hr | >50000 |  |
| 6.6 | Lamp efficiency | Lum/w | 125 |  |
| 6.7 | Lamp flux | lm |  |  |
| 6.8 | Fixture mounted height | m | Based on bidder’s offer |  |
| 6.9 | Number of fixture |  | Based on bidder’s offer |  |
| **7** | **Access and main road lighting** |  |  |  |
| 7.1 | Manufacturer |  | Based on bidder’s offer |  |
| 7.2 | Type of fixture |  | Street light |  |
| 7.3 | Type and power of lamp | w | (LED) |  |
| 7.4 | Type of mounting |  | Pole mounted |  |
| 7.5 | Pole distance from road | m | 0.9 |  |
| 7.6 | Pole height | m | Based on bidder’s offer |  |
| 7.7 | Fixture mounting heigh | m | Based on bidder’s offer |  |
| 7.8 | lamp life | hr | >50000 |  |
| 7.9 | Lamp flux | lm |  |  |
| 7.10 | Lamp efficiency | Lum/w | 125 |  |
| 7.11 | Type of lighting poles |  | Hot dip galvanized steel |  |
| 7.12 | Thickness of painting | μm | 80~120 |  |
| **8** | **110 V DC emergency lighting:** |  |  |  |
| 8.1 | Manufacturer |  | Based on bidder’s offer |  |
| 8.2 | Type of fitting |  | Based on bidder’s offer |  |
| 8.3 | Type of outdoor lamp | w | LED |  |
| 8.4 | Type of indoor lamp | w | LED |  |
| 8.5 | Location mounted for outdoor DC lighting |  | Based on bidder’s offer |  |
| 8.6 | Degree of protection | IP | 55(Outdoor) /42(Indoor) |  |
| **9** | **Main indoor lighting equipment** |  |  |  |
| 9.1 | Manufacturer |  | Based on bidder’s offer |  |
| 9.2 | Type of lighting fixture |  | LED |  |
| 9.3 | Type and power 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 |  | Based on bidder’s offer |  |
| 12.2 | Location |  | Based on bidder’s offer |  |
| **13** | **Electrical Socket** |  |  |  |
| 13.1 | Manufacturer |  | Based on bidder’s offer |  |
| 13.2 | Type(s) |  | Based on bidder’s offer |  |
| 13.3 | Voltage Rating |  | 415/240 |  |
| 13.4 | Phases |  | 1/3 |  |
| 13.5 | Rating of socket |  | Based on bidder’s offer |  |
| 13.6 | Single phase | A | >16 |  |
| 13.7 | Three phase | A | Acc. To calculation |  |
| 13.8 | Current Rating |  | Based on bidder’s offer |  |
| 13.9 | Quantity |  | Based on bidder’s offer |  |
| **14** | **Telephone System** |  |  |  |
| 14.1 | Subsets |  | Based on bidder’s offer |  |
| 14.2 | Manufacturer |  | Based on bidder’s offer |  |
| 14.3 | Type |  | Desk mounted / wall mounted/VOIP |  |
| 14.4 | Type of control & communication cable in telephone system |  | Twisted pair/copper conductor/ 0.6mm2 diameter colored PE insulation/overall screen with tinned copper drain wire/overall PVC sheath /Ethernet Cable |  |
| 14.5 | Degree of protection for terminal boxes |  | Based on bidder’s offer |  |
| 14.6 | Indoor | IP | 51 |  |
| 14.7 | Outdoor | IP | 55 |  |
| 14.8 | Quantities Required (minimum): |  | Based on bidder’s offer |  |
| 14.9 | Desk Mounted Type |  | Based on bidder’s offer |  |
| 14.10 | Wall Type |  | Based on bidder’s offer |  |
| 14.11 | Spare Units: |  | Based on bidder’s offer |  |
| 14.12 | Desk Mounted Type |  | Based on bidder’s offer |  |
| 14.13 | Wall Type |  | Based on bidder’s offer |  |
| 14.14 | Outdoor Wall Type |  | Based on bidder’s offer |  |
| **15** | **Type of equipment in battery room** |  | explosion proof  Zone0 Group IIC |  |

t) CCTV SURVEILLANCE AND ACCESS CONTROL

| 1. CCTV SURVEILLANCE AND ACCESS CONTROL | | **UNIT** | | **DATA** | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  | | **REQUIRED** | | **OFFERED** |
| 1.0 | **OUTDOOR IP CAMERA** | | | | | |
| 1.1 | Manufacturer and Country of Origin | |  | | To be Specified |  |
| 1.2 | Type | |  | | Outdoor IP Camera |  |
| 1.3 | Standards | |  | | EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B,  IEC62262, IEC61000-4-5, IEC60068-2-11. |  |
| 1.4 | Image Sensor | |  | | 1/2.8” 2.0-megapixel progressive scan CMOS sensor |  |
| 1.5 | Resolution and Day/Night Mode | |  | | 1920\*1080 resolution  Auto/Color/Monochrome (removable infrared-cut filter) mode |  |
| 1.6 | Shutter Speed | |  | | 1/100000s to 1s electronic shutter speed |  |
| 1.7 | Dynamic Range | |  | | 128dB wide dynamic mode |  |
| 1.8 | Digital Noise Reduction | |  | | Self-adaptive to 2D or 3D DNR |  |
| 1.9 | Backlight Compensation | |  | | Supported |  |
| 1.10 | Defog | |  | | Automatic/manual |  |
| 1.11 | Image Stabilisation | |  | | Electronic Image Stabilisation |  |
| 1.12 | IR coverage | |  | | Up to 80meters |  |
| 1.13 | Angular Field of View | |  | | Horizontal: [43° Wide 14°(Tele)] and Vertical: [22° (Wide) 9° (Tele)] |  |
| 1.14 | Video Compression | |  | | H.265/H.264/MJPEG |  |
| 1.15 | Multiple streaming | |  | | Double Full HD streams and Treble streams (30fps or 25fps) |  |
| 1.16 | Audio Compression | |  | | G.711a/G.711u/G.726/OPUS |  |
| 1.17 | Network Protocols | |  | | TCP, UDP, IPv4, IPv6, DHCP, DHCPv6, DNS, ICMP, SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS |  |
| 1.18 | Streaming Transmission and Encryption | |  | | Unicast/Multicast  AES 128/192/256 encryption algorithm |  |
| 1.19 | Intelligent Analytics | |  | | Loitering detection, Intrusion detection, Abandoned object detection, removed object detection, Target color recognition, Humans and vehicles distinguish, motion detection, tampering detection |  |
| 1.20 | Electrical and Serial Interfaces | |  | | 1xRJ-45 10/100Base-T self-adaptive Ethernet port,  At least 1\*RJ-45 10/100Base-T self-adaptive Ethernet port |  |
| 1.21 | Alarm and Audio Interfaces | |  | | Alarm: 2 channel input and 2 channel output,  Audio: 1 channel input and 1 channel output |  |
| 1.22 | Memory card Slot | |  | | Built in 32G memory slot |  |
| 1.23 | Power Supply | |  | | DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at) |  |
| 1.24 | Physical Characteristics | |  | | 6kV surge voltage protection, IK10 vandal proof metal casing, IP66 IP protection, 10-day salt spray test rating |  |
| **2.0** | **IP PAN TILT ZOOM CAMERA** | | | | | |
| 2.1 | Manufacturer and Country of Origin | |  | | To be specified |  |
| 2.2 | Type | |  | | IP Pan Tilt Zoom Camera |  |
| 2.3 | Standards | |  | | EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B,  IEC62262, IEC61000-4-5, IEC60068-2-11. |  |
| 2.4 | Image Sensor | |  | | 1/2.8” 2.0-megapixel progressive scan CMOS sensor |  |
| 2.5 | Resolution and Day/Night Mode | |  | | 1920\*1080 resolution  Auto/Color/Monochrome |  |
| 2.6 | Shutter Speed and Iris Diaphragm | |  | | 1/100000s to 1s,  Automatic iris diaphragm |  |
| 2.7 | Dynamic Range | | dB | | 120dB WDR |  |
| 2.8 | Digital Noise Reduction | |  | | self-adaptive to 2D or 3D |  |
| 2.9 | Backlight Compensation and highlight suppression | |  | | Supported |  |
| 2.1 | Defog | |  | | Automatic/Manual |  |
| 2.11 | Image Stabilisation | |  | | G-Sensor Unit Electronic Image stabilization |  |
| 2.12 | Lens | |  | | Focal Length: 4.5mm-135mm,  Zoom: 30X Optical zoom and 16X Digital zoom, |  |
| 2.13 | Angular and Rotational Field of View | |  | | Angular: [60.89° Wide 2.67°(Tele)] and Vertical: [37.34° (Wide) 1.51° (Tele)]  Rotation: (Horizontal:0° to 360°, Vertical: -20° to +90°),  Horizontal Rotation Speed: [Manual: 0.1°/s to 450°/s, Preset≥450°/s],  Vertical rotation speed: [Manual: 0.1°/s to 400°/s, Preset≥400°/s], 256 preset positions, : 8 scan lines each with 32 preset positions  Max of 5 scan lines each 10minutes, |  |
| 2.14 | Video Compression | |  | | H.265/H.264/MJPEG |  |
| 2.15 | Multiple streaming | |  | | Double Full HD streams and Treble streams (30fps or 25fps) |  |
| 2.16 | Media Encryption | |  | | AES128/192/256 encryption algorithm |  |
| 2.17 | Network Protocols | |  | | TCP, UDP, IPv4, IPv6, DHCP, DHCPv6, DNS, ICMP, SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS |  |
| 2.18 | Streaming Transmission and Encryption | |  | | Unicast/multicast steaming transmission and stream encryption capable |  |
| 2.19 | Intelligent Analytics | |  | | Park Action: Home position, preset position tour, pattern scan, horizontal scan, vertical scan, random scan, frame scan and panoramic scan  ISP Packages: 5 defined scenarios (outdoor, indoor, motion capture, lowlight, and backlight modes),  Event Triggers: motion detection, covering detection, alarm input, intelligent analytics alarm and network disconnection |  |
| 2.2 | Electrical and Serial Interfaces | |  | | One RJ-45 10/100/1000Base-TX self-adaptive Ethernet port |  |
| 2.21 | Alarm Interfaces | |  | | 4-channel alarm input and 1-channel alarm output(pigtail) |  |
| 2.22 | Memory card Slot | |  | | Micro SD cards in 64GB maximum memory slot of Speed class≥6 |  |
| 2.23 | Power Supply | |  | | DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at) |  |
| 2.24 | Maximum Power consumption | |  | | 45W |  |
| 2.25 | Physical Characteristics | |  | | 6kV surge voltage protection, IK10 vandal proof metal casing, IP66 IP protection, 10-day salt spray test rating |  |
| 3.0 | **IP DOME CAMERA** | | | | | |
| 3.1 | Manufacturer and Country of Origin | |  | | To be Specified |  |
| 3.2 | Type | |  | | IP Dome Camera |  |
| 3.3 | Standards | |  | | EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B,  IEC62262, IEC61000-4-5, IEC60068-2-11. |  |
| 3.4 | Image Sensor | |  | | 1/2.7” 2.0-megapixel progressive scan CMOS sensor |  |
| 3.5 | Resolution and Day/Night Mode | |  | | 1920\*1080 resolution  Auto/Multicolor/Monochrome (removable infrared-cut filter) |  |
| 3.6 | Shutter Speed and Iris Diaphragm | |  | | 1/100000s to 1s  Automatic iris diaphragm  Gain Control: Automatic/Manual |  |
| 3.7 | Dynamic Range | |  | | 120dB wide dynamic mode |  |
| 3.8 | Digital Noise Reduction | |  | | Self-adaptive to 2D or 3D |  |
| 3.9 | Backlight Compensation and highlight suppression | |  | | Supported |  |
| 3.10 | IR coverage | |  | | 30m minimum |  |
| 3.11 | Image Stabilisation | |  | | G-Sensor Unit Electronic Image stabilization |  |
| 3.12 | Lens | |  | | Focal Length: 2.8-12mm F1.4max,  Zoom: 30X Optical zoom and 16X Digital zoom |  |
| 3.13 | Angular Field of view and Camera Angle Adjustment | |  | | Angular field of view: Horizontal: [106° Wide 36°(Tele)] and Vertical: [57° (Wide) 20° (Tele)],  Camera angle adjustment: (Pan:0° to 356°, Tilt: 0° to 75°, Rotation: 0° to 356°), |  |
| 3.14 | Video and Audio Compression | |  | | Video: H.265/H.264/MJPEG  Audio: G.711a/G.711u/G.726/OPUS |  |
| 3.15 | Multiple streaming | |  | | Double Full HD streams and Treble streams (30fps or 25fps) |  |
| 3.16 | Media Encryption | |  | | AES128/192/256 encryption algorithm, |  |
| 3.17 | Network Protocols | |  | | TCP, UDP, IPv4, IPv6, DHCP, DHCPv6, DNS, ICMP, SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS |  |
| 3.18 | Streaming Transmission and Encryption | |  | | Unicast/multicast steaming transmission and stream encryption capable |  |
| 3.19 | Intelligent Analytics | |  | | Intelligent detections: (motion detection, covering detection),  Event actions: [Alarm output, SD card recording and snapshot], |  |
| 3.20 | Electrical and Serial Interfaces | |  | | 1xRJ-45 10/100Base-T self-adaptive Ethernet port, 1\*RS485 serial port |  |
| 3.21 | Alarm Interfaces | |  | | 1-channel alarm input and 1-channel alarm output |  |
| 3.22 | Memory card Slot | |  | | 64GB |  |
| 3.23 | Power Supply | |  | | DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at) |  |
| 3.24 | Maximum Power consumption | | W | | 9W |  |
| 3.25 | Physical Characteristics | |  | | 4kV surge voltage protection, IK10 vandal proof metal casing, IP66 IP protection, 10-day salt spray test rating |  |
| 4.0 | **VIDEO SURVEILLANCE SERVER** | | | | | |
| 4.1 | Manufacturer and Country of Origin | |  | | To be Specified |  |
| 4.2 | Type | |  | | Video Surveillance Server |  |
| 4.3 | Access Channels | |  | | 8 maximum video access channels, 8 video playback and download channels |  |
| 4.4 | Bandwidth | | Mbit/s | | input bandwidth: 128Mbit/s,  Video forwarding channels: 32  output bandwidth: 256Mbit/s, |  |
| 4.5 | Video Formats | |  | | H.264/H.265 |  |
| 4.6 | Decoding Performance | |  | | 1-channel 4K or 8-channel 1080p or 16-channel 720p |  |
| 4.7 | Preview Modes | |  | | 1/4/8/9/16 panes |  |
| 4.8 | Stacking function | |  | | 2 to 16 such modules, 2 number if storage disks with Hot-swappable SATA3.0 |  |
| 4.9 | Disk type | |  | | 50TB enterprise-level hard disk |  |
| 4.10 | RAID Level | |  | | non-RAID mode/RAID1 |  |
| 4.11 | Recording modes | |  | | (supported manual recording, scheduled recording, and alarm-triggered recoding), Query by time or events option, Batch download or download by time segment options |  |
| 4.12 | Media Encryption | |  | | supports multiple encryption algorithms such as AES256 |  |
| 4.13 | Compatibility | |  | | Supports access of devices that comply with the GB/T 28181, ONVIF 2.4, or ONVIF Profile S protocol, DHSDK, also supports connection to other platforms that comply with various protocols such as GB/T 28181 to implement diverse functions such as live video viewing and PTZ control and alarm reporting |  |
| 4.14 | Protocols | |  | | TCP, UDP, IPv4, HTTPS, RTP, RSTP, RTCP, AIP, SSL, NTP, HTTP |  |
| 4.15 | External Interfaces | |  | | at least 1\*HDMI 2.0, 1\*VGA, 2\*10/100/1000Mbit/s Ethernet ports, 1\* USB3.0, 1\*USB2.0, 1\*BNC Audio input, 1\*BNC Audio output, 2\*input Alarm channels, 1\*output Alarm channels |  |
| 4.16 | Power Consumption | | W | | <60W |  |
| 4.17 | Power Supply | | VAC | | 100VAC to 240VAC(50Hz/60Hz) |  |
| 4.18 | Cabinet | |  | | Standard 19-inch 9U cabinet |  |
| 5.0 | **3KVA BATTERY BACKUP SUPPLY (N/A)** | | | | | |
| 5.1 | Manufacturer and Country of Origin | |  | | To be Specified |  |
| 5.2 | Type | |  | | 3kVA Battery Backup Supply |  |
| 5.3 | Output Power Capacity | |  | | 2.7kW/3.0kVA |  |
| 5.4 | Output Voltage and distortion | | V | | 230V nominal, configurable for 220V, 230V, or 240V nominal output voltage, distortion less than 5% at full load |  |
| 5.5 | Output Frequency | | Hz | | 47 - 53 Hz for 50 Hz nominal, 57 - 63 Hz for 60 Hz nominal |  |
| 5.6 | Output Connections | |  | | (8) IEC 320 C13 (Battery Backup), (2) IEC Jumpers (Battery Backup), (1) IEC 320 C19 (Battery Backup) |  |
| 5.7 | Input Voltage | | V | | 230V, 220V or 240V |  |
| 5.8 | Input Frequency | | Hz | | 50/60 Hz +/- 3 Hz (auto sensing) |  |
| 5.9 | Input Connections | |  | | IEC-320 C20, Schuko CEE 7 / EU1-16P, British BS1363A |  |
| 5.10 | Input Voltage Range | | V | | 160-286V |  |
| 5.11 | Battery Type | |  | | Maintenance-free sealed Lead-Acid battery with suspended electrolyte: leak proof |  |
| 5.12 | Recharge Time | | Hours | | 3hrs |  |
| 5.13 | Interface Ports | |  | | USB |  |
| 5.14 | Control Panel | |  | | Multi-function LCD status and control console |  |
| 5.15 | Audible Alarm | |  | | Alarm when on battery, distinctive low battery alarm, configurable delays |  |
| 5.16 | Surge Energy Rating | | Joules | | 365 Joules |  |
| 5.17 | Filtering | |  | | Full time multi-pole noise filtering, 0.3% IEEE surge let-through, zero clamping response time, meets UL 1449 |  |
| 5.18 | Operating Temperature | | °C | | 0 - 40 °C |  |
| 5.19 | Audible Noise | | dBA | | 53.0dBA at 1 meter from surface of unit |  |
| 5.20 | Online Thermal Dissipation | | TU/hr | | 375.0BTU/hr |  |
| 5.21 | Protection Class | |  | | Minimum IP20 |  |
| 5.22 | Certification | |  | | CE, CSA, EAC, EN/IEC 62040-1, EN/IEC 62040-2, RCM, VDE |  |
|  |  | |  | |  |  |
| 6.0 | **5KVA BATTERY BACKUP SUPPLY** | | | | | |
| 6.1 | Manufacturer and Country of Origin | |  | | To be Specified |  |
| 6.2 | Type | |  | | 5kVA Battery Backup Supply |  |
| 6.3 | Output Power Capacity | |  | | 3.5kW/5.0kVA |  |
| 6.4 | Output Voltage and distortion | | V | | 230V, configurable for 220V, 230V, or 240V nominal output voltage, distortion less than 5% at full load |  |
| 6.5 | Efficiency at Full load | | % | | 92% |  |
| 6.6 | Output Frequency | | Hz | | 47 - 53 Hz for 50 Hz nominal, 57 - 63 Hz for 60 Hz nominal |  |
| 6.7 | Output Connections | |  | | 8) IEC 320 C13 (Battery Backup), (2) IEC Jumpers (Battery Backup), (1) IEC 320 C19 (Battery Backup) |  |
| 6.8 | Input Voltage | | V | | 230V, 220V or 240V |  |
| 6.9 | Input Frequency | | Hz | | 50/60 Hz +/- 5 Hz (auto sensing) |  |
| 6.10 | Input Connections | |  | | IEC-320 C20, Schuko CEE 7 / EU1-16P, British BS1363A |  |
| 6.11 | Input Voltage Range | | V | | 140-280V |  |
| 6.12 | Battery Type | |  | | Maintenance-free sealed Lead-Acid battery with suspended electrolyte: leak proof |  |
| 6.13 | Recharge Time | | Hours | | 3hrs maximum |  |
| 6.14 | Interface Ports | |  | | USB |  |
| 6.15 | Control Panel | |  | | ED status display with load and battery bar-graphs and On Line: On Battery: Replace Battery: Overload and Bypass Indicators |  |
| 6.16 | Audible Alarm | |  | | Alarm when on battery, distinctive low battery alarm, configurable delays |  |
| 6.17 | Surge Energy Rating | | Joules | | 555 Joules |  |
| 6.18 | Filtering | |  | | Full time multi-pole noise filtering, 0.3% IEEE surge let-through, zero clamping response time, meets UL 1449 |  |
| 6.19 | Operating Temperature | | °C | | 0 - 40 °C |  |
| 6.20 | Audible Noise | | dBA | | 55.0dBA at 1 meter from surface of unit |  |
| 6.21 | Online Thermal Dissipation | | TU/hr | | 1057.0BTU/hr |  |
| 6.22 | Protection Class | |  | | Minimum IP20 |  |
| 6.23 | Certification | |  | | CE, EN 50091-1, EN 50091-2, EN 55022 Class A, EN 60950, EN 61000-3-2, GOST, UL 1778, VDE |  |

u) FIRE DETECTION, ALARM SYSTEM

| 1. FIRE DETECTION, ALARM SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
| **REQUIRED** | **OFFERED** |
| **1** | **FACP (FIRE ALARM CONTROL PANEL)** | | | |
| 1.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 1.2 | Amb. Relative Hummidity Max. | % | 95% |  |
| 1.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 1.4 | Input voltage | V | 240 VAC |  |
| 1.5 | Output voltage | V | 24VDC |  |
| 1.6 | Output current |  | Based on bidder’s offer |  |
| 1.7 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 1.8 | Dimensions |  | Based on bidder’s offer |  |
| 1.9 | Weight |  | Based on bidder’s offer |  |
| 1.10 | Color |  | Based on bidder’s offer |  |
| 1.11 | Fully programmable | Yes/No | Yes |  |
| 1.12 | Password protection | Yes/No | Yes |  |
| 1.13 | Event History | Yes/No | Yes |  |
| 1.14 | RS 232 / RS 485 | Yes/No | Yes |  |
| 1.15 | Isolation facility | Yes/No | Yes |  |
| 1.16 | Paging System interface | Yes/No | Yes |  |
| 1.17 | Network facility |  | Based on bidder’s offer |  |
| 1.18 | Ingress protection |  | IP51 |  |
| 1.19 | Temperature rating | °C | MAX. 50C |  |
| 1.20 | MOUNTING |  | wall mounted |  |
| 1.21 | cable access |  | Bottom |  |
| 1.22 | Quantity | No. | According To Design |  |
| 1.23 | Other specifications |  | Based on bidder’s offer |  |
| 1.24 | Loop number | No. | According To Design |  |
| 1.25 | Backup Battery | Yes/No | YES |  |
| 1.26 | DISPLAY |  | LCD |  |
| 1.27 | LED ZONE (INDICATOR) | Yes/No | Yes |  |
| 1.28 | Charger | Yes/No | Yes |  |
| 1.29 | Type | Addressable/ Conventional |  |  |
| 1.30 | Certificate |  | Based on bidder’s offer |  |
| 1.31 | Relay card |  | Based on bidder’s offer |  |
| 1.32 | Model No. |  | Based on bidder’s offer |  |
| 1.33 | Manufacturer |  | Based on bidder’s offer |  |
| 1.34 | Requisition No. |  | Based on bidder’s offer |  |
| 1.35 | P.O. No. |  | Based on bidder’s offer |  |
| **2** | **FIX HEAT DETECTOR** | | | |
| 2.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 2.2 | Ambient Relative Humidity Max. | % | 95% |  |
| 2.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 2.4 | Type and model | Addressable/Conventional |  |  |
| 2.5 | Function |  | Heat Detector |  |
| 2.6 | Supply voltage | V | 17-28 v dc |  |
| 2.7 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 2.8 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 2.9 | Humidity | % | 0-95% |  |
| 2.10 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 2.11 | Dimensions |  | Based on bidder’s offer |  |
| 2.12 | Weight |  | Based on bidder’s offer |  |
| 2.13 | Color |  | WHITE |  |
| 2.14 | Ingress protection |  | Based on bidder’s offer |  |
| 2.15 | Sensibility range for |  | SENSITIVITY IS AUTOMATICALLY ADJUST |  |
| 2.16 | Alarm indicator | Color/type | Red LED |  |
| 2.17 | Grade |  | 1 |  |
| 2.18 | Response time | Low/Fast | Fast |  |
| 2.19 | Initiating temperature |  | Based on bidder’s offer |  |
| 2.20 | Mounting |  | Base |  |
| 2.21 | Body & housing material |  | Based on bidder’s offer |  |
| 2.22 | Output signal |  | Serial out put |  |
| 2.23 | Detector type |  | Ionization and Photoelectric |  |
| 2.24 | Material |  | Fire Retardant Plastic |  |
| 2.25 | Sensor Type |  | fixed temperature |  |
| 2.26 | Certificate |  | Based on bidder’s offer |  |
| 2.27 | Model No. |  | Based on bidder’s offer |  |
| 2.28 | Manufacturer |  | Based on bidder’s offer |  |
| 2.29 | Requisition No. |  | Based on bidder’s offer |  |
| 2.30 | P.O. No. |  | Based on bidder’s offer |  |
| **3** | **RATE OF RISE HEAT DETECTOR** | | | |
| 3.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 3.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 3.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 3.4 | Type and model | Addressable/Conventional |  |  |
| 3.5 | Function |  | Heat Detector |  |
| 3.6 | Supply voltage | V | 17-28 v dc |  |
| 3.7 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 3.8 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 3.9 | Humidity | % | 0-95% |  |
| 3.10 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 3.11 | Dimensions |  | Based on bidder’s offer |  |
| 3.12 | Weight |  | Based on bidder’s offer |  |
| 3.13 | Color |  | White |  |
| 3.14 | Ingress protection |  | IP53 |  |
| 3.15 | Sensibility range for |  | Sensitivity Is Automatically Adjust |  |
| 3.16 | Alarm indicator | Color/type | Red LED |  |
| 3.17 | Grade |  | 1 |  |
| 3.18 | Response time | TEMP.RISE ºc/min | 1, 3, 5, 10, 20, 30 |  |
| GRADE1:min/secs | 34:11, 9:33, 5:24, 2:52, 1:42, 1:17 |  |
| 3.19 | Initiating temperature |  | Based on bidder’s offer |  |
| 3.20 | Mounting |  | Base |  |
| 3.21 | Body & housing material |  | Based on bidder’s offer |  |
| 3.22 | Output signal |  | Serial out put |  |
| 3.23 | Detector type |  | Ionization and Photoelectric |  |
| 3.24 | Material |  | Fire Retardant Plastic |  |
| 3.25 | Sensor Type |  | Rate of rise |  |
| 3.26 | Certificate |  | Based on bidder’s offer |  |
| 3.27 | Model No. |  | Based on bidder’s offer |  |
| 3.28 | Manufacturer |  | Based on bidder’s offer |  |
| 3.29 | Requisition No. |  | Based on bidder’s offer |  |
| 3.30 | P.O. No. |  | Based on bidder’s offer |  |
| **4** | **SMOKE DETECTOR** | | | |
| 4.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 4.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 4.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 4.4 | Type and model | Addressable/ Conventional |  |  |
| 4.5 | Supply voltage | V | 17-28 v dc |  |
| 4.6 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 4.7 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 4.8 | Humidity | % | 0-95% |  |
| 4.9 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 4.10 | Dimensions |  | Based on bidder’s offer |  |
| 4.11 | Weight |  | WHITE |  |
| 4.12 | Color |  | Based on bidder’s offer |  |
| 4.13 | Ingress protection |  | IP43 |  |
| 4.14 | Sensibility range for |  | SENSITIVITY IS AUTOMATICALLY ADJUST |  |
| 4.15 | Alarm indicator | Color/type | Red LED |  |
| 4.16 | Response time | Low/Fast | FAST |  |
| 4.17 | Initiating temperature |  | Based on bidder’s offer |  |
| 4.18 | Temperature rating | °C | MAX. 50C |  |
| 4.19 | Quantity (CON.-ADD.-EX.-ISO.) |  | ACCORDING TO DESIGN |  |
| 4.20 | Detector type |  | Ionization and Photoelectric |  |
| 4.21 | Material |  | Fire Retardant Plastic |  |
| 4.22 | Certificate |  | Based on bidder’s offer |  |
| 4.23 | Model No. |  | Based on bidder’s offer |  |
| 4.24 | Manufacturer |  | Based on bidder’s offer |  |
| 4.25 | Requisition No. |  | Based on bidder’s offer |  |
| 4.26 | P.O. No. |  | Based on bidder’s offer |  |
| **5** | **BEAM DETECTOR** |  |  |  |
| 5.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 5.2 | Amb. Relative Humidity Max. | % | 0.95 |  |
| 5.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 5.4 | Type and model | Addressable/ Conventional |  |  |
| 5.5 | Supply voltage | V | 17-28 v dc |  |
| 5.6 | Current at 24 vdc |  | Based on bidder’s offer |  |
| 5.7 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 5.8 | Humidity | % | 0-95% |  |
| 5.9 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 5.10 | Dimensions |  | Based on bidder’s offer |  |
| 5.11 | Weight |  | Based on bidder’s offer |  |
| 5.12 | Color |  | WHITE |  |
| 5.13 | Ingress protection |  | IP53 (Indoor) , IP65 (Outdoor) |  |
| 5.14 | Diameter of infra-red | m | min:3m |  |
| 5.15 | Alarm indicator | Color/type | Red LED |  |
| 5.16 | maximum distance | m | 100 |  |
| 5.17 | Normal operation temperature | °C | -20 TO 60C |  |
| 5.18 | Quantity |  | ACCORDING TO DESIGN |  |
| 5.19 | Automatic Gain Control | Yes/No | Yes |  |
| 5.20 | Fault alarm indication | Yes/No | Yes |  |
| 5.21 | Material |  | Fire Retardant Plastic |  |
| 5.22 | Certificate |  | Based on bidder’s offer |  |
| 5.23 | Model No. |  | Based on bidder’s offer |  |
| 5.24 | Manufacturer |  | Based on bidder’s offer |  |
| 5.25 | Requisition No. |  | Based on bidder’s offer |  |
| 5.26 | P.O. No. |  | Based on bidder’s offer |  |
| **6** | **LHD ( LINEAR HEAT DETECTOR)** |  |  |  |
| 6.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 6.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 6.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 6.4 | Type and model | Addressable/ Conventional |  |  |
| 6.5 | Supply voltage | V | 17-28 v dc |  |
| 6.6 | Current at 24 vdc |  | Based on bidder’s offer |  |
| 6.7 | Maximum Ambient Install Temperature |  | Based on bidder’s offer |  |
| 6.8 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 6.9 | Ingress protection |  | IP53 (Indoor) , IP65 (Outdoor) |  |
| 6.10 | Alarm Temp. | °C | 60-70c |  |
| 6.11 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 6.12 | Sheath |  | Advanced Polymer Thermal Reactant. twisted pair |  |
| 6.13 | Metallic Core |  | Tin For Corrosion Resistance. steel provides tensile strength copper increases conductivity |  |
| 6.14 | Outer Covering |  | Chemical and UV Resistant |  |
| 6.15 | Quantity |  | According To Design |  |
| 6.16 | Certificate |  | Based on bidder’s offer |  |
| 6.17 | Model No. |  | Based on bidder’s offer |  |
| 6.18 | Manufacturer |  | Based on bidder’s offer |  |
| 6.19 | Requisition No. |  | Based on bidder’s offer |  |
| 6.20 | P.O. No. |  | Based on bidder’s offer |  |
| **7** | **GD (GAS DETECTOR)** |  |  |  |
| 7.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 7.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 7.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 7.4 | Type and model |  | Electro Chemical  (Domestic gas ) |  |
| 7.5 | Supply voltage | V | 17-28 v dc |  |
| 7.6 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 7.7 | Sensor life |  | Based on bidder’s offer |  |
| 7.8 | Humidity | % | 0-95% |  |
| 7.9 | Manufactured to which standard |  | proper type suitable for area classification |  |
| 7.10 | Weight |  | Based on bidder’s offer |  |
| 7.11 | Dimensions |  | Based on bidder’s offer |  |
| 7.12 | Color |  | WHITE |  |
| 7.13 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 7.14 | Ingress protection |  | IP54 |  |
| 7.15 | Body material |  | 316 stainless steel |  |
| 7.16 | Alarm indication | Yes/No | Yes |  |
| 7.17 | Set point adjustment | PPM | 0-50 PPM |  |
| 7.18 | Normal operation temperature | °C | -20 TO 60C |  |
| 7.19 | Quantity |  | According To Design |  |
| 7.20 | output signal | No. | 1 No SPDT,1Amp-24VDC |  |
| 7.21 | Material |  | Fire Retardant Plastic |  |
| 7.22 | Certificate |  | Based on bidder’s offer |  |
| 7.23 | Model No. |  | Based on bidder’s offer |  |
| 7.24 | Manufacturer |  | Based on bidder’s offer |  |
| 7.25 | Requisition No. |  | Based on bidder’s offer |  |
| 7.26 | P.O. No. |  | Based on bidder’s offer |  |
| **8** | **H2 GAS DETECTOR** |  |  |  |
| 8.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 8.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 8.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 8.4 | Type and model |  | Electro Chemical (H2 Gas) |  |
| 8.5 | Supply voltage | V | 17-28 v dc |  |
| 8.6 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 8.7 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 8.8 | Sensor life | Year | at least 3 years |  |
| 8.9 | Manufactured to which standard |  |  |  |
| 8.10 | Dimensions |  | Based on bidder’s offer |  |
| 8.11 | Weight |  | Based on bidder’s offer |  |
| 8.12 | Color |  | WHITE |  |
| 8.13 | Ingress protection |  | IP54 |  |
| 8.14 | Body material |  | Based on bidder’s offer |  |
| 8.15 | Alarm indication | Yes/No | Yes |  |
| 8.16 | Set point adjustment | PPM | 0-50 PPM |  |
| 8.17 | Normal operation temperature | °C | -20 TO 60C |  |
| 8.18 | Quantity |  | According To Design |  |
| 8.19 | output signal |  | 1 No SPDT,1Amp-24VDC |  |
| 8.20 | Material |  | Fire Retardant Plastic |  |
| 8.21 | Certificate |  | Based on bidder’s offer |  |
| 8.22 | Area Classification |  | Explosion proof |  |
| 8.23 | Model No. |  | Based on bidder’s offer |  |
| 8.24 | Manufacturer |  | Based on bidder’s offer |  |
| 8.25 | Requisition No. |  | Based on bidder’s offer |  |
| 8.26 | P.O. No. |  | Based on bidder’s offer |  |
| **9** | **BEACONE** |  |  |  |
| 9.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 9.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 9.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 9.4 | Type and model | Addressable/Conventional |  |  |
| 9.5 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 9.6 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 9.7 | Nominal voltage |  | Based on bidder’s offer |  |
| 9.8 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 9.9 | Dimensions |  | Based on bidder’s offer |  |
| 9.10 | Color |  | Red |  |
| 9.11 | Weight |  | Based on bidder’s offer |  |
| 9.12 | Ingress protection |  | IP53 (Indoor) , IP65 (Outdoor) |  |
| 9.13 | Temperature rating | °C | -25 TO 55C |  |
| 9.14 | Flash rate |  | Based on bidder’s offer |  |
| 9.15 | Quantity |  | According To Design |  |
| 9.16 | Response time |  | Immediate Response |  |
| 9.17 | MOUNTING |  | Wall Mounted |  |
| 9.18 | Nominal voltage | V | 6-25VDC |  |
| 9.19 | Initiating temperature |  | Based on bidder’s offer |  |
| 9.20 | Material |  | Fire Retardant Plastic |  |
| 9.21 | Certificate |  | Based on bidder’s offer |  |
| 9.22 | Model No. |  | Based on bidder’s offer |  |
| 9.23 | Manufacturer |  | Based on bidder’s offer |  |
| 9.24 | Requisition No. |  | Based on bidder’s offer |  |
| 9.25 | P.O. No. |  | Based on bidder’s offer |  |
| **10** | **SOUNDER** |  |  |  |
| 10.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 10.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 10.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 10.4 | Type and model | Addressable/Conventional |  |  |
| 10.5 | Nominal voltage |  | Based on bidder’s offer |  |
| 10.6 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 10.7 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 10.8 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 10.9 | Adjustable Volume Control | Yes/No | Yes |  |
| 10.10 | Dimensions |  | Based on bidder’s offer |  |
| 10.11 | Weight |  | Based on bidder’s offer |  |
| 10.12 | Ingress protection |  | IP53 (Indoor) , IP65 (Outdoor) |  |
| 10.13 | Temperature rating | °C | -25 TO 55C |  |
| 10.14 | Flash rate |  |  |  |
| 10.15 | Quantity |  | According To Design |  |
| 10.16 | Response time |  | Immediate Response |  |
| 10.17 | Nominal voltage | V | 6-25VDC |  |
| 10.18 | Initiating temperature |  | Wall Mounted |  |
| 10.19 | MOUNTING |  | Based on bidder’s offer |  |
| 10.20 | SOUND LEVEL |  | 105 db (with volume control) |  |
| 10.21 | Material |  | Based on bidder’s offer |  |
| 10.22 | Certificate |  | Based on bidder’s offer |  |
| 10.23 | Model No. |  | Based on bidder’s offer |  |
| 10.24 | Manufacturer |  | Based on bidder’s offer |  |
| 10.25 | Requisition No. |  | Based on bidder’s offer |  |
| 10.26 | P.O. No. |  | Based on bidder’s offer |  |
| **11** | **POWER SUPPLY** |  |  |  |
| 11.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 11.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 11.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 11.4 | Input voltage | V | 220 VAC |  |
| 11.5 | Output voltage | V | 24VDC |  |
| 11.6 | Output current |  | Based on bidder’s offer |  |
| 11.7 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 11.8 | Dimensions |  | Based on bidder’s offer |  |
| 11.9 | Weight |  | Based on bidder’s offer |  |
| 11.10 | Color |  | Based on bidder’s offer |  |
| 11.11 | Ingress protection |  | IP42 |  |
| 11.12 | Temperature rating | °C | MAX. 50C |  |
| 11.13 | Quantity |  | According To Design |  |
| 11.14 | Other specifications |  | Based on bidder’s offer |  |
| 11.15 | Backup Battery |  | Yes (According To NFPA) |  |
| 11.16 | Quantity |  | According To Design |  |
| 11.17 | Other specifications |  | For Details Refer To Detail Design |  |
| 11.18 | LED (INDICATOR) | Yes/No | Yes |  |
| 11.19 | Charger | Yes/No | Yes |  |
| 11.20 | Certificate |  | Based on bidder’s offer |  |
| 11.21 | Model No. |  | Based on bidder’s offer |  |
| 11.22 | Manufacturer |  | Based on bidder’s offer |  |
| 11.23 | Requisition No. |  | Based on bidder’s offer |  |
| 11.24 | P.O. No. |  | Based on bidder’s offer |  |
| **12** | **CALL POINT** |  |  |  |
| 12.1 | Amb. Temp. Min / Max | °C | -16 TO 45.6 |  |
| 12.2 | Amb. Relative Humidity Max. | % | 95% |  |
| 12.3 | Normal operation temperature | °C | -20 TO 50C |  |
| 12.4 | Type and model | Addressable/Conventional |  |  |
| 12.5 | Nominal voltage | V | 15-28VDC |  |
| 12.6 | Current at 24 Vdc |  | Based on bidder’s offer |  |
| 12.7 | Alarm current at 24vdc |  | Based on bidder’s offer |  |
| 12.8 | Manufactured to which standard |  | Based on bidder’s offer |  |
| 12.9 | Dimensions |  | Based on bidder’s offer |  |
| 12.10 | Weight |  | Based on bidder’s offer |  |
| 12.11 | color |  | Red |  |
| 12.12 | Ingress protection |  | IP53 (Indoor) , IP65 (Outdoor) |  |
| 12.13 | Temperature | °C | -10 To 50c |  |
| 12.14 | Quantity |  | According To Design |  |
| 12.15 | Other specifications |  | Fast Response Operation In Two Wires On Line Test Facility - Break Glass |  |
| 12.16 | MOUNTING |  | Wall Mounted |  |
| 12.17 | LED INDICATOR | Yes/No | Yes |  |
| 12.18 | Material |  | Fire Retardant Plastic |  |
| 12.19 | Breaking glass type | Yes/No | Yes |  |
| 12.20 | Certificate |  | Based on bidder’s offer |  |
| 12.21 | Model No. |  | Based on bidder’s offer |  |
| 12.22 | Manufacturer |  | Based on bidder’s offer |  |
| 12.23 | Requisition No. |  | Based on bidder’s offer |  |
| 12.24 | P.O. No. |  | Based on bidder’s offer |  |
|  | **NOTE:** | | | |
|  | 1 - It shall be possible to test the sensitivity of a gas detector in the field. | | | |
|  | 2 - The sensor shall be suitable for easy on site calibration. | | | |
|  | 3 - Each gas detector shall be provided with its associated connection box. | | | |
|  | 4 - The gas detectors shall still work after an extended period in operation, without any low concentration of the specific gas, or none at all. | | | |
|  | 5 - The detector shall be designed in such a way that ambient conditions, humidity temperature and wind cannot affect the sensor signal. | | | |
|  | 6 - The gas detectors must be resistant against high concentration of gases, which may be present, when serious leaks occur .The full scale reading shall not turn down, when full scale gas concentration is exceeded. | | | |
|  | 7 - Cable Gland is included in vendor scope of supply. | | | |
|  | 8 - Mounting Accessories is included in vendor scope of supply. | | | |
|  | 9 -The detector shall be inserted into or removed from the base by a simple push twist | | | |
|  | 10 - The detector shall be designed for fast and simple laboratory cleaning. | | | |
|  | 11 - All circuitry must be protected against electrical transients and electromagnetic interferences. | | | |
|  | 12 - There should be provided an alarm indicator lamp on detector. | | | |
|  | 13 - The detector shall be procurement by relevant base. | | | |
|  | 14 - Fire alarm system shall provide for all buildings (control building, guard house, all BCRs, Shelter and all other buildings). | | | |
|  | 15 – Fire alarm system shall equip with Auto dialer system. | | | |

v) FIRE FIGHTING SYSTEM

| 1. FIRE FIGHTING SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
|  | **Transformer Nitrogen Injection and Oil Evacuation Fire Protection System** |  |  |  |
| 1.1 | Manufacturer |  | Based on bidder’s offer |  |
| 1.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 1.3 | Details of System equipment (Model name) |  | Based on bidder’s offer |  |
| 1.4 | Applicable standards |  | UL, FM, VdS, LPCB, NFPA |  |
| 1.5 | Certified By |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 1.8.2 | Weight | Kg | Based on bidder’s offer |  |
| 1.8.3 | Capacity of nitrogen cylinder | m3 | 60,000 lit oil |  |
| 1.8.4 | Number of cylinders | nos. | Based on bidder’s offer |  |
| 1.8.5 | Pressure of nitrogen filling | Kg/cm2 | 150 |  |
| 1.8.6 | Minimum distance of FEC from the transformer | m | 5-10 |  |
| 1.8.7 | Method of mounting |  | Based on bidder’s offer |  |
| 1.8.8 | Whether the following items are provided in FEC. If so, furnish make, type and other details |  | Based on bidder’s offer |  |
| 1.8.8.1 | Contact Manometer |  | Based on bidder’s offer |  |
| 1.8.8.2 | Pressure Regulator |  | Based on bidder’s offer |  |
| 1.8.8.3 | Oil release unit |  | Based on bidder’s offer |  |
| 1.8.8.4 | Gas release unit |  | Based on bidder’s offer |  |
| 1.8.8.5 | Oil drain assembly |  | Based on bidder’s offer |  |
| 1.8.8.6 | Pressure switch : Back up for nitrogen release |  | Based on bidder’s offer |  |
| 1.8.8.7 | Limit switch: No. of contacts and spare contacts (NO & NC) |  | Based on bidder’s offer |  |
| 1.8.9 | Oil drain valve (above FEC) | No. | 1 |  |
| 1.8.9.1 | Make |  | Based on bidder’s offer |  |
| 1.8.9.2 | Type |  | Based on bidder’s offer |  |
| 1.8.9.3 | Size | mm | 80 |  |
| 1.8.9.4 | Type of metal |  | Based on bidder’s offer |  |
| 1.8.10 | Nitrogen injection valve (above FEC) | No. | 4 |  |
| 1.8.10.1 | Make |  | Based on bidder’s offer |  |
| 1.8.10.2 | Type |  | Based on bidder’s offer |  |
| 1.8.10.3 | Size | mm | 25 |  |
| 1.8.11 | Oil drain pipe |  | Based on bidder’s offer |  |
| 1.8.11.1 | Size | mm | 150 |  |
| 1.8.11.2 | Length |  | Based on bidder’s offer |  |
| 1.8.11.3 | Number of openings in the transformer tank |  | Based on bidder’s offer |  |
| 1.8.11.4 | Material |  | Based on bidder’s offer |  |
| 1.9 | Control Box |  |  |  |
| 1.9.1 | Dimension | L x W x H mm | Based on bidder’s offer |  |
| 1.9.2 | Weight | Kg | Based on bidder’s offer |  |
| 1.9.3 | Type & thickness of sheet steel |  | Based on bidder’s offer |  |
| 1.9.4 | Details of components provided in the control box |  | Based on bidder’s offer |  |
| 1.9.5 | Control voltage | V | Based on bidder’s offer |  |
| 1.9.6 | Method of mounting |  | Based on bidder’s offer |  |
| 1.9.7 | Whether audio and visual alarms provided? | Yes/No | Based on bidder’s offer |  |
| 1.10 | Transformer Conservator isolation valve (TCIV) |  |  |  |
| 1.10.1 | Make |  | Based on bidder’s offer |  |
| 1.10.2 | Type |  | Based on bidder’s offer |  |
| 1.10.3 | Location of installation |  | Based on bidder’s offer |  |
| 1.10.4 | Whether suitable for pipe of size 80mm diameter | Yes/No | Based on bidder’s offer |  |
| 1.10.5 | Provision for glass window for inspection | Yes/No | Based on bidder’s offer |  |
| 1.10.6 | No. of contacts & spare contacts (NO & NC) | Nos. | Based on bidder’s offer |  |
| 1.10.7 | Padlocking provision for service position | Yes/No | Based on bidder’s offer |  |
| 1.10.8 | Padlocking provision for filtration/filing/refilling position | Yes/No | Based on bidder’s offer |  |
| 1.11 | Fire Detectors |  |  |  |
| 1.11.1 | Make |  | Based on bidder’s offer |  |
| 1.11.2 | Type |  | Based on bidder’s offer |  |
| 1.11.3 | Quantity required | Nos. | Based on bidder’s offer |  |
| 1.11.4 | Method of fixing |  | Based on bidder’s offer |  |
| 1.11.5 | Effective heat sensing area | m2 | Based on bidder’s offer |  |
| 1.11.6 | Temperature recommended for effective heat sensing | °C | Based on bidder’s offer |  |
| 1.11.7 | Number of contacts NO/NC | Nos. | Based on bidder’s offer |  |
| 1.11.8 | Necessity and condition of refilling |  | Based on bidder’s offer |  |
| 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 | Yes |  |
| 2.1.2 | Jockey Pump | Yes/No | Yes |  |
| 2.1.3 | Stand by pump | Yes/No | Yes |  |
| 2.1.4 | Booster pump | Yes/No | Based on bidder’s offer |  |
| 2.1.5 | Electric Motor | Yes/No | Yes |  |
| 2.1.6 | Diesel Engine | Yes/No | Yes |  |
| 2.1.7 | Control panel (Instrumentation & Control System) | Yes/No | Yes |  |
| 2.1.8 | Pressure Gauge and Switches | Yes/No | Yes |  |
| 2.1.9 | Pipes, Nozzles, Fittings and Accessories | Yes/No | Yes |  |
| 2.1.10 | Pressure Tank | Yes/No | Yes |  |
| 2.1.11 | Suction Line | Yes/No | Yes |  |
| 2.1.12 | Common Fabricated steel base frame | Yes/No | Yes |  |
| 2.1.13 | Fire Detection and Alarm System | Yes/No | Yes |  |
| 2.1.14 | Sprinkler System | Yes/No | Yes |  |
| 2.1.15 | Hydrant Valves | Yes/No | Yes |  |
| 2.1.16 | Firefighting box (containing hose and fire extinguisher) | Yes/No | Yes |  |
| **2.2** | **Firefighting Package (Fire Pump Package)** |  |  |  |
| **2.2.1** | **General information** |  |  |  |
| 2.2.1.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2.1.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 2.2.1.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 2.2.1.4 | System type |  | Based on bidder’s offer |  |
| 2.2.1.5 | System model |  | Based on bidder’s offer |  |
| 2.2.1.6 | Applicable standards |  | Based on bidder’s offer |  |
| 2.2.1.7 | Certification |  | Based on bidder’s offer |  |
| 2.2.1.8 | Pressure vessel |  | Based on bidder’s offer |  |
| 2.2.1.9 | No. of pumps |  | 3 |  |
| 2.2.1.10 | No. of Electric motors |  | 2 |  |
| 2.2.1.11 | Motor pump | Yes/No | Yes |  |
| 2.2.1.12 | Diesel pump | Yes/No | Yes |  |
| 2.2.1.13 | Control panel (Instrumentation & Control System) |  | Based on bidder’s offer |  |
| 2.2.1.14 | Annunciation System |  | Based on bidder’s offer |  |
| 2.2.1.15 | Power Supply for control system |  | Based on bidder’s offer |  |
| 2.2.1.16 | Power supply for service/lighting |  | Based on bidder’s offer |  |
| **2.2.2** | **Main pump** |  | Based on bidder’s offer |  |
| 2.2.2.1 | Standby Pump | Yes/No | Yes/No |  |
| 2.2.2.2 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2.2.3 | Country of manufacturing |  | Based on bidder’s offer |  |
| 2.2.2.4 | Year of manufacturing |  | Based on bidder’s offer |  |
| 2.2.2.5 | Applicable standard |  | Based on bidder’s offer |  |
| 2.2.2.6 | Certification |  | UL&FM |  |
| 2.2.2.7 | Listed | Yes/No | Based on bidder’s offer |  |
| 2.2.2.8 | Type |  | Split case |  |
| 2.2.2.9 | Model |  | Based on bidder’s offer |  |
| 2.2.2.10 | Size |  | Based on bidder’s offer |  |
| 2.2.2.11 | Dimensions |  | Based on bidder’s offer |  |
| 2.2.2.12 | Dry Weight | kg | Based on bidder’s offer |  |
| 2.2.2.13 | Flow (Capacity) | GPM | 1000 |  |
| 2.2.2.14 | Head | m | 102 |  |
| 2.2.2.15 | Discharge pressure | bar | 10 |  |
| 2.2.2.16 | Speed | rpm | Based on bidder’s offer |  |
| 2.2.2.17 | Mounting |  | Based on bidder’s offer |  |
| 2.2.2.18 | Casing material |  | Based on bidder’s offer |  |
| 2.2.2.19 | Impeller material |  | Based on bidder’s offer |  |
| 2.2.2.20 | Shaft material |  | Based on bidder’s offer |  |
| 2.2.2.21 | Wearing rings material |  | Based on bidder’s offer |  |
| 2.2.2.22 | Mechanical seal material |  | Based on bidder’s offer |  |
| 2.2.2.23 | Bearing lubrication |  | Based on bidder’s offer |  |
| 2.2.2.24 | Operating temperature |  | Based on bidder’s offer |  |
| 2.2.2.25 | Suction x delivery dia. | mm x mm | Based on bidder’s offer |  |
| 2.2.2.26 | Painting |  | Based on bidder’s offer |  |
| 2.2.2.27 | Required electric motor power | HP | Based on bidder’s offer |  |
|  | * Electric motor manufacturer |  | Based on bidder’s offer |  |
|  | * Country of manufacturing |  | Based on bidder’s offer |  |
|  | * Year of manufacturing |  | Based on bidder’s offer |  |
|  | * Model name |  | Based on bidder’s offer |  |
|  | * Certification |  | Based on bidder’s offer |  |
|  | * Rated power | kW | Based on bidder’s offer |  |
|  | * Applicable standard |  | Based on bidder’s offer |  |
|  | * Voltage | V | 415 |  |
|  | * Frequency |  | Based on bidder’s offer |  |
|  | * Speed | RPM | Based on bidder’s offer |  |
|  | * Current | A | Based on bidder’s offer |  |
|  | * Service factor |  | Based on bidder’s offer |  |
|  | * Service duty |  | Based on bidder’s offer |  |
|  | * Starting | DOL/Soft starter/VFD | Based on bidder’s offer |  |
|  | * Enclosure |  | Based on bidder’s offer |  |
|  | * Ingress protection |  | Based on bidder’s offer |  |
|  | * Insulation class |  | Based on bidder’s offer |  |
|  | * Design temperature | °C | Based on bidder’s offer |  |
|  | * Design altitude (above sea level) | m | Based on bidder’s offer |  |
|  | * Temperature rise |  | Based on bidder’s offer |  |
|  | * Efficiency class |  | Based on bidder’s offer |  |
|  | * Frame size |  | Based on bidder’s offer |  |
|  | * Mounting |  | Based on bidder’s offer |  |
|  | * Direction of rotation (view from drive end) |  | Based on bidder’s offer |  |
|  | * Painting |  | Based on bidder’s offer |  |
| **2.2.3** | **Jockey pump** |  | Based on bidder’s offer |  |
| 2.2.3.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2.3.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 2.2.3.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 2.2.3.4 | Applicable standard |  | Based on bidder’s offer |  |
| 2.2.3.5 | Certification |  | Based on bidder’s offer |  |
| 2.2.3.6 | Listed | Yes/No | Based on bidder’s offer |  |
| 2.2.3.7 | Type |  | Based on bidder’s offer |  |
| 2.2.3.8 | Model |  | Based on bidder’s offer |  |
| 2.2.3.9 | Size |  | Based on bidder’s offer |  |
| 2.2.3.10 | Dimensions |  | Based on bidder’s offer |  |
| 2.2.3.11 | Dry Weight | kg | Based on bidder’s offer |  |
| 2.2.3.12 | Flow (Capacity) | m3/h | Based on bidder’s offer |  |
| 2.2.3.13 | Head | m | Based on bidder’s offer |  |
| 2.2.3.14 | Discharge pressure | psi | Based on bidder’s offer |  |
| 2.2.3.15 | Speed | rpm | Based on bidder’s offer |  |
| 2.2.3.16 | Mounting |  | Based on bidder’s offer |  |
| 2.2.3.17 | Casing material |  | Based on bidder’s offer |  |
| 2.2.3.18 | Impeller material |  | Based on bidder’s offer |  |
| 2.2.3.19 | Shaft material |  | Based on bidder’s offer |  |
| 2.2.3.20 | Wearing rings material |  | Based on bidder’s offer |  |
| 2.2.3.21 | Mechanical seal material |  | Based on bidder’s offer |  |
| 2.2.3.22 | Bearing lubrication |  | Based on bidder’s offer |  |
| 2.2.3.23 | Operating temperature |  | Based on bidder’s offer |  |
| 2.2.3.24 | Suction x delivery dia. | mm x mm | Based on bidder’s offer |  |
| 2.2.3.25 | Painting |  | Based on bidder’s offer |  |
| 2.2.3.26 | Required electric motor power | HP | Based on bidder’s offer |  |
|  | * Electric motor manufacturer |  | Based on bidder’s offer |  |
|  | * Country of manufacturing |  | Based on bidder’s offer |  |
|  | * Year of manufacturing |  | Based on bidder’s offer |  |
|  | * Model name |  | Based on bidder’s offer |  |
|  | * Certification |  | Based on bidder’s offer |  |
|  | * Rated power | kW | Based on bidder’s offer |  |
|  | * Applicable standard |  | Based on bidder’s offer |  |
|  | * Voltage | V | Based on bidder’s offer |  |
|  | * Frequency |  | Based on bidder’s offer |  |
|  | * Speed | RPM | Based on bidder’s offer |  |
|  | * Current | A | Based on bidder’s offer |  |
|  | * Service factor |  | Based on bidder’s offer |  |
|  | * Service duty |  | Based on bidder’s offer |  |
|  | * Starting | DOL/Soft starter/VFD | Based on bidder’s offer |  |
|  | * Enclosure |  | Based on bidder’s offer |  |
|  | * Ingress protection |  | Based on bidder’s offer |  |
|  | * Insulation class |  | Based on bidder’s offer |  |
|  | * Design temperature | °C | Based on bidder’s offer |  |
|  | * Design altitude (above sea level) | m | Based on bidder’s offer |  |
|  | * Temperature rise |  | Based on bidder’s offer |  |
|  | * Efficiency class |  | Based on bidder’s offer |  |
|  | * Frame size |  | Based on bidder’s offer |  |
|  | * Mounting |  | Based on bidder’s offer |  |
|  | * Direction of rotation (view from drive end) |  | Based on bidder’s offer |  |
|  | * Painting |  | Based on bidder’s offer |  |
| **2.2.4** | **Booster pump** |  | Based on bidder’s offer |  |
| 2.2.4.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2.4.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 2.2.4.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 2.2.4.4 | Applicable standard |  | Based on bidder’s offer |  |
| 2.2.4.5 | Certification |  | Based on bidder’s offer |  |
| 2.2.4.6 | Listed | Yes/No | Based on bidder’s offer |  |
| 2.2.4.7 | Type |  | Based on bidder’s offer |  |
| 2.2.4.8 | Model |  | Based on bidder’s offer |  |
| 2.2.4.9 | Size |  | Based on bidder’s offer |  |
| 2.2.4.10 | Dimensions |  | Based on bidder’s offer |  |
| 2.2.4.11 | Dry Weight | kg | Based on bidder’s offer |  |
| 2.2.4.12 | Flow (Capacity) | m3/h | Based on bidder’s offer |  |
| 2.2.4.13 | Head | m | Based on bidder’s offer |  |
| 2.2.4.14 | Discharge pressure | bar | Based on bidder’s offer |  |
| 2.2.4.15 | Speed | rpm | Based on bidder’s offer |  |
| 2.2.4.16 | Mounting |  | Based on bidder’s offer |  |
| 2.2.4.17 | Casing material |  | Based on bidder’s offer |  |
| 2.2.4.18 | Impeller material |  | Based on bidder’s offer |  |
| 2.2.4.19 | Shaft material |  | Based on bidder’s offer |  |
| 2.2.4.20 | Wearing rings material |  | Based on bidder’s offer |  |
| 2.2.4.21 | Mechanical seal material |  | Based on bidder’s offer |  |
| 2.2.4.22 | Bearing lubrication |  | Based on bidder’s offer |  |
| 2.2.4.23 | Operating temperature |  | Based on bidder’s offer |  |
| 2.2.4.24 | Suction x delivery dia. | mm x mm | Based on bidder’s offer |  |
| 2.2.4.25 | Painting |  | Based on bidder’s offer |  |
| 2.2.4.26 | Required electric motor power | kW | Based on bidder’s offer |  |
|  | * Electric motor manufacturer |  | Based on bidder’s offer |  |
|  | * Country of manufacturing |  | Based on bidder’s offer |  |
|  | * Year of manufacturing |  | Based on bidder’s offer |  |
|  | * Model name |  | Based on bidder’s offer |  |
|  | * Certification |  | Based on bidder’s offer |  |
|  | * Rated power | kW | Based on bidder’s offer |  |
|  | * Applicable standard |  | Based on bidder’s offer |  |
|  | * Voltage | V | Based on bidder’s offer |  |
|  | * Frequency |  | Based on bidder’s offer |  |
|  | * Speed | RPM | Based on bidder’s offer |  |
|  | * Current | A | Based on bidder’s offer |  |
|  | * Service factor |  | Based on bidder’s offer |  |
|  | * Service duty |  | Based on bidder’s offer |  |
|  | * Starting | DOL/Soft starter/VFD | Based on bidder’s offer |  |
|  | * Enclosure |  | Based on bidder’s offer |  |
|  | * Ingress protection |  | Based on bidder’s offer |  |
|  | * Insulation class |  | Based on bidder’s offer |  |
|  | * Design temperature | °C | Based on bidder’s offer |  |
|  | * Design altitude (above sea level) | m | Based on bidder’s offer |  |
|  | * Temperature rise |  | Based on bidder’s offer |  |
|  | * Efficiency class |  | Based on bidder’s offer |  |
|  | * Frame size |  | Based on bidder’s offer |  |
|  | * Mounting |  | Based on bidder’s offer |  |
|  | * Direction of rotation (view from drive end) |  | Based on bidder’s offer |  |
|  | * Painting |  | Based on bidder’s offer |  |
| **2.2.5** | **Engine** |  | Based on bidder’s offer |  |
| 2.2.5.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2.5.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 2.2.5.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 2.2.5.4 | Applicable standards |  | UL&FM |  |
| 2.2.5.5 | Design temperature | °C | Based on bidder’s offer |  |
| 2.2.5.6 | Design altitude (above sea level) | m | Based on bidder’s offer |  |
| 2.2.5.7 | Air inlet temperature | °C | Based on bidder’s offer |  |
| 2.2.5.8 | Fuel inlet temperature | °C | Based on bidder’s offer |  |
| 2.2.5.9 | Power rating | HP | Based on bidder’s offer |  |
| 2.2.5.10 | Speed | RPM | Based on bidder’s offer |  |
| 2.2.5.11 | Min. and Max. rating | kW @ RPM | Based on bidder’s offer |  |
| 2.2.5.12 | Min. and Max. torque | Nm @ RPM | Based on bidder’s offer |  |
| 2.2.5.13 | Engine type |  | Based on bidder’s offer |  |
| 2.2.5.14 | Injection Type |  | Based on bidder’s offer |  |
| 2.2.5.15 | Model |  | Based on bidder’s offer |  |
| 2.2.5.16 | Service | Indoor/ outdoor | indoor |  |
| 2.2.5.17 | Intake type |  | Based on bidder’s offer |  |
| 2.2.5.18 | Starting type |  | Based on bidder’s offer |  |
| 2.2.5.19 | No. of cylinders |  | Based on bidder’s offer |  |
| 2.2.5.20 | Bore x Stroke | mm | Based on bidder’s offer |  |
| 2.2.5.21 | Displacement | cm3 | Based on bidder’s offer |  |
| 2.2.5.22 | Compression ratio |  | By vendor |  |
| 2.2.5.23 | Emission certification |  | Based on bidder’s offer |  |
| 2.2.5.24 | Max. Temp. rise between ambient air and Engine air inlet | °C | Based on bidder’s offer |  |
| 2.2.5.25 | Air cleaner element |  | Based on bidder’s offer |  |
| 2.2.5.26 | Exhaust temperature | °C | Based on bidder’s offer |  |
| 2.2.5.27 | Exhaust gas flow | L/sec | Based on bidder’s offer |  |
| 2.2.5.28 | Max. back pressure imposed by exhaust system | kPa | Based on bidder’s offer |  |
| 2.2.5.29 | Exhaust pipe size | mm | Based on bidder’s offer |  |
| 2.2.5.30 | Exhaust protection |  | Based on bidder’s offer |  |
| 2.2.5.31 | Aspiration |  | Based on bidder’s offer |  |
| 2.2.5.32 | Fuel type |  | Gas Oil |  |
| 2.2.5.33 | Max. fuel temperature @ lift pump inlet | °C | Based on bidder’s offer |  |
| 2.2.5.34 | Oil consumption | Kg/hr | 0.2 |  |
| 2.2.5.35 | Oil sump capacity | Liter | Based on bidder’s offer |  |
| 2.2.5.36 | Dry weight | kg | Based on bidder’s offer |  |
| 2.2.5.37 | Wet weight | kg | Based on bidder’s offer |  |
| 2.2.5.38 | Lubrication type |  | Based on bidder’s offer |  |
| 2.2.5.39 | Lubrication system oil pressure | psi | Based on bidder’s offer |  |
| 2.2.5.40 | Lube oil filter |  | Based on bidder’s offer |  |
| 2.2.5.41 | Oil capacity of pan (High-Low) | Liter | Based on bidder’s offer |  |
| 2.2.5.42 | Lube oil cooler |  | Based on bidder’s offer |  |
| 2.2.5.43 | Lube oil pump |  | Based on bidder’s offer |  |
| 2.2.5.44 | Battery voltage | V DC | Based on bidder’s offer |  |
| 2.2.5.45 | Battery capacity | Ah | Based on bidder’s offer |  |
| 2.2.5.46 | Valves per cylinder: Intake / Exhaust |  | Based on bidder’s offer |  |
| 2.2.5.47 | Gate valves |  | Based on bidder’s offer |  |
| 2.2.5.48 | Check valves |  | Based on bidder’s offer |  |
| 2.2.5.49 | Power take off flywheel |  | Based on bidder’s offer |  |
| 2.2.5.50 | Flywheel size |  | Based on bidder’s offer |  |
| 2.2.5.51 | Direction of rotation (view from power take-off side) |  | Based on bidder’s offer |  |
| 2.2.5.52 | Cooling fan |  | Based on bidder’s offer |  |
| 2.2.5.53 | Fitted water radiator (heat exchanger) |  | Based on bidder’s offer |  |
| 2.2.5.54 | Raw water pressure at heat exchanger | psi | Based on bidder’s offer |  |
| 2.2.5.55 | Coolant water capacity (engine side) | Liter | Based on bidder’s offer |  |
| 2.2.5.56 | Water temperature switch |  | Based on bidder’s offer |  |
| 2.2.5.57 | Engine heater | VAC, Watt | Based on bidder’s offer |  |
| 2.2.5.58 | Centrifugal speed governor |  | Based on bidder’s offer |  |
| 2.2.5.59 | Torque regulator |  | Based on bidder’s offer |  |
| 2.2.5.60 | Manual start control |  | Based on bidder’s offer |  |
| 2.2.5.61 | Overspeed control |  | Based on bidder’s offer |  |
| 2.2.5.62 | Run-stop control |  | Based on bidder’s offer |  |
| 2.2.5.63 | Run solenoid |  | Based on bidder’s offer |  |
| 2.2.5.64 | Stop solenoid |  | Based on bidder’s offer |  |
| 2.2.5.65 | Throttle control |  | Based on bidder’s offer |  |
| 2.2.5.66 | Water pump type |  | Based on bidder’s offer |  |
| 2.2.5.67 | Sound pressure level (front / side / exhaust) | dB(A) | Based on bidder’s offer |  |
| 2.2.5.68 | Crankcase material |  | Based on bidder’s offer |  |
| 2.2.5.69 | Painting |  | Based on bidder’s offer |  |
| **2.2.6** | **Control panel** |  | Based on bidder’s offer |  |
| 2.2.6.1 | Manufacturer |  | Based on bidder’s offer |  |
| 2.2.6.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 2.2.6.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 2.2.6.4 | Applicable standards |  | Based on bidder’s offer |  |
| 2.2.6.5 | Design temperature | °C | Based on bidder’s offer |  |
| 2.2.6.6 | Enclosure IP |  | Based on bidder’s offer |  |
| 2.2.6.7 | Main door lock disconnect switch |  | Based on bidder’s offer |  |
| 2.2.6.8 | MCB |  | Based on bidder’s offer |  |
| 2.2.6.9 | Fuses |  | Based on bidder’s offer |  |
| 2.2.6.10 | No. of switching battery chargers |  | Based on bidder’s offer |  |
| 2.2.6.11 | Control circuits relay |  | Based on bidder’s offer |  |
| 2.2.6.12 | Thermal overload relay |  | Based on bidder’s offer |  |
| 2.2.6.13 | Terminal board |  | Based on bidder’s offer |  |
| 2.2.6.14 | Motor-Pump-Engine control unit |  | Based on bidder’s offer |  |
| 2.2.6.15 | Multifunction instrument with display |  | Based on bidder’s offer |  |
|  | * Voltmeter |  | Based on bidder’s offer |  |
|  | * Ammeter |  | Based on bidder’s offer |  |
|  | * Rev counter |  | Based on bidder’s offer |  |
|  | * Duty hours counter |  | Based on bidder’s offer |  |
|  | * Fuel level gauge |  | Based on bidder’s offer |  |
|  | * Oil pressure gauge |  | Based on bidder’s offer |  |
|  | Start and stop pushbuttons |  | Based on bidder’s offer |  |
| 2.2.6.16 | Indicator lights |  | Based on bidder’s offer |  |
| 2.2.6.17 | Test button for first start-up |  | Based on bidder’s offer |  |
| 2.2.6.18 | AUT - 0 - MAN selector with key |  | Based on bidder’s offer |  |
| 2.2.6.20 | Contacts on the terminal board to remote signals panel |  | Based on bidder’s offer |  |
|  | * Pump running |  | Based on bidder’s offer |  |
|  | * Selector not on AUT |  | Based on bidder’s offer |  |
|  | * Failed starting |  | Based on bidder’s offer |  |
|  | * Control panel and/or batteries fault |  | Based on bidder’s offer |  |
| 2.2.6.21 | Automatic engine cranking system |  | Based on bidder’s offer |  |
| 2.2.6.22 | Automatic battery charger |  | Based on bidder’s offer |  |
| **2.2.7** | **Pipes and valves and fittings** |  | Based on bidder’s offer |  |
| 2.2.7.1 | Pipe |  | Based on bidder’s offer |  |
|  | * Manufacturer |  | Based on bidder’s offer |  |
|  | * Country of manufacturing |  | Based on bidder’s offer |  |
|  | * Year of manufacturing |  | Based on bidder’s offer |  |
|  | * manufacturing standards |  | Based on bidder’s offer |  |
|  | * OD | mm | Based on bidder’s offer |  |
|  | * Thickness | mm | Based on bidder’s offer |  |
|  | * Material |  | Based on bidder’s offer |  |
| 2.2.7.2 | Valves |  | Based on bidder’s offer |  |
|  | * Manufacturer |  | Based on bidder’s offer |  |
|  | * Country of manufacturing |  | Based on bidder’s offer |  |
|  | * Year of manufacturing |  | Based on bidder’s offer |  |
|  | * Manufacturing standard |  | Based on bidder’s offer |  |
|  | * Testing standard |  | Based on bidder’s offer |  |
|  | * Type |  | Based on bidder’s offer |  |
|  | * Model |  | Based on bidder’s offer |  |
|  | * Size |  | Based on bidder’s offer |  |
|  | * Quantity |  | Based on bidder’s offer |  |
|  | * Service condition |  | Based on bidder’s offer |  |
|  | * Construction |  | Based on bidder’s offer |  |
|  | * End connections |  | Based on bidder’s offer |  |
|  | * Rating |  | Based on bidder’s offer |  |
|  | * Face to face |  | Based on bidder’s offer |  |
|  | * Size |  | Based on bidder’s offer |  |
|  | * M.O.C |  | Based on bidder’s offer |  |
|  | * Body |  | Based on bidder’s offer |  |
|  | * Adaptor |  | Based on bidder’s offer |  |
|  | * Ball/ Disc material |  | Based on bidder’s offer |  |
|  | * Gland |  | Based on bidder’s offer |  |
|  | * Spindle |  | Based on bidder’s offer |  |
|  | * Seat |  | Based on bidder’s offer |  |
|  | * Seal |  | Based on bidder’s offer |  |
|  | * Packing |  | Based on bidder’s offer |  |
|  | * Fasteners |  | Based on bidder’s offer |  |
|  | * Actuation |  | Based on bidder’s offer |  |
|  | * Hydro Test pressure | Kg/cm2 | Based on bidder’s offer |  |
|  | * Pneumatic Test pressure | Kg/cm2 | Based on bidder’s offer |  |
| 2.2.7.3 | Fittings |  | Based on bidder’s offer |  |
|  | * Manufacturer |  | Based on bidder’s offer |  |
|  | * Country of manufacturing |  | Based on bidder’s offer |  |
|  | * No. and type |  | Based on bidder’s offer |  |
|  | * Material |  | Based on bidder’s offer |  |
|  | * Applicable standard |  | Based on bidder’s offer |  |
| **2.3** | **Deluge and Sprinkler System** |  | Based on bidder’s offer |  |
|  | Location in the substation |  | Based on bidder’s offer |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | Country of manufacturing |  | Based on bidder’s offer |  |
|  | Year of manufacturing |  | Based on bidder’s offer |  |
|  | Applicable standard |  | Based on bidder’s offer |  |
|  | Spatial structure made of pipes | Yes/No | Based on bidder’s offer |  |
|  | Automatic spray type Fire Protection System | HVW/MVW | Based on bidder’s offer |  |
|  | * Main Transformer |  | Based on bidder’s offer |  |
|  | * Aux. Transformer |  | Based on bidder’s offer |  |
|  | * Shunt Reactor |  | Based on bidder’s offer |  |
|  | Water supply System |  | Based on bidder’s offer |  |
|  | No. of sprinklers |  | Based on bidder’s offer |  |
|  | No. of actuator stations |  | Based on bidder’s offer |  |
|  | Type of actuator stations |  | Based on bidder’s offer |  |
|  | Diaphragm flood valve |  | Based on bidder’s offer |  |
|  | Bolted flange joints | Yes/No | Based on bidder’s offer |  |
|  | Certification |  | Based on bidder’s offer |  |
|  | VdS and FM Approves | Yes/No | Yes |  |
|  | Hot-dip galvanized pipes | Yes/No | Yes |  |
|  | Anti-corrosion coatings | Yes/No | Yes |  |
|  | Manual activation in the control room | Yes/No | Based on bidder’s offer |  |
|  | Manual opening of the flood valves | Yes/No | Based on bidder’s offer |  |
|  | Fire detection system by temp. sensor |  | Based on bidder’s offer |  |
|  | Temperature thresholds |  | Based on bidder’s offer |  |
|  | Sensor cable |  | Based on bidder’s offer |  |
|  | Initiating gases in Buchholz relay |  | Based on bidder’s offer |  |
|  | Automatic activation by |  | Based on bidder’s offer |  |
|  | Pressure of system pressure test | MPa, hours | Based on bidder’s offer |  |
|  | Sound alarm | Yes/No | Based on bidder’s offer |  |
| **2.4** | **Fire hydrant system (only after full electrical isolation)** |  |  |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | Country of manufacturing |  | Based on bidder’s offer |  |
|  | Year of manufacturing |  | Based on bidder’s offer |  |
|  | Fire hydrant No. |  | 6 |  |
|  | Fire hydrants locations |  | Based on bidder’s offer |  |
|  | * Near buildings |  | Yes |  |
|  | * Transformers |  | Yes |  |
|  | * Reactors |  | Yes |  |
|  | Fire hydrant type |  | Based on bidder’s offer |  |
|  | Fire hydrant dimensions |  | Based on bidder’s offer |  |
|  | Fire hydrant class |  | C |  |
|  | Fire hydrant flow | GPM | 500 |  |
|  | Fire hydrant working pressure | psi | 10 |  |
|  | Fire hydrant hydrostatic test pressure | psi | 12 |  |
|  | Fire hydrant clearance | m | Based on bidder’s offer |  |
|  | Size of nozzle | inch | Based on bidder’s offer |  |
|  | Pumper nozzle size | inch | Based on bidder’s offer |  |
|  | Fire hydrants installation |  | Based on bidder’s offer |  |
|  | Applicable standard |  | Based on bidder’s offer |  |
|  | Hydrants distance from substation buildings | m | 12 |  |
|  | Hydrants distance from each other | m | 90 |  |
|  | Water Supply |  | Based on bidder’s offer |  |
|  | Hose Boxes |  | Based on bidder’s offer |  |
|  | * Hose Pipe size and material |  | 21/2", The single jacket hose made of  high tenacity polyester staple and  polyester filaments. Lining is natural rubber |  |
|  | * Branch pipes size and material |  |  |  |
|  | * Nozzles size and material |  | 2/12", Bronze |  |
|  | Provision of Hose Reel and wet Riser in the buildings | Yes/No | Yes |  |
|  | Hydrant system design for farthest point of the switchyard considering the present scope & future bays | Yes/No | Yes |  |
|  | Warning plates | Yes/No | Yes |  |
| **2.5** | **Fire water tank** |  |  |  |
|  | Capacity |  | 230 |  |
|  | Construction type |  | Based on bidder’s offer |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | Country of origin |  | Based on bidder’s offer |  |
|  | Model |  | Based on bidder’s offer |  |
|  | International listing UL, FM, VdS or LPCB |  | UL |  |
| **2.6** | **Main fire alarm & extinguishing control panel** |  |  |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | country of origin |  | Based on bidder’s offer |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Type |  | Analogue  addressable |  |
|  | International listing UL, FM, VdS or LPCB |  | Based on bidder’s offer |  |
|  | Number of loops |  | Based on bidder’s offer |  |
|  | Display type |  | LCD |  |
|  | Enclosure |  | Based on bidder’s offer |  |
|  | Mounting |  | Floor |  |
|  | Rack size |  | 19” rack  system |  |
|  | Dimension |  | 2.2x0.8x0.8 |  |
|  | Batteries for fire alarm panel |  | Based on bidder’s offer |  |
|  | Type |  | Maintenance  free |  |
|  | Voltage | V DC | 48 |  |
|  | Backup | hr | 24 |  |
|  | Primary power supply voltage | V | 220 |  |
|  | Printer |  | Non-thermal |  |
|  | Battery type |  | Maintenance  free, dry fit  and gas tight |  |
|  | Secondary power supply from UPS | Yes/No | Yes |  |
|  | Mimic Panel | Yes/No | Yes |  |
|  | * Fascia material |  | SS (matte  finish) |  |
|  | * Size | mm | 800 x 800 |  |
|  | **Fire Extinguishers** |  |  |  |
| **3.1.** | **CO2 Wall Mounting Extinguisher** |  |  |  |
| 3.1.1 | Manufacturer |  | Based on bidder’s offer |  |
| 3.1.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 3.1.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 3.1.4 | Dimensions |  | Based on bidder’s offer |  |
| 3.1.5 | Weight | Kg | Based on bidder’s offer |  |
| 3.1.6 | Type of dry powder |  | CO2 |  |
| 3.1.7 | Test pressure | Bar g | 250 |  |
| 3.1.8 | Working pressure | Bar g | 60 |  |
| 3.1.9 | Applicable standards |  | NFPA |  |
| 3.1.10 | International listing UL, FM, VdS or LPCB |  | Based on bidder’s offer |  |
| **3.2.** | **Dry Powder Wall Mounting Extinguisher** |  | Based on bidder’s offer |  |
| 3.2.1 | Manufacturer |  | Based on bidder’s offer |  |
| 3.2.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 3.2.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 3.2.4 | Dimensions |  | Based on bidder’s offer |  |
| 3.2.5 | Weight | Kg | Based on bidder’s offer |  |
| 3.2.6 | Type of dry powder |  | ABC |  |
| 3.2.7 | Test pressure | Bar g | 27 |  |
| 3.2.8 | Working pressure | Bar g | 15 |  |
| 3.2.9 | Applicable standards |  | NFPA |  |
| 3.2.10 | International listing UL, FM, VdS or LPCB |  | Based on bidder’s offer |  |
| **3.3.** | **CO2 wheeled Extinguisher** |  | Based on bidder’s offer |  |
| 3.3.1 | Manufacturer |  | Based on bidder’s offer |  |
| 3.3.2 | Country of manufacturing |  | Based on bidder’s offer |  |
| 3.3.3 | Year of manufacturing |  | Based on bidder’s offer |  |
| 3.3.4 | Dimensions |  | Based on bidder’s offer |  |
| 3.3.5 | Weight | Kg | Based on bidder’s offer |  |
| 3.3.6 | Type of dry powder |  | CO2 |  |
| 3.3.7 | Test pressure | Bar g | 250 |  |
| 3.3.8 | Working pressure | Bar g | 55 |  |
| 3.3.9 | Applicable standards |  | NFPA |  |
| 3.3.10 | International listing UL, FM, VdS or LPCB |  | Based on bidder’s offer |  |
|  | **Fire Blanket** |  |  |  |
| 4.1 | Manufacturer |  | Based on bidder’s offer |  |
| 4.2 | Weight | Kg | Based on bidder’s offer |  |
| 4.3 | Temperature Resistance | °C | Based on bidder’s offer |  |
| 4.4 | Size | m | Based on bidder’s offer |  |
| 4.5 | Material |  | Based on bidder’s offer |  |
| 4.6 | Applicable standards |  | BS 7944,  BS EN 1869:1997 |  |

w) 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 |  | Based on bidder’s offer |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Applicable standards |  | Based on bidder’s offer |  |
|  |  |  | Based on bidder’s offer |  |
|  | Enclosure color code |  | Based on bidder’s offer |  |
|  | HVAC CONTROL PANEL FIRE PUMP ROOM |  | Based on bidder’s offer |  |
|  | Manufacturer / country of origin |  | Based on bidder’s offer |  |
|  | Model (wall mounted) |  | Based on bidder’s offer |  |
|  | Applicable standards |  | Based on bidder’s offer |  |
|  | Enclosure color code |  | Based on bidder’s offer |  |
| 2. | SPLIT UNITS |  |  |  |
|  | Manufacturer / country of origin |  | Based on bidder’s offer |  |
|  | Quantity | NO | 44 |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Applicable standards |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Power | kW | Based on bidder’s offer |  |
|  | Condenser model |  | Based on bidder’s offer |  |
| 3. | AIR COOLED CONDENSING UNITS |  |  |  |
|  | Manufacturer / country of origin |  | Based on bidder’s offer |  |
|  | Quantity |  | Based on bidder’s offer |  |
|  | Model |  | Based on bidder’s offer |  |
|  | Applicable standards |  | Based on bidder’s offer |  |
|  | Type of refrigerant |  | Based on bidder’s offer |  |
|  | Cooling capacity | Btu/hr | 9000,12000,18000,24000 |  |
|  | Number of cooling circuit | No | Based on bidder’s offer |  |
|  | Compressors per cooling circuit | No | Based on bidder’s offer |  |
|  | Compressor model |  | Based on bidder’s offer |  |
|  | Compressor type |  | Based on bidder’s offer |  |
|  | Condenser coil |  | Based on bidder’s offer |  |
|  | Fin material |  | Based on bidder’s offer |  |
|  | Tube material |  | Based on bidder’s offer |  |
| 4. | EXHAUST FANS |  |  |  |
|  | Manufacturer / country of origin |  | Based on bidder’s offer |  |
|  | Quantity |  | 25 |  |
|  | Model |  | Based on bidder’s offer |  |
|  | International approvals |  | Based on bidder’s offer |  |
|  | Fan Speed | rpm | Based on bidder’s offer |  |
|  | Fan impeller material |  | Based on bidder’s offer |  |
|  | Fan Shaft Material |  | Based on bidder’s offer |  |
|  | Voltage/Frequency | V/Hz | Based on bidder’s offer |  |
|  | Capacity for Battery room, toilet, pantry,  basement | m3/hr | 2900, 240, 270,770 |  |
|  | Capacity for gas cylinder room, staircase  pressurization fans, diesel pump exhaust |  | Based on bidder’s offer |  |
|  | Gas flooded room fan type |  | Based on bidder’s offer |  |
|  | Type |  | Based on bidder’s offer |  |
|  | Capacity |  | Based on bidder’s offer |  |
|  | Basement extract fans |  | Based on bidder’s offer |  |
|  | Battery room fan type |  | Suitable for hazardous area |  |
|  | Storage warehouse |  | Based on bidder’s offer |  |
|  | DG house |  | Based on bidder’s offer |  |
| 5. | EXHAUST AIR FLOW RATES |  |  |  |
| 5.1 | Control Building |  | Based on bidder’s offer |  |
|  | Telecommunication room | m3/s | 2 |  |
|  | Battery room | m3/s | 15 |  |
|  | Relay room | m3/s | 2 |  |
|  | LVAC/DC room | m3/s | 2 |  |
|  | Cable basement | m3/s | Based on bidder’s offer |  |
|  | Operator room | m3/s | 2 |  |
|  | Office | m3/s | 2 |  |
|  | Kitchen or pantry | m3/s | 12 |  |
|  | Store | m3/s | Based on bidder’s offer |  |
|  | Toilet | m3/s | 10 |  |
| 5.2 | Guard House and Telecom Room | m3/s | Based on bidder’s offer |  |
|  | Main equipment room | m3/s | 2 |  |
|  | Customer equipment room | m3/s | 2 |  |
|  | Battery room | m3/s | 15 |  |
|  | Guard room | m3/s | 2 |  |
|  | Kitchen | m3/s | 12 |  |
|  | Toilet | m3/s | 10 |  |
| 5.3 | Staff Housings | m3/s | Based on bidder’s offer |  |
| 5.3.1 | Technical staff housing | m3/s | Based on bidder’s offer |  |
|  | * Bedroom | m3/s | 2 |  |
|  | * Living room | m3/s | 2 |  |
|  | * Kitchen | m3/s | 12 |  |
|  | * Toilet | m3/s | 10 |  |
| 5.3.2 | Security staff housing | m3/s | Based on bidder’s offer |  |
|  | * Bedroom | m3/s | 2 |  |
|  | * Living room | m3/s | 2 |  |
|  | * Kitchen | m3/s | 12 |  |
|  | * Toilet | m3/s | 10 |  |
| 5.4 | DG house | m3/s | Based on bidder’s offer |  |
| 5.5 | Fire pump house | m3/s | Based on bidder’s offer |  |
| 6. | SOUND ATTENUATORS |  |  |  |
| 6.1 | Manufacturer / country of origin |  | Based on bidder’s offer |  |
| 6.2 | Model |  | Based on bidder’s offer |  |
| 6.3 | International approvals |  | Based on bidder’s offer |  |
| 6.4 | Main supply air |  | Based on bidder’s offer |  |
| 6.5 | Main return air |  | Based on bidder’s offer |  |
| 6.6 | Pressure drop across attenuators | Pa | Based on bidder’s offer |  |
| 6.7 | Main supply air | Pa | Based on bidder’s offer |  |
| 6.8 | Main return air | Pa | Based on bidder’s offer |  |

x) LOW VOLTAGE CABLES

| 1. LOW VOLTAGE CABLES | | **UNIT** | **DATA** | | |
| --- | --- | --- | --- | --- | --- |
|  | |  | **REQUIRED** | | **OFFERED** |
| **1** | **Low Voltage Power Cable** |  |  |  | |
| 1.1 | Manufacturer |  | Based on bidder’s offer |  | |
|  | Name |  | Based on bidder’s offer |  | |
|  | Country |  | Based on bidder’s offer |  | |
|  | Type designation |  | Based on bidder’s offer |  | |
| 1.2 | Applicable standard |  | Based on bidder’s offer |  | |
| 1.3 | Rated voltage | kV rms | Based on bidder’s offer |  | |
| 1.4 | Number of cores / size |  | Based on bidder’s offer |  | |
| 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 | Based on bidder’s offer |  | |
| 1.8 | Type and thickness of inner sheath material | mm | extruded P.V.C |  | |
| 1.9 | Whether shield is provided? (Yes/No) |  | Based on bidder’s offer |  | |
| 1.10 | Type and material of armor (wire/tape & Steel/Al) |  | Galvanized steel wire |  | |
| 1.11 | Type and thickness of outer sheath material | mm | extruded P.V.C |  | |
| 1.12 | High voltage test | kV | Based on bidder’s offer |  | |
| 1.13 | Short circuit withstand current/time of conductor. | kA/Sec | Based on bidder’s offer |  | |
| 1.14 | Minimum bending radius at minimum temperature |  | Based on bidder’s offer |  | |
| 1.15 | Conductor DC resistance at 20°c | Ω/km | Based on bidder’s offer |  | |
| 1.16 | Minimum temperature during installation | °C | Based on bidder’s offer |  | |
| 1.17 | Minimum pulling tension | N | Based on bidder’s offer |  | |
| 1.18 | Approx. weight of cable | kg/m | Based on bidder’s offer |  | |
| 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 |  | Based on bidder’s offer |  | |
|  | Name |  | Based on bidder’s offer |  | |
|  | Country |  | Based on bidder’s offer |  | |
|  | Type designation |  | Based on bidder’s offer |  | |
| 2.2 | Applicable standard |  | Based on bidder’s offer |  | |
| 2.3 | Rated voltage | kV rms | Based on bidder’s offer |  | |
| 2.4 | Type and material of conductor |  | Stranded/ high conductivity plain annealed copper |  | |
| 2.5 | Diameter of each strand | mm | Based on bidder’s offer |  | |
| 2.6 | Number and cross section of wires in each cable |  | Based on bidder’s offer |  | |
|  | For CT cable |  | 4 mm2 |  | |
|  | For CVT cable |  | 2.5 mm2 |  | |
|  | For control cable |  | 2.5 mm2 |  | |
| 2.7 | Insulation material |  | P.V.C or X.L.P.E |  | |
| 2.8 | Material and thickness of inner sheath | mm | extruded P.V.C |  | |
| 2.9 | Material and thickness of shield | mm | Lead or copper |  | |
| 2.10 | Material and thickness of bedding for armor | mm | Based on bidder’s offer |  | |
| 2.11 | Material and thickness of armor | mm | Aluminium or galvanized steel |  | |
| 2.12 | Material and thickness of outer sheath | mm | extruded P.V.C |  | |
| 2.13 | Type of sheath between shield and armor |  | Based on bidder’s offer |  | |
| 2.14 | Short circuit withstand current/time of conductors | kA/Sec | Based on bidder’s offer |  | |
| 2.15 | Minimum bending radius at minimum temperature |  | Based on bidder’s offer |  | |
| 2.16 | Conductor DC resistance at 20°c | Ω/km | Based on bidder’s offer |  | |
| 2.17 | Minimum temperature during installation | °C | Based on bidder’s offer |  | |
| 2.18 | Minimum pulling tension | N | Based on bidder’s offer |  | |
| 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 |  | Based on bidder’s offer |  | |
| 3.2 | Type of optical fiber cable |  | G652.D/G655 |  | |
| 3.3 | Number of cores |  | 48 |  | |
| 3.4 | Mode - field diameter at 1550 nm & | µm | 10.4 ± 0.5 |  | |
|  | Mode - field diameter at 1310 nm |  | 9.2 ± 0.4 |  | |
| 3.5 | Effective core area | µm2 | 100 |  | |
| 3.6 | Mode field concentricity error at 1550 nm & | ≤ µm | 0.8 |  | |
| 3.7 | Mode field concentricity error at 1310 nm |  | 1 |  | |
| 3.8 | Mode field non - circularity error |  | 6 |  | |
| 3.9 | Cut - off wavelength λCC |  | ≤ 1450 nm |  | |
| 3.10 | Attenuation coefficient : in 1550 nm & | dB/Km | 0.30  typical / max. |  | |
|  | Attenuation coefficient : in 1310 nm |  | 0.40  typical / max. |  | |
| 3.11 | 1550 nm bend performance | ≤ db | ≤ 0.05 |  | |
| 3.12 | Non - zero dispersion region | nm | 1300-1324 |  | |
| 3.13 | Zero dispersion wavelength | < µm | 1302 – 1322 |  | |
| 3.14 | Cladding diameter | µm | 125.0 |  | |
| 3.15 | Cladding non - circularity | ≤ % | ±0.7 |  | |
| 3.16 | Primary coating diameter | µm | 245±10 |  | |
| 3.17 | Primary coating concentricity error | ≤ µm | 250±15 |  | |
| 3.18 | Primary coating non- circularity error | ≤ % | 12.5 |  | |
| 3.19 | Fiber materials |  | Core: Germanium doped silica  Clad : Silica, step index and matched clad type |  | |
| 3.20 | Fiber coating material |  | Dual layers of UV-cured acrylat |  | |
| 3.21 | Number of armor |  | To be defined |  | |
| 3.22 | Material of outer jacket |  | PE, PVC, PVDF, LSZH |  | |
| 3.23 | Color coding of fiber |  | To be defined |  | |
| 3.24 | Normal drum length | m | 4000 |  | |
| 3.25 | Proof stress level | ≥ Gpa | 0.69 |  | |
| **4** | **Cable Gland** |  |  |  | |
| 4.1 | Cable glands |  | Based on bidder’s offer |  | |
|  | Manufacturer |  | Based on bidder’s offer |  | |
|  | Material |  | Based on bidder’s offer |  | |
|  | Type designation |  | Based on bidder’s offer |  | |
| **5** | **Cable Tray, Ladder and Accessories** |  |  |  | |
| 5.1 | Manufacturer |  | Based on bidder’s offer |  | |
|  | Name |  | Based on bidder’s offer |  | |
|  | Country |  | Based on bidder’s offer |  | |
|  | Type designation |  | Based on bidder’s offer |  | |
| 5.2 | Material |  | Based on bidder’s offer |  | |
| 5.3 | Galvanized thickness |  | Based on bidder’s offer |  | |

y) 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 |  | Based on bidder’s offer |  |
|  | ALTERNATOR |  | Based on bidder’s offer |  |
|  | Model |  | Based on bidder’s offer |  |
|  | AVR Model |  | Based on bidder’s offer |  |
|  | Rated Cont. Power Output |  | 500 kVA for Main Generator  200 kVA for Housing Generator |  |
|  | 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 |  | Based on bidder’s offer |  |
|  | Control Card | Yes/No | yes |  |
|  | Auto Start-up , Mains Failure | Yes/No | yes |  |
|  | Manual Start-up | Yes/No | yes |  |
|  | ALARMS |  | Based on bidder’s offer |  |
|  | 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 |  | Based on bidder’s offer |  |
|  | Emergency Stop Button | Yes/No | yes |  |
|  | ATS (optional) |  | Based on bidder’s offer |  |
| **2** | **A.C. Generator** |  |  |  |
| 2.1 | General |  | Based on bidder’s offer |  |
|  | Manufacturer |  | Based on bidder’s offer |  |
|  | country |  | Based on bidder’s offer |  |
| 2.2 | Degree Of Protection For GEN |  | Ip23 |  |
| 2.3 | Degree Of Protection For Term Box |  | Ip55 |  |
| 2.4 | Type designation |  | Based on bidder’s offer |  |
| 2.5 | Number of Poles |  | Based on bidder’s offer |  |
| 2.6 | Class of insulation: |  | Based on bidder’s offer |  |
|  | Stator |  | Based on bidder’s offer |  |
|  | Rotor |  | Based on bidder’s offer |  |
| 2.7 | Rated voltage | V rms | 415 , 3ph , ±5% |  |
| 2.8 | Rated current | A rms | Based on bidder’s offer |  |
| 2.9 | Rated out put | kVA | 315 |  |
| 2.10 | Rated Power Factor | lag | 0.8 |  |
| 2.11 | Total Harmonic Distortion | % | <3 |  |
| 2.12 | Over-load rating and time duration | kW.h | Based on bidder’s offer |  |
| 2.13 | Short circuit withstand in 1 second (with submission of calculation) | kA (rms) | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 2.19 | frequency stability equipment and range |  | Based on bidder’s offer |  |
| 2.20 | Connection of windings |  | Based on bidder’s offer |  |
| 2.21 | Neutral grounding |  | Based on bidder’s offer |  |
| 2.22 | Is generator brushless? |  | Based on bidder’s offer |  |
| 2.23 | Number of Phases |  | Based on bidder’s offer |  |
| 2.24 | Reactances: |  | Based on bidder’s offer |  |
| 2.25 | Synchronous Xd | % | Based on bidder’s offer |  |
| 2.26 | Transient X'd | % | Based on bidder’s offer |  |
| 2.27 | Sub transient X''d | % | Based on bidder’s offer |  |
| 2.28 | Type of cooling |  | Based on bidder’s offer |  |
| 2.29 | Efficiency at rated voltage and frequency: |  | Based on bidder’s offer |  |
| 2.30 | 75% rated load |  | Based on bidder’s offer |  |
| 2.31 | 100% rated load |  | Based on bidder’s offer |  |
| 2.32 | Exciter details: |  | Based on bidder’s offer |  |
| 2.33 | Manufacturer |  | Based on bidder’s offer |  |
| 2.34 | Power rating | kW | Based on bidder’s offer |  |
| 2.35 | Voltage rating | V-DC | Based on bidder’s offer |  |
| 2.36 | Max. instantaneous change in frequency for instantaneous load change from zero to full load |  | Based on bidder’s offer |  |
| **3** | **Diesel Engine** |  |  |  |
| 3.1 | Manufacture |  | Based on bidder’s offer |  |
| 3.2 | country |  | Based on bidder’s offer |  |
| 3.3 | Type designation |  | Based on bidder’s offer |  |
| 3.4 | Number of cylinders |  | 6 |  |
| 3.5 | Speed | r.p.m | 1500 |  |
| 3.6 | Type of cooling |  | Based on bidder’s offer |  |
| 3.7 | Compression Ratio |  | By vendor |  |
| 3.8 | Coupling |  | Based on bidder’s offer |  |
| 3.9 | Start-up time from initiation until circuit breaker closes | S | Based on bidder’s offer |  |
| 3.10 | Number of strokes |  | Based on bidder’s offer |  |
| 3.11 | Compression ratio |  | Based on bidder’s offer |  |
| 3.12 | Efficiency at rated load | % | Based on bidder’s offer |  |
| 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 |  | Based on bidder’s offer |  |
| 3.18 | Fuel Tank Capacity |  | Based on bidder’s offer |  |
| 3.19 | Fuel injection system |  | Based on bidder’s offer |  |
| 3.20 | Specific fuel consumption at:(Based on generation output) |  | Based on bidder’s offer |  |
| 3.21 | Aspiration (Natural or supercharger) |  | Based on bidder’s offer |  |
| 3.22 | ENGINE SAFETY SHUTDOWN WITH ALARM & INDICATION |  | Based on bidder’s offer |  |
| 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 | Based on bidder’s offer |  |
| 3.28 | Water Jacket Heater | Yes/No | yes |  |
| 3.29 | LUBRICATION SYSTEM |  | Based on bidder’s offer |  |
| 3.30 | Maximum Oil Consumption ( % Fuel Consumption) |  | 0.2 |  |
| **4** | **Governor** |  |  |  |
| 4.1 | Type | Electric/Hydraulic | Electronic |  |
| 4.2 | Manufacturer and country |  | Based on bidder’s offer |  |
| **5** | **Starting system** |  |  |  |
| 5.1 | Type of the battery |  | Based on bidder’s offer |  |
| 5.2 | Number of Batteries |  | 1 |  |
| 5.3 | ‍Capacity of the battery | Ah | Based on bidder’s offer |  |
| 5.4 | Rated voltage of the battery | V DC | 24 |  |
| 5.5 | Type of starter |  | Based on bidder’s offer |  |
| 5.6 | Type of charger |  | Based on bidder’s offer |  |
| 5.7 | charger voltage supply |  | Based on bidder’s offer |  |
| **6** | **‍Control and indication** |  |  |  |
| 6.1 | Type of control cubicle (local console or control panel) |  | Based on bidder’s offer |  |
| 6.2 | Number and type of alarms |  | Based on bidder’s offer |  |
| 6.3 | Number and type of alarms |  | Based on bidder’s offer |  |
| 6.4 | Type of remote alarms |  | Based on bidder’s offer |  |
| 6.5 | Metering equipment (manufacturer, type and range): |  | Based on bidder’s offer |  |
|  | A.C. ammeter |  | Based on bidder’s offer |  |
|  | A.C. voltmeter |  | Based on bidder’s offer |  |
|  | Frequency-meter |  | Based on bidder’s offer |  |
|  | Water temperature indicator |  | Based on bidder’s offer |  |
|  | Oil pressure indicator |  | Based on bidder’s offer |  |
|  | Running hour-meter |  | Based on bidder’s offer |  |
| 6.6 | Control switches and knobs (manufacturer and type) |  | Based on bidder’s offer |  |
| 6.7 | Protective relaying (manufacturer and type) |  | Based on bidder’s offer |  |
| 6.8 | Circuit breaker (contactor): |  | Based on bidder’s offer |  |
|  | Manufacturer and type |  | Based on bidder’s offer |  |
|  | Current rating | A(rms) | Based on bidder’s offer |  |
| **7** | **Weight and dimension** |  |  |  |
| 7.1 | Main fuel tank |  | Based on bidder’s offer |  |

| 1. TARIFF METERING SYSTEM | | **UNIT** | **DATA** | |
| --- | --- | --- | --- | --- |
|  | **Required** | **Offered** |
| **1.** | **TARIFF METER** |  |  |  |
| 1.1 | Manufacturer |  |  |  |
| 1.2 | Model |  |  |  |
| 1.3 | Construction |  |  |  |
|  | Measuring Principle |  | 3ph, 4wire |  |
|  | Type |  | Numerical |  |
|  | Display/Reading digits |  | ≥7 |  |
|  | Backlit LCD |  | Yes |  |
| 1.4 | Auxiliary voltage range |  |  |  |
|  | DC (Vn = 110Vdc) | Vdc | 88®125 |  |
|  | AC | Vac | 230 |  |
| 1.5 | CT analog inputs |  |  |  |
|  | Rated current | A | 1 |  |
|  | Current measuring range | pu | 1.2 |  |
|  | Power consumption (burden) | VA |  |  |
| 1.6 | VT analog inputs |  |  |  |
|  | Rated voltage | V | 110 |  |
|  | Voltage measuring range | pu | 0.8 – 1.15 |  |
|  | Power consumption (burden) | VA |  |  |
| 1.7 | Accuracy Class |  |  |  |
|  | Watt hour (IEC 6~~0~~2053-22) |  | 0.2s |  |
|  | VAr hour (IEC 62053-23) |  | 2.0 |  |
| 1.8 | Measurements |  |  |  |
|  | kWh, MWh, kVArh, MVArh (Accumulated values) | Yes/No | Yes |  |
|  | kW, kVAr, MW, MWAr | Yes/No | Yes |  |
|  | V, I | Yes/No | Yes |  |
|  | Four quadrant reactive energy | Yes/No | Yes |  |
|  | Max Demand | Yes/No | Yes |  |
|  | THD | Yes/No | Yes |  |
| 1.9 | Outputs |  |  |  |
|  | Pulsed Outputs (IEC 62053-1) |  | 5 (min) |  |
| 1.10 | Data Logging |  |  |  |
|  | Integral Logging/Storage function |  |  |  |
|  | Duration | days | 180 |  |
|  | Channels |  | 4 |  |
|  | Programmable Periods | Yes/No | Yes |  |
|  | Inputs from external meters | Yes/No |  |  |
| 1.11 | Other functions |  |  |  |
|  | Battery Back-up | Yes/No | Yes |  |
|  | Back-up duration | days | ≥14 |  |
|  | GPS clock | Yes/No | Yes |  |
|  | Self-monitoring and alarm facility | Yes/No | Yes |  |
|  | Dual supply changeover (VT) | Yes/No | Yes |  |
|  | Remote Transmission of Energy and Power Values | Yes/No | Yes |  |
|  | Remote Interrogation via TCP/IP Link | Yes/No | Yes |  |
| 1.12 | Communications |  |  |  |
|  | Local Communication ports (Front/rear etc.) |  |  |  |
|  | RS232 | Yes/No | Yes |  |
|  | RS485 | Yes/No | Yes |  |
|  | Optical (IEC 62056-21) | Yes/No | Yes |  |
|  | Ethernet-IEC 61850 | Yes/No | Yes |  |
|  | Remote communication options |  |  |  |
|  | 5G/4G/3G/GPRS/GSM | Yes/No | Yes |  |
|  | Wifi | Yes/No | Yes |  |
|  | Protocols supported |  |  |  |
|  | IEC 62056-21, | Yes/No | Yes |  |
|  | IEC 61850 | Yes/No | Yes |  |
|  | DLMS/COSEM | Yes/No | Yes |  |
|  | MODBUS | Yes/No | Yes |  |
|  | Others (please list) |  |  |  |
| 1.13 | Type Tests |  |  |  |
| 1.13.1 | 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 |  |
| 1.13.2 | Relative Humidity |  |  |  |
|  | Operation at 93% | Yes/No | Yes |  |
|  | Tested to IEC 60068-2-3 with severity class 56 days | Yes/No | Yes |  |
| 1.13.3 | Enclosure |  |  |  |
|  | IEC 60529 |  | IP52~~0~~ |  |
| 1.13.4 | Mechanical Environment |  |  |  |
|  | Vibration IEC 60255-2 | Yes/No | Yes |  |
|  | Shock and bump IEC 60255-2 | Yes/No | Yes |  |
|  | Seismic IEC 60255-2 | Yes/No | Yes |  |
| 1.13.5 | 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 |  |
| 1.13.6 | Electromagnetic compatibility |  |  |  |
|  | 1MHz Burst disturbance test,  IEC 60255- severity class III | Yes/No | Yes |  |
|  | Electrostatic Discharge  IEC 60255 severity class III | Yes/No | Yes |  |
|  | Radiated Electromagnetic Field Disturbance  IEC 60255-26 severity class III  Test method A, 27MHz through 500MHz | Yes/No | Yes |  |
|  | Electromagnetic Emissions  IEC 60255-26 | Yes/No | Yes |  |
|  | Fast Transient Disturbance  IEC 60255-26 severity level IV | Yes/No | Yes |  |
| 1.13.7 | Type test certificate provided | Yes/No | Yes |  |

| 1. 400 kV OVERHEAD LINE EARTH CONDUCTOR | | | **DATA** | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Required** | | | **Offered** |
| 1.0 | **Earth conductor and fittings** | | |  | | |
| 1.1 | Number of ACS earth conductors | | 1 no. | | |  |
| 1.2 | International Standard No. applied | | ASTM B416 | | |  |
| 1.3 | Material of earth conductor | | Aluminium clad steel (ACS) | | |  |
| 1.4 | Number and diameter of wires | | 7/3.26  No/mm | | |  |
| 1.5 | Total area of earth conductor | | 58.6 mm2 | | |  |
| 1.6 | Overall diameter of earth conductor | | 9.78 mm | | |  |
| 1.7 | Mass of earth conductor | | 390 kg/km | | |  |
| 1.8 | Ultimate strength of earth conductor | | 71,000 Newton | | |  |
| 1.9 | Maximum tension of earth conductor in still air at “everyday” temperature | | -     Newton | | |  |
| 1.10 | Assumed equivalent modulus of elasticity of earth conductor | | 162,000 N/mm2 | | |  |
| 1.11 | Assumed equivalent coefficient of linear expansion of earth conductor | | 12.6 x 10-6 per deg.C | | |  |
| 1.12 | Minimum bending radius | | -       mm | | |  |
| 1.13 | Minimum length of earth conductor on drum | | 4 km | | |  |
| **1.14** | **Individual wires before stranding** |  | | |  | |
| 1.14.1 | Standard for Aluminium-clad steel | | ASTM B415 | | |  |
|  | a. Grade of steel | | 20SA | | |  |
| **1.15** | **Vibration damping system for earth conductor** | | | | | |
| 1.15.1 | Maximum span for | | | | | |
|  | a. One vibration damper at each end of span (2 in the span) | | -       m | | |  |
|  | b. Two vibration dampers at each end of span (4 in the span) | | -       m | | |  |
|  | c. Three vibration dampers at each end of span (6 in the span) | | -       m | | |  |
| **2.0** | **OPGW and fittings** | | | | | |
| 2.1 | Number of OPGW earth conductors | | 1 no. | | |  |
| 2.2 | International Standard applied | | IEEE 1138  IEC60794-4 | | |  |
| 2.3 | Material of OPGW conductors | | Aluminium Alloy/ Aluminium clad steel | | |  |
| 2.4 | Number and diameter of wires | | -    No/mm | | |  |
| 2.5 | Total area of OPGW conductor | | -       mm2 | | |  |
| 2.7 | Overall diameter of OPGW conductor | | -       mm | | |  |
| 2.8 | Mass of OPGW conductor | | < 850 kg/km | | |  |
| 2.9 | Ultimate strength of OPGW conductor | | >/= 93,000 Newton | | |  |
| 2.10 | Maximum tension of OPGW conductor in still air at “everyday” temperature 25 deg.C | | > 18,500 Newton | | |  |
| 2.11 | Assumed equivalent modulus of elasticity of OPGW conductor | | >/= 70,000 N/mm2 | | |  |
| 2.12 | Assumed equivalent coefficient of linear expansion of OPGW conductor | | </= 1.98 x 10-5 per deg.C | | |  |
| 2.13 | Minimum bending radius | | -       mm | | |  |
| 2.14 | Short circuit current rating | | 496 kA2s | | |  |
| 2.15 | Minimum length of OPGW conductor on drum | | 4 km | | |  |
| **2.16** | **Individual wires before stranding** | | | | | |
|  | * Aluminium alloy Standard applied | | IEC 60104 | | |  |
|  | -  Minimum conductivityof aluminium wires at 20deg.C | | 52.5 % IACS | | |  |
|  | * Aluminium-clad steel Standard applied | | IEC 60232 | | |  |
|  | * Grade of Steel | | 20SA | | |  |
| **2.17** | **Vibration damping system of OPGW** | | | | | |
|  | Maximum span for | | | | | |
|  | a. One vibration damper at each end of span (2 in the span) | | -       m | | |  |
|  | b. Two vibration dampers at each end of span (4 in the span) | | -       m | | |  |
|  | c. Three vibration dampers at each end of span (6 in the span) | | -       m | | |  |
| **3.0** | **Particulars of Fibre Optic Transmission System** | | | | | |
| 3.1 | Type of Fibre optic data | | Non-Zero Dispersion- Shifted Single-Mode as per ITU-T G.655 | | |  |
| 3.2 | Wavelength | | 1550/1625 nm | | |  |
| 3.3 | Number of fibres | | 48 nos. | | |  |
| 3.4 | Transmission attenuation |  | | |  | |
| a. at 1550 nm | | < 0.22 dB/km | | |  |
| b. at 1625 nm | | < 0.24 dB/km | | |  |
| 3.5 | Transmission bandwidth | | > 10,000 MHz/km | | |  |
| 3.6 | Fibre identification by | | Colour code | | |  |
| 3.7 | Chromatic dispersion |  | | |  | |
| a. at 1550 nm | | < 2 ps/nm.km | | |  |
| b. at 1625 nm | | <12.4 ps/nm.km | | |  |
| 3.8 | Splicing loss | | < 0.1 dB | | |  |
| 3.9 | Polarisation Mode Dispersion (PMD) | | < 20 √km | | |  |
| 3.10 | Minimum bending radius | | -       mm | | |  |

| 1. 400KV OVERHEAD LINE CONDUCTOR | | **DATA** | | | |
| --- | --- | --- | --- | --- | --- |
| **REQUIRED** | | **OFFERED** | |
| **1.0** | **Minimum factors of safety to be applied to assumed simultaneous maximum loadings** | | | | |
| 1.1 | Line and earth conductors, based on ultimate strength | | 2.5 | |  |
| 1.2 | Line and earth conductors at everyday temperature, still air, based on ultimate strength | | 5.0 | |  |
| 1.3 | Complete insulators and fittings | | 2.5 | |  |
| **1.4** | **Steel supports, foundation structures, based on elastic limit of members in tension and on crippling loads of compression members, or on tests on complete supports (but not tests on the foundations):** | | | | |
| 1.4.1 | Suspension supports | | | | |
|  | a. Normal conditions | | 2.0 | |  |
|  | b. Unbalanced conditions (except cascade) | | 1.5 | |  |
|  | c. Cascade collapse condition | | 1.0 | |  |
| 1.4.2 | Tension supports | | | | |
|  | a. Normal conditions | | 2.0 | |  |
|  | b. Unbalanced conditions | | 1.5 | |  |
| 1.4.3 | Foundations | | | | |
|  | a. Normal conditions | | 2.5 | |  |
|  | b. Unbalanced conditions | | 1.75 | |  |
| 1.4.4 | Maintenance and Erection | | 2.0 | |  |
| **2.0** | **Assumed Loading Conditions** | |  | |  |
| 2.1 | Minimum temperature of line and earth conductors | | 1°C | |  |
| 2.2 | “Everyday” temperature | | 25°C | |  |
| 2.3 | Maximum operating temperature of line conductor | | 80°C | |  |
| **2.4** | **Basic Wind Speed**  - Wind pressure on projected area of insulators  - Wind pressure on projected area of conductors  - Wind pressure on projected area of earthwires  - Wind pressure on the projected area of     members of one face of the towers | | N/m²  N/m²  N/m²  N/m² | |  |
| 2.5 | Site altitude above sea level (maximum) | | 2000 metres | |  |
| **3.0** | **Particulars of spans** | | | | |
| 3.1 | Basic span | | 400 m | |  |
| 3.2 | Maximum sum of adjacent spans | | 880 m | |  |
| 3.3 | Maximum single span | | 600 m | |  |
| 3.4 | Tower design spans | | | | |
| 3.4.1 | Wind span for tower design | | | | |
|  | a. Suspension towers | | 440 m | |  |
|  | b. Tension towers | | 450 m | |  |
| 3.4.2 | Maximum weight spans | | | | |
|  | a. Suspension towers | | 800 m | |  |
|  | b. Tension towers | | 900 m | |  |
| 3.4.3 | Minimum weight spans (for design purposes) | | | | |
|  | a. Suspension towers | | 35% of sum of adjacent spans | |  |
|  | b. Tension towers (uplift net) | | - 450 m | |  |
| **4.0** | **Line conductors and fittings** | | | | |
| 4.1 | **Complete line conductor** | |  | |  |
| 4.1.1 | Nominal area per conductor | | 455 mm2 | |  |
| 4.1.2 | Numbers of conductors per phase | | 3 nos. | |  |
| 4.1.3 | Distance between conductor centres of one phase | | 400 mm | |  |
| 4.1.4 | Conductor code name | | ACSR Condor | |  |
| 4.1.5 | Applicable standard | | IEC 61089 | |  |
| 4.1.6 | Applicable standard (Metric system, Condor) | | ASTM B 232 | |  |
| 4.1.7 | Material of conductor | | Aluminum/ Galvanised steel | |  |
| 4.1.8 | Numbers and diameters of wires | | Al 54/3.08  St 7/3.08  (No/mm) | |  |
| 4.1.9 | Overall diameter of stranded conductor | | 27.73 mm | |  |
| 4.1.10 | Resistance of conductor (dc) at 20deg.C | | 0.07173 ohm/km | |  |
| 4.1.11 | Mass of conductor (without grease) | | 1,522 kg/km | |  |
| 4.1.12 | Total mass of greased conductor (greased to Case 2 of IEC 61089) | | -       Kg/km | |  |
| 4.1.13 | Ultimate rated strength of conductor | | 127,800 Newton | |  |
| 4.1.14 | Maximum tension of conductor in still air at “everyday” temperature 25deg.C | | 25,560 Newton | |  |
| 4.1.15 | Assumed equivalent modulus of elasticity of conductor | | 68,650 N/mm2 | |  |
| 4.1.16 | Assumed equivalent coefficient of linear expansion of conductor | | 1.93 x 10-5 per deg.C | |  |
| 4.1.17 | Maximum length of conductor on drum | | 3 km | |  |
| **4.2** | **Conductor grease** | | | | |
| 4.2.1 | Type | |  | |  |
| 4.2.2 | Minimum drop-point temperature | | 120 deg.C | |  |
| 4.2.3 | Mass of grease per kilometre of conductor (all inner layers greased – Case 2 to IEC 61089) | | -       kg | |  |
| **4.3** | **Vibration damping system** | | | | |
| 4.3.1 | Type of system (vibration damper + spacer or spacer damper) | | Stockbridge type | |  |
| 4.3.2 | Type of vibration damper (if proposed and used) | |  | |  |
| 4.3.3 | Standard applied | | IEC 61897 | |  |
| 4.3.4 | Conductor diameter range | | -       mm | |  |
| 4.3.5 | Mass of damper | | -       kg | |  |
| 4.3.6 | Maximum span length for | | | | |
|  | a. One vibration damper at each end of span (2 in the span) | | -       m | |  |
|  | b. Two vibration dampers at each end of span (4 in the span) | | -       m | |  |
|  | c. Three vibration dampers at each end of span (6 in the span) | | -       m | |  |
| 4.3.7 | Distances from clamp mouth to vibration damper attachment | | | | |
|  | a. First damper | | -       m | |  |
|  | b. Second damper when required | | -       m | |  |
|  | c. Third damper when required | | -       m | |  |
| **4.4** | **Spacer or spacer damper** | | | | |
| 4.4.1 | Type of spacer or spacer damper | |  | |  |
| 4.4.2 | Standard applied | | IEC 61854 | |  |
| 4.4.3 | Conductor diameter range | | -       mm | |  |
| 4.4.4 | Mass | | -       kg | |  |
| 4.4.5 | Symmetrical or asymmetrical in-span spacing | |  | |  |
| 4.4.6 | Maximum sub-span length (distances between spacers) | |  | |  |