

PART 2: FORM OF TENDER AND APPENDICES
Appendix D – GUARANTEE TABLES
66 kV Bus Conductors and Connectors

1. Bus Conductors and Connectors

| | |
|--|--------------------------|
| a. Maker's Name | ..... |
| b. Material | ..... |
| c. Number and Size per phase:- | |
| - For Bus Conductors | ..... |
| - For Connectors | ..... |
| d. Cross – Section per phase:- | |
| - For Bus Conductors | mm ² |
| - For Connectors | mm ² |
| e. Number of Strands: | |
| - For Bus Conductors | ..... |
| - For Connectors | ..... |
| f. Overall Diameter | |
| - For Bus Conductors | mm |
| - For Connectors | mm |
| g. Nominal Breaking load | |
| - For Bus Conductors | kN |
| - For Connectors | kN |
| - Bus bar current at full rated load | A |
| - Approx. Capacitance per meter of bus bar | μ F |
| - Max. Continuous current density at full rated load | A/mm ² |
| - Normal spacing between conductors of different phases | mm |
| - Min. spacing between conductors or live metal of different phases under severest conditions of swing and sag or for rigid bus bars | mm |
| - Min. clearance between any live metal and earthed metal work | mm |
| - Min. tensile breaking stress of material | kg/cm ² |
| - Max. tensile working stress | kg/cm ² |
| - Distance between supports for rated kVA rupturing capacity | m |
| - Tensile factor of safety based on breaking stress | ..... |
| - Elongation in 25 cm specimen on breaking | % |

66 kV Bus Conductors and Connectors (con'd)

h. Electrical Resistance At 20°C

- For Bus conductors ohm/km
- For Connectors ohm/km

i. Max. Current Carrying Capacity with 35°C Max. Temperature Rise over the 45°C

Ambient Temperature

- For Bus conductors amp
- For Connectors amp

j. Weight

- For Bus conductors kg/km
- For Connectors kg/km

k. Modulus of Elasticity

- For Bus conductors kg/cm²
- For Connectors kg/cm²

l. Coefficient of Expansion

- For Bus conductors
- For Connectors

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
66 kV Suspension, Tension Insulators and Fittings

1. Insulator Units

| | |
|--|-----------|
| a. Maker's Name | ..... |
| b. Insulator type | ..... |
| c. Breaking Load/unit | kg |
| d. Electro-mechanical type test load | kg |
| e. Outside diameter of unit | cm |
| f. Electrostatic capacity of unit | mfd |
| g. Weight of unit | kg |
| h. Min. length of total leakage path | cm |
| i. Min. length of protected leakage path | cm |
| j. Min. flashover voltage of unit | |
| - Dry | kV |
| - Wet | kV |
| k. Min. puncture voltage of unit | kV |

2. Complete insulator sets

| | |
|--|----------|
| A. Mechanical characteristics | |
| a. Material of fittings | ..... |
| b. Maker's Name | ..... |
| c. Method of attachment between units | ..... |
| d. Material and construction of arcing ring or horn | ..... |
| e. Number of strings in parallel, if any | ..... |
| f. Max. working load, normally | kg |
| g. Max. working load, under short circuit | kg |
| h. Number of units in string | ..... |
| i. Distance between centers of units | cm |
| j. Length of string overall including clamps and fittings | cm |
| k. Least distance between arcing rings and horns | cm |
| l. Weight of string complete with all fittings | kg |
| m. Routine mechanical test load | kg |
| n. Electro-mechanical test load | kg |
| o. Factor of safety based on electromechanical test load at lest 2.5 | ..... |

66 kV Suspension, Tension Insulators and Fittings (con'd)

B. Electrical Characteristics

a. Power frequency flashover voltage of set complete with all fittings

- dry clean kV
- dry polluted kV
- wet kV

b. Power frequency flashover voltage of set with arcing rings and horn removed

- dry clean kV
- dry polluted kV
- wet kV

c. 50% impulse flashover peak voltage with 1/50 μ sec positive wave under polluted conditions kV

d. Max. withstand peak voltage 1/50 μ sec wave under polluted conditionskV

e. Min. voltage at which corona appears when polluted kV

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
66 kV Post Insulators and Fittings

A. General particulars

- Maker's Name
- Insulator type
- Greatest diameter cm
- Number of units in post insulators
- Distance between centers of units cm
- Overall length of insulator cm
- Distance between horns and rings cm
- Weight of insulators with fittings kg
- Material of fittings
- Material & construction of arcing rings & horns

B. Mechanical Characteristics

- Max. longitudinal working load normally kg
- Max. longitudinal working load under short circuit
- kg
- Max. transversal working load/normally kg
- Max. transversal working load under short circuit
- kg
- Max. torsion working load/normally kg
- Max. torsion working under short circuit kg
- Min. longitudinal breaking load kg
- Routine mechanical test load kg
- Mechanical type test load kg
- Electro-mechanical type test load kg
- Factor of safety based on electromechanical type test load not less than 2.5

C. Electrical Characteristics

- Min. length of total leakage path cm
- Min. length of protected leakage path cm
- Min. power frequency flashover voltage complete with all fittings
- dry clean kV
- dry polluted kV
- wet kV
- Min. power frequency flashover voltage complete with horns & rings removed
- dry clean kV
- dry polluted kV
- wet kV

66 kV Post Insulators and Fittings (con'd)

- One-minute power frequency withstands voltage under polluted conditions complete with all fittings
 - drykV
 - wetkV
- 50% impulse flashover peak voltage with 1/50 μ sec. positive wave under polluted conditionskV
- Max. impulse withstand peak voltage with 1/50 μ sec. wave under polluted conditionskV
- Min. corona voltage pollutedkV
- Electrostatic capacity of insulatormfd

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PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
Bushing Insulator and Fittings

- Maker's Name
- Insulator type (outdoor or indoor)
- Greatest diametercm
- Gap between horns or rings/..... cm
- Overall length of insulator cm
- Minimum length of total leakage path in air cm
- Minimum length of protected leakage path in air cm
- Weight of insulator kg
- Material of fittings
- Material & construction of arcing rings and horns

A. Mechanical Characteristics

- Max. working longitudinal load (tension or compression)kg
- Minimum longitudinal breaking load tensionkg
- Maximum transverse working load kg
- Electro-mechanical type load kg
- Factor of safety based on electromechanical type test loads (at least 2.5)
.....

B. Electrical Characteristics

- Min. power frequency flashover voltage of insulator complete with fittings when:
 - Dry clean kV
 - Dry pollutedkV
 - Wet kV
- Min. power frequency flashover voltage of insulator with arcing rings and horns removed, when:
 - Dry cleankV
 - Dry pollutedkV
 - Wet kV
- One minute withstand power frequency voltage of insulator complete with fittings when:
 - Dry cleankV
 - Dry pollutedkV
 - WetkV
- 50% flashover impulse peak voltage with 1/50 micro sec positive wave
.....kV
- Maximum withstand peak voltage with 1/50 micro sec wave when polluted
.....kV

Bushing Insulator and Fittings (con'd)

- Minimum voltage for flashover under oil type test at 50 cycles secondkV
- Design puncture voltagekV
- Minimum voltage at which corona appears when pollutekV
- Electro static capacity of insulatorsmfd

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PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
66 kV Circuit Breakers

| | | |
|---|-------|-------------------|
| 1. Maker's Name | ..... |  |
| 2. Type | ..... |  |
| 3. Breaking capacity at 66 kV | ..... | MVA |
| 4. Particulars | | |
| a. Rated Insulation Level | ..... |  |
| b. Standard specifications | ..... |  |
| c. Type | ..... |  |
| d. Type of main contact | | |
| - Fixed | ..... |  |
| - Moving | ..... |  |
| e. Total travel of moving main contacts | ..... | mm |
| f. Material of main contacts | ..... |  |
| g. Material of arcing contacts | ..... |  |
| h. Type of arc control device | ..... |  |
| i. Material of arc control device | ..... |  |
| j. Current density in contact at rated current | ..... | A/mm ² |
| k. Voltage drop across contacts at rated current | ..... | volts |
| l. Type of operating mechanism: | | |
| - Closing | ..... |  |
| - Tripping | ..... |  |
| m. Rated transient recovery voltage | | |
| - Peak value | ..... | kV |
| - Rate of rise | ..... | kV/μs |
| n. Rating of motor required for spring mechanism | ..... | kW |
| o. Number of breaks in circuit per phase | ..... |  |
| p. Voltage across each break | ..... | V |
| q. Length of stroke | ..... | mm |
| r. D.C. voltage (closing and tripping) | | |
| - Normal | ..... | volts |
| - Minimum | ..... | volts |
| s. SF6 circuit breaker | | |
| - Rated pressure of SF6 isolation | ..... | bar |
| - Rated arc quenching pressure at ambient temperature | ..... | bar |
| t. Rated small inductive breaking current | ..... | A |

66 kV Circuit Breakers (con'd)

| | | |
|---|-------|--------|
| u. Rated cable charging current | ..... | A |
| v. Safety devices | ..... |  |
| w. Min. clearance in air: | | |
| - Between live parts and earth | ..... | mm |
| - Between phases | ..... | mm |
| x. Temperature rise at full rated current at 45°C ambient temperature | | |
| - Coils | ..... | °C |
| - Other parts | ..... | °C |
| 5. Weight and Dimension: | | |
| - Weight of Circuit Breaker | ..... | tons |
| - Dimensional drawing (to submitted with the tender), supplier drawings | | |
| 6. Performance | | |
| a. Rated voltage | ..... | kV |
| b. Rated normal current | ..... | A |
| c. Rated frequency | ..... | Hz |
| d. Rated breaking capacity | ..... | MVA |
| - Symmetrical | ..... | kA |
| - Asymmetrical | ..... | kA |
| e. Making current | ..... | kA |
| f. Breaking current | ..... | kA |
| g. Short time rating | | |
| - For 1 sec | ..... | kA |
| - For 3 sec | ..... | kA |
| h. Speed of breaker contacts | ..... | cm/sec |
| i. Time between energizing of trip coil and contact separation | ..... | cycles |
| j. Time for complete separation of contacts | ..... | cycles |
| k. Total break time | ..... | cycles |
| l. Total make time | ..... | cycles |
| m. Total make/break time | ..... | cycles |
| n. Time difference between poles during opening operation | ..... | cycles |
| o. Ditto during closing operation | ..... | cycles |
| p. Power required at normal voltage by: | | |
| - Trip coil | ..... | Watts |
| - Closing coil | ..... | Watts |
| q. Flashover voltage of insulator(dry) | ..... | kV |
| r. Impulse test and application | ..... | kV |
| s. One minute AC 50Hz test voltage | ..... | kV |
| t. Other tests recommended by the manufacturer | ..... |  |

66 kV Circuit Breakers (con'd)

- u. Leakage path cm/kV
- v. NO. and type of spare auxiliary contacts or switches
.....

7. Auto Re-closing Equipment

- a. Type of timing relay
- b. Automatic re-closing cycle
- c. Dead time between the instant of final arc extinction in the three phases and the instant of re-establishment of current in the subsequent closing operation
..... sec
- d. Re-closing time sec
- e. Corresponding reduction factor for the symmetrical capacity of the breaker
..... %

8. Maintenance

Number of breaking after which maintenance of gas change is necessary:

- Without current
- At rated normal current
- At 50% rated S.C. breaking current
- At 100% rated S.C. breaking current

9. Replacement of Parts

Number of breaking after which replacement of any part is necessary:

- Without current
- At rated normal current
- At 50% rated S.C. breaking current
- At 100% rated S.C. breaking current
- Parts to be replaced

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66 kV Isolating Switches (con'd)

3. Motor Operation Mechanism

- Type
- Power demand of motor Watts
- Opening time of disconnecter sec
- Closing time of disconnecter sec
- Weight kg

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
66 kV Potential Transformers

- | | |
|---|-------------|
| 1. Maker's Name | ..... |
| 2. Type | ..... |
| 3. Standard Specification | ..... |
| 4. Service voltage at site | kV |
| 5. Highest system voltage | kV |
| 6. Rated frequency | Hz |
| 7. Rated voltage (UN) : | |
| - Primary | ..... |
| - Measuring and protective winding | ..... |
| - Open – delta winding | ..... |
| 8. Rated burden at ambient temp. 45°C for: | |
| - Measuring, protection | VA |
| - Open delta | VA |
| 9. Accuracy class for: | |
| a. Measuring | ..... |
| b. Protection | ..... |
| 10. Short circuit strength: For 1 sec | kA |
| : For 3 sec | kA |
| 11. Ratio cross at rated output: | |
| a. 120% to 20% of rated of primary current | % |
| b. 20% to 10% of rated of primary current | % |
| 12. Power frequency withstand voltage | kV |
| 13. Impulse test voltage with wave for 1.2/50 micro-sec | kV |
| 14. Leakage path | cm/kV |
| 15. Approximate Weight | kg |
| 16. Height | mm |
| 17. Grade of oil filling | |

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
66 kV, 11 kV Lightning Arresters

| | <u>66 kV</u> | <u>11 kV</u> |
|---|--------------|--------------------|
| 1. Maker's Name | | |
| 2. Type | | |
| 3. Rated Voltage | |kV |
| 4. Nominal discharge current | |kA |
| 5. Rated frequency | |Hz |
| 6. Leakage path | |cm/kV |
| 7. Overall height of unit | |mm |
| 8. Approx. weight | |kg |
| 9. Rated discharge current (8/20 μ sec) | |kA |
| 10. Max. power frequency spark-over voltage | |kV |
| 11. 100% impulse spark-over voltage at wave with 1.2/50 micro-sec | |kV |
| 12. Impulse spark-over voltage on front of wave | |kV |
| 13. Residential voltage at impulse wave with 8/20 micro sec shape | |kV |
| 14. Maximum short circuit current that could pass without damage to arrester | |kA |
| - For | |sec |
| 15. Minimum energy discharge capability of max. continuous operating voltage (MCOV) | |kJ/kV |
| 16. Peak value of high current impulse wave form of 4/10 micro-sec | |kA |
| 17. Peak value of long duration discharge current for 2000 micro-sec. | |kA |
| 18. Ambient air temperature range | | $^{\circ}$ C |
| 19. Type of pressure relief device | | |
| 20. Terminals | | |
| a. Material | | |
| b. Coating | | |
| c. Dimensions | |mm |
| d. Permissible static cantilever forces | |N |

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PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
Main Transformers

| | | |
|--|-------|-----|
| - Maker's Name | ..... |  |
| - Type | ..... |  |
| - Standard Specification | ..... |  |
| - Rated output with self air cooling | ..... | MVA |
| - Maximum output with forced air cooling | ..... | MVA |
| - Method of cooling | ..... |  |
| - System connections | ..... |  |
| - Neutral point | ..... |  |

A. Construction

| | | |
|---|------------------------------|-------|
| - Material of tank | ..... |  |
| - Thickness of tank sides/cover/bottom | mm/ mm/ mm | |
| - Vacuum strength of the transformer tank | ..... |  |
| - Material of insulation: | | |
| a. Primary windings | ..... |  |
| b. Secondary windings | ..... |  |
| - Major insulation | ..... |  |
| - Core plates | ..... |  |
| - Type and number of coils per phase | | |
| a. Primary windings | ..... |  |
| b. Secondary windings | ..... |  |
| - Material of core | ..... |  |
| - Thickness of core laminations | ..... | mm |
| - Weight of core | ..... | ton |
| - Weight of winding | ..... | ton |
| - Total weight of transformer with oil | ..... | ton |
| - Approximate overall length of transformer | ..... | mm |
| - Approximate overall width of transformer | ..... | mm |
| - Approximate overall height of transformer | ..... | mm |
| - Type and number of bushing | | |
| a. Primary side | ..... |  |
| b. Secondary side | ..... |  |
| - Leakage path of primary side bushing | ..... | cm/kV |

Main Transformers (con'd)

B. Cooling System

- Type and number of cooling fans
- Power required by cooling fans kW
- Blade diameter of cooling fans mm
- Type of cooler, thickness and dimensions of cooling elements
- Type of the oil

C. Transformer Rating and Over Load Capacity

- Continuous rated output kVA
- Permissible overload duration without change of specified temperature rise
 - 10% hr
 - 20% hr
 - 30% hr
 - 50% hr
 - 70% hr
 - 100% hr

D. Temperature Rise

- At rated output at 45 °C ambient temperature:
 - Oil at top level °C
 - Winding temperature °C
 - Core temperature °C
- At 10% overload for two hours above 45°C ambient temperature:
 - Oil at top level °C
 - Winding temperature °C
 - Core temperature °C
- Hot spot temperature °C

E. On Load Tap Changing Gear

- Type
- Manufacturer
- Number of steps and range per tapping switch
- Full load voltage on Power factor of 0.8, at:
 - Primary side V
 - Secondary side V
 - Plus 9th Step V
 - Plus 8th Step V
 - Plus 7th Step V
 - Plus 6th Step V
 - Plus 5th Step V

Main Transformers (con'd)

| | |
|------------------|---------|
| - Plus 4th Step | V |
| - Plus 3rd Step | V |
| - Plus 2nd Step | V |
| - Plus 1st Step | V |
| - Normal tap | V |
| - Minus 1st Step | V |
| - Minus 2nd Step | V |
| - Minus 3rd Step | V |
| - Minus 4th Step | V |
| - Minus 5th Step | V |
| - Minus 6th Step | V |
| - Minus 7th Step | V |
| - Minus 8th Step | V |
| - Minus 9th Step | V |

F. Electrical Performance and Characteristics

| | |
|--|-------------------------|
| -No load voltage at: | |
| a. Primary side | V |
| b. Secondary side | V |
| - No load current at: | |
| a. Primary side | A |
| b. Secondary side | A |
| - Rated full load current with normal ratio at 25,000 kVA | |
| a. Primary side | A |
| b. Secondary side | A |
| - Rated load current at 20,000 kVA | |
| a. Primary side | A |
| b. Secondary side | A |
| - Current density at rated output | |
| a. Primary side | A/mm ² |
| b. Secondary side | A/mm ² |
| - Resistance per phase at 95°C | |
| a. Primary side | ohm |
| b. Secondary side | ohm |
| - Impedance voltage at full load and normal ratio at 95°C | % |
| - Equivalent resistance referred to primary side winding at 95°C | ohm |
| - Equivalent resistance referred to secondary side winding at 95°C | ohm |
| - Equivalent reactance referred to secondary side winding at 95°C | ohm |

Main Transformer (con'd)

- Regulation at full load:
 - a. At power factor is 100%%
 - b. At power factor is 80%%
- Percentage deformation of wave form%
- Magnetizing current at normal voltage and 50 cyclesA
- Flux density at normal voltage and 50 cycles
 - a. In core tesla
 - b. In yoke tesla
- Permissible symmetrical short circuit current and the corresponding time
 - a. Primary side kA,sec
 - b. Secondary side kA,sec
- Duration to withstand the mechanical and thermal effects due to external short circuit current sec
- Magnitude of harmonics of the no load current in all phases of the transformer%

G. Losses and Efficiency

- Copper losses at normal ratio and 95°C
 - a. Copper losses at full load: 25,000kVA kW
 - b. Copper losses at full load: 20,000kVA kW
- Iron losses at full load kW
- Total losses at 25,000 kVA kW
- Total losses at 20,000 kVA (with natural cooling) kW
- Efficiency at normal ratio%
- At 100% rated output (Power factor: 100%)%
- At 100% rated output (Power factor: 80%)%
- At 75% rated output (Power factor: 100%)%
- At 75% rated output (Power factor: 80%)%
- At 50% rated output (Power factor: 100%)%
- At 50% rated output (Power factor: 80%)%
- At 25% rated output (Power factor: 100%)%
- At 25% rated output (Power factor: 80%)%

Main Transformers (con'd)

H. Insulation Level

- One minute high voltage testkV
- Induced voltage test
- Impulse voltage test with wave 1.2/50 micro-sec
.....kV

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
11 kV Single Pole Isolating Switches

1. Particulars

- a. Maker's Name
- b. Type
- c. Number of poles
- d. Type of insulators (brown glazed porcelain)
- e. Greatest diameter of insulator mm
- f. Overall length of insulator mm
- g. Total length of leakage path of insulator mm
- h. Min. clearance between live parts mm
- i. Distance between contacts when switch is opened
..... mm
- j. Overall dimensions:
 - Height mm
 - Width mm
 - Length mm
- k. Weight of disconnecter kg

2. Rating and Performance

- a. Normal current rating A
- b. Normal current density at contacts A/mm²
- c. Max. short circuit current kA
 - For sec
- d. Rated auxiliary supply voltage volt
- e. One minute AC. Hz test voltage kV
- f. Max. flashover voltage of complete switch
 - Wet kV
 - Dry kV
- g. Impulse level of insulation kV

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
11 kV Switchgears

1. General

| | | |
|---|-------|----|
| a. Service Voltage at site | ..... | kV |
| b. Maker's Name | ..... |  |
| c. Type | ..... |  |
| d. Material of enclosure (sheet steel of cast iron) | ..... |  |
| a. Thickness of enclosure | ..... | mm |
| b. Dimension of cubicle: | | |
| - Width | ..... | mm |
| - Depth | ..... | mm |
| - Height | ..... | mm |

2. Bus Bars

| | | |
|---------------------------------------|-------|-----------------|
| a. Material | ..... |  |
| b. Number and size per phase | ..... |  |
| c. Cross section per phase | ..... | mm ² |
| d. Minimum clearance between phases | ..... | mm |
| e. Minimum clearance to earthed metal | ..... | mm |
| f. Space between bus bars support | ..... | mm |

3. Connectors

| | | |
|---|-------|-------------------|
| a. Material | ..... |  |
| b. Number and size per phase | ..... |  |
| c. Cross section per phase | ..... | mm |
| d. Minimum clearance between phases | ..... | mm |
| e. Minimum clearance to earth | ..... | mm |
| f. Maximum allowable current density at the worst conditions: | | |
| - For bus bars | ..... | A/mm ² |
| - For connectors | ..... | A/mm ² |
| g. Dynamic short-circuit limiting current | ..... | kA |
| h. Thermal short-circuit limiting current | ..... | kA |

11 kV Switchgears (con'd)

4. Instrument transformers

A. Current Transformers

- a. Maker's Name
- b. Type
- c. Transformation ratio A
- d. Accuracy class
- e. Rated burden at 45 °C for:
 - Measuring VA
 - Protection VA
- f. Short circuit strength for:
 - 1 sec kA
 - 3 sec kA

B. Potential Transformers

- a. Maker's Name
- b. Type
- c. Transformation Ratio V
- d. Accuracy class
- e. Rated burden at 45 °C for:
 - Measuring VA
 - Protection VA

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
11 kV Circuit Breakers

| | | |
|---|-------------|----------------------------|
| 1. Maker's Name | ..... | ..... |
| 2. Type | ..... | ..... |
| 3. Breaking capacity | ..... | ..... MVA |
| 4. Particulars | | |
| | <u>800A</u> | <u>3000A</u> |
| a. Standard specification | ..... | ..... |
| b. Type of main contacts | | |
| - Fixed | ..... | ..... |
| - Moving | ..... | ..... |
| c. Material of main contacts | ..... | ..... |
| d. Total travel of moving main contact | ..... | ..... mm |
| e. Material of arcing contacts | ..... | ..... |
| f. Type of arc control device | ..... | ..... |
| g. Material of arc control device | ..... | ..... |
| h. Current density in contact area at rated current | ..... | ..... Amps/mm ² |
| i. Voltage drop across contact at rated current | ..... | ..... mV |
| j. Type of operating mechanism | | |
| - Closing | ..... | ..... |
| - Tripping | ..... | ..... |
| k. DC. voltage for closing and tripping | | |
| - Normal | ..... | ..... volts |
| - Minimum | ..... | ..... volts |
| i. Minimum clearance in air: | | |
| - between live parts to earth | ..... | ..... mm |
| - between phases | ..... | ..... mm |
| 5. Weight and Dimensions:- | | |
| - Weight of circuit breaker | ..... | ..... tons |
| - Overall dimensions with bushings, fittings and operation mechanism in open position | ..... | ..... mm |

11 kV Circuit Breakers (con'd)

| | <u>630A</u> | <u>1600A</u> | <u>3000A</u> |
|--|-------------|--------------|--------------|
| 6. Performance | | | |
| a. Rated voltage between phases | | | V |
| b. Rated normal current | | | A |
| c. Rated breaking current | | | |
| (1) Symmetrical | | | kA |
| (2) Asymmetrical | | | kA |
| (3) Based on duty cycle and recovery voltage | | | kV |
| d. Rated making capacity | | | MVA |
| e. Short time rating: | | | |
| - For 1 sec | | | kA |
| - For 3 sec | | | kA |
| f. Total travel of moving main contacts | | | mm |
| g. Speed of breaker contacts | | | cm/sec |
| h. Time from energizing trip coil to contact separation | | | cycle |
| i. Time for complete separation of contacts | | | cycle |
| j. Total make time | | | cycle |
| k. Total break time | | | cycle |
| l. Power required at normal voltage by: | | | |
| - Trip coil | | | watt |
| - Closing coil | | | watt |
| m. Flashover voltage of bushing (dry) | | | kV |
| n. Withstand impulse level of insulation | | | kV |
| o. One minute AC. 50 cycle test voltage | | | kV |
| p. Other tests recommended by the manufacturer | | | |
| A. For SF6 Gas Circuit Breakers | | | |
| - Rated pressure of SF6 insulation | | | bar |
| - Rated quenching pressure of SF6 at ambient temperature | | | bar |
| B. For Vacuum Circuit Breaker | | | |
| - Pressure in the vacuum interrupter | | | bar |
| - Contact gap | | | mm |

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PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
Auxiliary Transformers

| | | | |
|---|---|-------|-------------|
| - | Maker's Name | ..... |  |
| - | Type | ..... |  |
| - | Standard Specification | ..... |  |
| - | Rated output | ..... | kVA |
| - | Method of cooling | ..... |  |
| - | System of connection | ..... |  |
| - | Neutral Point | ..... |  |
| - | Material of insulation | | |
| | a. Primary windings | ..... |  |
| | b. Secondary windings | ..... |  |
| | c. Major insulation | ..... |  |
| - | Material of core | ..... |  |
| - | Material of tank | ..... |  |
| - | Ratio | ..... | Volt |
| - | Iron losses at full load | ..... | Watt |
| - | Copper losses at full load and 95 °C winding temperature. | ..... | Watt |
|  | - | ..... | Watt |
| - | Permissible symmetrical short-circuit current and time | ..... | kA sec |
| - | Primary voltage at normal tapping | ..... | Volt |
| - | Corresponding secondary voltage at: | | |
| | a. No load | ..... | Volt |
| | b. Full load (Power factor: 100%, at 95°C) | ..... | Volt |
| | c. Full load (Power factor: 80%, at 95°C) | ..... | Volt |
| - | Regulation at Power factor: 100%, 95°C | ..... | % |
| - | Regulation at Power factor 80%, 95°C | ..... | % |
| - | Full load current secondary side | ..... | amp |
| - | No load current secondary side | ..... | amp |
| - | Impedance voltage | ..... | % |
| - | Efficiency at normal ratio and 95 °C | | |
| | - At 100% rated output, power factor 100% | ..... | % |
| | - At 100% rated output, power factor 80% | ..... | % |
| | - At 75% rated output, power factor 100% | ..... | % |
| | - At 75% rated output, power factor 80% | ..... | % |
| | - At 50% rated output, power factor 100% | ..... | % |
| | - At 50% rated output, power factor 80% | ..... | % |
| | - At 25% rated output, power factor 100% | ..... | % |
| | - At 25% rated output, power factor 80% | ..... | % |

Auxiliary Transformers (con'd)

- 23. Temperature rise at rated output above 45°C ambient temp.
 - At oil top level °C
 - Winding temperature °C
 - Core temperature °C
- 24. Total weight of transformer including oil kg
- 25. Approx. overall length mm
- 26. Approx. overall width mm
- 27. Approx. overall height mm
- 28. One minute voltage withstand test kV
- 29. Induced voltage test kV
- 30. Impulse voltage test with wave 1.2/50 micro-sec kV

I/We guarantee the information given above for the equipment offered.

Signature:

Date :

PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
0.4 kV Switcgears

1. Circuit Breakers

- a. Maker's Name
- b. Type
- c. Construction
- d. Breaking capacity kVA

A. Particular

- a. Standard Specification
- b. Type of main contacts (fixed)
- c. Type of main contacts (moving)
- d. Material of main contacts
- e. Material of arcing contacts
- f. Type of arc control device
- g. Voltage drop across contact mV
- h. Material of arc control device
- i. Current density on contact area amp/mm²
- j. Type of operating mechanism
 - Closing
 - Tripping
- k. DC. voltage for closing and tripping
 - a. Normal Volt
 - b. Minimum Volt

B. Performance

- a. Rated voltage between phases Volt
- b. Rated normal current amp
- c. Rated breaking capacity (sym) kVA
- d. Short time rating: for 1 sec Amp
- for 3 sec Amp
- e. Power required at normal voltage by:
 - Tripping coil Watt
 - Closing coil Watt

0.4 kV Switchgears (con'd)

2. Switchgear Type

- Material of enclosure (Sheet steel or cast iron)
- Thickness of enclosure mm
- Dimensions
 - a. Width mm
 - b. Depth mm
 - c. Weight kg
- Bus bars
 - a. Material
 - b. Number and size per phase
 - c. Cross section per phase mm²
- Min. clearance between phases mm
- Min. clearance earthed metal mm
- Span between bus bar supports mm

3. Connectors and accessories

- Material and size per phase
- Number and size per phase
- Cross section per phase mm²
- Min. clearance between phases mm
- Min. clearance to grounded metal mm
- Max. allowable current carrying capacity at worst conditions
 - a. For bus bars A
 - b. For connectors A
- Temperature rise of plug and socket connections °C
- Current Transformers:
- Type
- Transformation ratio
- Accuracy class
- Ammeter:
- a. Type
- b. Range
- c. Accuracy
- Voltmeter:
- a. Type
- b. Range
- c. Accuracy

I/We guarantee the information given above for the equipment offered

Signature:

Date :

PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
DC Installation

1. Accumulator Batteries

- (1) Maker's Name
- (2) Type
- (3) Capacity Ah
- (4) Voltage Volt
- (5) Total Number of Cells Cell
- (6) Number of working Cells Cell
- (7) Voltage of Each Cell Volt

2. Charging Rectifiers

- (1) Maker's Name
- (2) Type
- (3) Number of Charging Rectifiers
- (4) DC. Voltage Volt
- (5) AC. Voltage Volt
- (6) DC. Voltage when set is on normal/quick charging position
..... Volt
- (7) Dimension of cabinet
 - a. Width mm
 - b. Depth mm
 - c. Height mm

3. DC Switch boards

- (1) Maker's Name
- (2) Material of Enclosure
- (3) Thickness of Enclosure
- (4) Dimensions
 - a. Width mm
 - b. Depth mm
 - c. Height mm
- (5) Bus Bars
 - a. Material
 - b. Cross section area mm²
 - c. Min. clearance between phase and neutral
..... mm
 - d. Min. clearance to earthed metal mm
 - e. Max. allowable current carrying capacity A

DC Installation (con'd)

4. Circuit Breakers

- a. Maker's Name
- b. Type
- c. Breaking Current kA
- d. Rated Current A
- e. Total Break Time ms.

5. Ammeters

- a. Accuracy %
- b. Range A

6. Volt meters

- a. Accuracy %
- b. Range volt

I/We guarantee the information given above for the equipment offered

Signature:

Date :

PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
Medium Voltage Cables

1. Service Voltage at site 11kV

- a. Rated voltagekV
- b. Maker's name
- c. Type
- d. Standard specifications

2. Conductor Per phase

- a. Number of cores/cable
- b. Nominal cross sectional area per coremm²
- c. Number of strands per core
- d. Material of core
- e. Cross sectional area of each strandmm²
- f. Guaranteed cross-sectional area of conductormm²
- g. Overall diameter of conductormm
- h. Weight of conductor per kilometerkg
- i. Resistance of conductor at 20°C per kilometerohm
- j. Temperature coefficient of resistance
- k. Current carrying capacity (cable laid in ducts)amp
- l. Max. allowable current at site at worst conditions (for ambient temp. 55°C in shade, mutual heating, laying etc.)amp
- m. Max. working current at siteamps

3. Insulation

- a. Insulation classkV
- b. Material of insulation per core
- c. Thickness of insulation between coresmm
- d. Max. allowable final temperature°C
- e. Test voltage between core and earthkV

4. Cables (Armour)

- a. Type of thickness of armouring
- b. Type and thickness of outer sheath
- c. Weight of cable per kilometerkg
- d. Test voltage between core and earthkV

I/We guarantee the information given above for the equipment offered

Signature:

Date :

PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
Low voltage Cables

- 1. Service Voltage at site 0.4 kV**
- a. Rated voltagekV
 - b. Maker's name
 - c. Type
 - d. Standard specifications
- 2. Conductor Per phase**
- a. Number of cores/cable
 - b. Nominal cross sectional area per coremm²
 - c. Number of strands per core
 - d. Material of core
 - e. Cross sectional area of each strandmm²
 - f. Guaranteed cross-sectional area of conductormm²
 - g. Overall diameter of conductormm
 - h. Weight of conductor per kilometerkg
 - i. Resistance of conductor at 20°C per kilometerohm
 - j. Temperature coefficient of resistance
 - k. Current carrying capacity (cable laid in ducts)amp
 - l. Max. allowable current at site at worst conditions (for ambient temperature 55°C
in shade, mutual heating, laying etc.)amp
 - m. Max. working current at siteamp
- 3. Insulation**
- a. Insulation classkV
 - b. Material of insulation per core
 - c. Thickness of insulation between coresmm
 - d. Max. allowable final temperature°C
 - e. Test voltage between core and earthkV
- 4. Cables (Armour)**
- a. Type of thickness of armouing
 - b. Type and thickness of outer sheath
 - c. Weight of cable per kilometerkg
 - d. Test voltage between core and earthkV

I/We guarantee the information given above for the equipment offered

Signature:

Date :

PART 2: FORM OF TENDER AND APPENDICES
GUARANTEE TABLES
Control Cables

1. Service Voltage at site

- a. Rated voltage kV
- b. Maker's name
- c. Type
- d. Standard specifications

2. Conductor per phase

- a. Number of cores/cable
- b. Nominal cross sectional area per core mm²
- c. Number of strands per core
- d – Material of core
- e. Cross sectional area of each strand mm²
- f. Guaranteed cross-sectional area of conductor mm²
- g. Overall diameter of conductor mm
- h. Weight of conductor per kilometer kg
- i. Resistance of conductor at 20°C per kilometer ohm
- j. Temperature coefficient of resistance
- k. Current carrying capacity (cable laid in ducts) amp
- l. Max. allowable current at site at worst conditions (for ambient temperature
55°C in shade, mutual heating, laying etc.) amp
- m. Max. working current at site amp

3. Insulation

- a. Insulation class kV
- b. Material of insulation per core
- c. Thickness of insulation between cores mm
- d. Max. allowable final temperature °C
- e. Test voltage between core and earth kV

4. Cables (Armour)

- a. Type of thickness of armouring
- b. Type and thickness of outer sheath
- c. Weight of cable per kilometer kg
- d. Test voltage between core and earth kV

I/We guarantee the information given above for the equipment offered

Signature:

Date :

PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
MEASURING INSTRUMENTS
FOR 66 kV SWITCHGEAR

AMMETERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

VOLTMETERERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO-WATT HOUR METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO-WATT METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO VAR HOUR-METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO VAR-METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

I/We guarantee the information given above for the equipment offered.

Signature:

Date :

PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
MEASURING INSTRUMENTS
FOR 11 kV SWITCHGEAR

AMMETERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

VOLTMETERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO-WATT HOUR METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO-WATT METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO-VAR HOUR METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

KILO-VAR METERS

| POSITION | Type and Maker's name | ACCURACY | RANGE OF SCALE | OTHER PARTICULARS |
|----------|--------------------------|----------|-------------------|----------------------|
| | | | | |

I/We guarantee the information given above for the equipment offered.

Signature:

Date :

PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
RELAYS FOR 66 kV SWITCHGEAR

| DESCRIPTION | TYPE OF RELAY | | | | |
|--|---------------|--|--|--|--|
| | | | | | |
| 1 – Maker’s Name 2 – Type and Designation 3 – Standard Specification with which relay complies 4 – Relay Characteristic 5 – Range of relay time setting (sec) 6 – Current rating of relay coil (A) 7 – Voltage rating of relay coil (V) 8 – Burden of current coils (VA) 9 – Burden of voltage coil (VA) 10 – Other relay particulars | | | | | |

I/We guarantee the information given above for the equipment offered.

Signature:

Date :

PART 2: FROM OF TENDER AND APPENDICES
GUARANTEE TABLES
RELAYS FOR 11 kV SWITCHGEAR

| DESCRIPTION | TYPE OF RELAY | | | | |
|--|---------------|--|--|--|--|
| | | | | | |
| 1 – Maker’s Name | | | | | |
| 2 – Type and Designation | | | | | |
| 3 – Standard Specification with which relay complies | | | | | |
| 4 – Relay Characteristic | | | | | |
| 5 – Range of relay time setting (sec) | | | | | |
| 6 – Current rating of relay coil (A) | | | | | |
| 7 – Voltage rating of relay coil (V) | | | | | |
| 8 – Burden of current coils (VA) | | | | | |
| 9 – Burden of voltage coil (VA) | | | | | |
| 10 – Other relay particulars | | | | | |

I/We guarantee the information given above for the equipment offered.

Signature:

Date :

PART 2: FORM OF TENDER AND APPENDICES
APPENDIX E: FORM OF QUALIFICATION

1 – MANUFACTURING TIE SCHEDULE

Tenderer shall attach hereto a CPM Diagram showing times for design, material procurement, manufacturing, delivery, erection and testing of various items of apparatus required for the SUBSTATIONS.

2 – INFORMATION AND DATA TO BE FURNISHED BY TENDERERS

Each Tenderer shall submit with his tender the following information and data:

- A – Single line diagrams, where applicable, and general drawings showing the general construction and overall dimensions and weights of the parts and assemblies of Apparatus proposed.
- B – Conceptual layout of the substations
- C – Tests at works, if any, in addition to those specified, which Tenderer intends to make
- D – Approximate weight, space and shipping weight of heaviest crate or part to be handled by unloading facilities, weight and dimensions of largest piece to be shipped and total weight of complete work to be furnished
(above information shall be shown on separate sheets following later.)

3 – STATEMENT OF QUALIFICATIONS

The following statements as to experience and financial qualifications of the bidder have to be submitted with the bid, as a part thereof. The Bidder warrants that all these statements are true and correct.

3 – 1 TRANSFORMER MANUFACTURER INFORMATION

- A – Tenderer’s qualification has been in business as a power Transformer manufacture for Years, from year
- B - Tenderer’s organization has had experience in producing equipment comparable with that required under this proposed contract for years.
- C - Equipment similar in character to that require din this proposed contract, which tenderer’s organization has completed.

| No. | Year Commission | Type and description of owner | Contract value |
|------|-----------------|-------------------------------|----------------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| etc. | | | |

The Bidder shall submit this sheet together with certificate of successful operation from one or two customer mentioned above as evidence of supply record.

3.2 66 kV CIRCUIT BREAKER MANUFACTURER INFORMATION

- A – Tenderer’s organization has been in business as a 66 kV circuit breaker manufacturer for years, from year
- B – Tenderer’s organization has had experience in producing equipment comparable with that required under this proposed contract for years
- C - Equipment similar in character to that require din this proposed contract, which tenderer’s organization has completed.

| No. | Year Commission | Type and description of owner | Contract value |
|------|-----------------|-------------------------------|----------------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| etc. | | | |

The Bidder shall submit this sheet together with certificate of successful operation from one or two customer mentioned above as evidence of supply record.

3.3 METAL CLAD SWITCHGEAR MANUFACTURER INFORMATION

A – Tenderer’s organization has been in business as an 11 kV metal clad switchgear manufacturer for __ years, from year

B – Tenderer’s organization has had experience in producing equipment comparable with that required under this proposed contract for years

C - Equipment similar in character to that required in this proposed contract, which tenderer’s organization has completed.

| No. | Year Commission | Type and description of owner | Contract value |
|------|-----------------|-------------------------------|----------------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| etc. | | | |

The Bidder shall submit this sheet together with certificate of successful operation from one or two customer mentioned above as evidence of supply record.

3.4 CONTROL BOARD MANUFACTURER INFORMATION

A – Tenderer’s organization has been in business as a control Board manufacturer for ___ years, from year.

B – Tenderer’s organization has had experience in producing equipment comparable with that required under this proposed contract for years.

C - Equipment similar in character to that require din this proposed contract, which tenderer’s organization has completed.

| No. | Year Commission | Type and description of owner | Contract value |
|------|-----------------|-------------------------------|----------------|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| etc. | | | |

The Bidder shall submit this sheet together with certificate of successful operation from one or two customer mentioned above as evidence of supply record.

3.5 BANKING REFERENCES

Reference is hereby made to the following banks as to the financial responsibility of the tenderers.

| NAME OF BANK | ADDRESS |
|--------------|---------|
| | |
| | |
| | |
| | |

Attached is Financial statements of the Bidder, and of each consortium member if applicable, covering the last five financial years. The ownership of each company must be stated.

3.6 QUALITY CONTROL SYSTEM

The Bidder/the Manufacturer has to establish quality control systems and organizations designed to achieve high levels of equipment reliability during manufacturing. In this connection the Bidder/the Manufacturer shall submit information of the quality control system and organizations.

The quality control system consists of following items at least.

- 1 – Organization chart of the company
- 2 – Organization of the plant
- 3 – Business of Quality Control Department
- 4 – Manufacturing process, in process and final inspection

3.7 TESTING FACILITIES

The Bidder/the Manufacturer shall have capability of testing facilities and shall give detailed information in accordance with following schedule.

| ITEM | DESCRIPTION | RATINGS | QUANTITY |
|------|-------------|---------|----------|
| 1 - | | | |
| 2 - | | | |
| 3 - | | | |
| 4 - | | | |
| 5 - | | | |
| 6 - | | | |
| 7 - | | | |
| 8 - | | | |
| 9 - | | | |
| 10 - | | | |

REA reserves the right to inspect a factor or factories of the Bidder and/or his Sub-Contractors prior to the award of the contract if the engineer finds it necessary to confirm the testing facilities and capacities of such plant.

3.8 PRODUCTION CAPABILITY

| KINDS | VOL./MONTH (AS MINIMUM) |
|-----------|-------------------------|
| 1 - | |
| 2 - | |

REA reserves the right to inspect a factory or factories of the contractor and/or his Sub-Contractors prior to the Award of the contract if the Engineer finds it necessary to confirm the production capabilities and production facilities of such plant.

The Bidder who will not provide above mentioned document or will provide the false information may not be considered.

