# SCHEDULE OF TECHNICAL DATA

# FOR SF6 CIRCUIT BREAKER

# WAPDA/NTDC Specifications (P-193:2010)

# Bid/Tender No.\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **GENERAL**

|  |  |  |
| --- | --- | --- |
| 1. | Manufacturer’s name & address  (Attach Manufacturer’s catalogue/broucher with bid) |  |
| 2. | Type/designation of offered circuit breaker |  |
| 3. | Offered Circuit Breaker Class w.r.t   1. Mechanical Endurance 2. Electrical Endurance 3. Capacitive Current Breaking 4. Connection to Overheard Line |  |
| 4. | No. of poles of Circuit Breaker |  |
| 5. | Suitability for three phase operation and rapid reclosing |  |
| 6 | Is the offered circuit breaker conforms to all constructional & performance requirements of the specification (if not, give list of deviations) |  |
| 7. | Type Test Report. (Attach copy of type test report)   1. a) Issuing laboratory. b) No. and Date. 2. Current rating of tested circuit breaker 3. Rated Short Circuit Breaking Current 4. Rated duration of short circuit current 5. Resistance of Main circuit of tested circuit breaker. 6. Whether complete type test as per IEC 62271-100 were carried out at an independent lab.( if not, give details). 7. Whether the details of circuit breaker for type tests as required in clause 18.2.1 have been attached with the bid | Yes/No  Yes/No |

1. **RATINGS**

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Rated voltage(Ur), rms | (kV) |  |
| 2. | Nominal voltage, rms | (kV) |  |
| 3. | Highest operating voltage | (kV) |  |
| 4. | Lowest operating voltage | (kV) |  |
| 5. | Lightning Impulse withstand voltage   1. Phase to Phase 2. Phase to Earth |  |  |
|  | (kV)  (kV) |  |
| 6. | One minute Power Frequency withstand voltage   1. Phase to Phase 2. Phase to Earth |  |  |
|  | (kV)  (kV) |  |
| 7. | Rated Frequency | (Hz) |  |
| 8. | Rated Continuous current of offered circuit breaker |  |  |
|  | (A) |  |
| 9. | Max. continuous current of offered Circuit Breaker | (A) |  |
| 10. | Rated short circuit breaking current for 1 sec, rms | (kA) |  |
| 11. | Rated short circuit breaking current for 3 sec, rms | (kA) |  |
| 12. | Rated D.C. component | (%) |  |
| 13. | Rated short time withstand current for 1 sec, rms | (kA) |  |
| 14. | Rated short time withstand current for 3 sec, rms | (kA) |  |
| 15. | Rated peak withstand current, rms | (kA) |  |
| 16. | Rated short-circuit making current (Peak) | (kA) |  |
| 17. | Rated operating sequence |  |  |
| 18. | Rated out-of-phase breaking current at rated voltage | (kA) |  |

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| --- | --- | --- | --- |
| 19. | Line-charging breaking capacity:   1. Rated current 2. Over voltage factor |  |  |
|  | (kA)  (p.u) |  |
| 20. | Cable charging breaking current at rated voltage | (kA) |  |
| 21. | Single capacitor bank breaking current | (A) |  |
| 22. | Rated Back to back capacitor bank switching current | (A) |  |
| 23. | Max. RIV at 1 MHz at 10% above rated voltage (1.1Ur/√3) | (µV) |  |
| 24. | First Pole to Clear Factor (FPCF) |  |  |
| 25. | Resistance of main circuit of the offered circuit breaker at 20oC ambient temperature | (µΩ) |  |
| 26. | Transient recovery voltage for terminal faults (1.5 F.P.C. factor)   1. At 100% rated short circuit breaking current ul- first reference voltage   t1- first time co-ordinate  uc- TRV peak value  t2- second time co-ordinate td- time delay  u´- voltage co-ordinate t´- third time co-ordinate  u1/t1- Rate of Rise of Recovery Voltage Kaf - Amplitude Factor   1. At 60% rated short circuit breaking current: ul- first reference voltage   t1- first time co-ordinate  uc- reference voltage TRV peak value t3- time to reach uc  td- time delay  u´- delay line voltage co-ordinate t´- delay line time co-ordinate  t3- initial rate of rise  u1/t1- Rate of Rise of Recovery Voltage Kaf - Amplitude Factor |  |  |
|  | (kV)  (µ Sec)  (kV)  (µ Sec)  (µ Sec)  (kV)  (µ Sec) (kV/µSec) (p.u)  (kV)  (µ Sec)  (kV)  (µ Sec)  (µ Sec)  (µ Sec)  (kV)  (µ Sec) (kV/µSec) (p.u) |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1. At 30% rated short circuit breaking current   ul- first reference voltage t1- first time co-ordinate  uc- reference voltage TRV peak value t3- time to reach uc  td- time delay  u´- delay line voltage co-ordinate t´- delay line time co-ordinate  t3- initial rate of rise  u1/t1- Rate of Rise of Recovery Voltage Kaf - Amplitude Factor   1. At 10% rated short circuit breaking current ul- first reference voltage   t1- first time co-ordinate  uc- reference voltage TRV peak value t3- time to reach uc  td- time delay  u´- delay line voltage co-ordinate t´- delay line time co-ordinate  t3- initial rate of rise  u1/t1- Rate of Rise of Recovery Voltage Kaf - Amplitude Factor | (kV)  (µ Sec)  (kV)  (µ Sec)  (µ Sec)  (µ Sec)  (kV)  (µ Sec) (kV/µSec) (p.u)  (kV)  (µ Sec)  (kV)  (µ Sec)  (µ Sec)  (µ Sec)  (kV)  (µ Sec) (kV/µSec) (p.u) |  |
| 27.  28. | Transient Recovery Voltage for short line faults  u1- first reference voltage t1- first time co-ordinate uc- TRV peak value  t2- second time co-ordinate td- time delay  u´- voltage co-ordinate  t´- third time co-ordinate  u1/t1- Rate of Rise of Recovery Voltage Kaf - Amplitude Factor  Transient Recovery Voltage for out of phase u1- first reference voltage  t1- first time co-ordinate  uc- TRV peak value  t2- second time co-ordinate td- time delay  u´- voltage co-ordinate  t´- third time co-ordinate  u1/t1- Rate of Rise of Recovery Voltage Kaf - Amplitude Factor | (kV)  (µ Sec)  (kV)  (µ Sec)  (µ Sec)  (kV)  (µ Sec) (kV/µSec) (p.u)  (kV)  (µ Sec)  (kV)  (µ Sec)  (µ Sec)  (kV)  (µ Sec) (kV/µSec) (p.u) |  |

1. **PERFORMANCE DATA**

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | Maximum ambient temperature range | (C) |  |
| 2. | Whether circuit breaker is capable of switching of :   1. Power Transformers 2. Capacitor Banks 3. Charging current of over head lines/cables | |  |
|  | Yes/No Yes/No Yes/No |
| 3. | Resistance of main circuit at 20oC | (µΩ) |  |
| 4. | Current carrying capacity of offered circuit breaker at different ambient temperatures (Attach Ambient Temperature Vs Current curve with the bid)   1. Max. Continuous Current at 50oC Ambient (A) 2. Max. Continuous Current at 40oC Ambient (A) 3. Max. Continuous Current at 30oC Ambient (A) 4. Max. Continuous Current at 20oC Ambient (A) 5. Max. Continuous Current at 10oC Ambient (A) | | |
| 5. | Temperature rise at at 50oC Ambient Temperature:   1. Contacts 2. Terminals 3. Other metal parts |  |  |
|  | (C)  (C)  (C) |  |
| 6. | 1. Rated voltage of :    1. Closing coil    2. Tripping coil    3. Control Voltage 2. Rated power consumption of :    1. Closing coil    2. Tripping coil |  |  |
|  | (V DC)  (V DC)  (W)  (W) |  |
| 7. | 1. Heater voltage 2. Heater Power | (V)  (Watts) |  |

|  |  |  |
| --- | --- | --- |
| 8. Range of rated control and auxiliary supply viz: |  | |
| i) Control- Max./Min. | (V DC) |  |
| ii) Charging Motor-Max./Min. | (VDC) |  |
| iii) Tripping voltage – Max./Min. | ( V DC) |  |
| iv) Three phase AC system | (VAC) |  |
| 9. Tolerance in operating time | (m sec) |  |
| 10. Rated closing time | (m sec) |  |
| 11. Rated break time | (m sec) |  |
| 12. Rated make time | (m sec) |  |
| 13. Rated dead time | (m sec) |  |
| 14. Rated open-close time | (m sec) |  |
| 15. Rated close-open time | (m sec) |  |
| 16. Rated Arcing time | (m sec) |  |
| 17. Rated pre-arcing time | (m sec) |  |
| 18. Rated reclosing time | (m sec) |  |
| 19. Rated Re-make time | (m sec) |  |
| 20. Rated opening time | (m sec) |  |
| 21. Maximum clearing time during test duty T100a | (m sec) |  |
| 1. No. of switching operations permissible at: (attach test results)    1. 100% short circuit breaking current | (No.) |  |
| ii) 60% short circuit breaking current | (No.) |  |
| iii) 30% short circuit breaking current | (No.) |  |
| iv) Max. continuous current carrying capacity | (No.) |  |
| 23. Max. time interval between first and last pole for 3 phase pole operation | (m sec) |  |
| 24. Make-break time | (m sec) |  |
| 25. Pre-Insertion time | (m sec) |  |
| 26. Min. close duration | (m sec) |  |

|  |  |  |  |
| --- | --- | --- | --- |
| 27. | Min. Trip duration | (m sec) |  |
| 28. | Electrical Endurance | (Nos.) |  |
| 29. | Mechanical endurance | (Nos.) |  |
| 30. | Max. noise at a distance of 10m from the breaker and 2meter from base during opening and closing operation | (dB) |  |

1. **CONSTRUCTION**

## (Attach internal view of a pole of circuit breaker showing all the components with a detail legend with the bid)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1.  2. | No. of breaks per pole  No. of trip coils for pole | (No.)  (Nos.) |  |  |
| 3. | Total length of break per pole | (mm) |  |  |
| 4. | No. of operating mechanism for 3-phase circuit breaker |  |  |  |
|  |  |  |  |
| 5. | Whether two electrically independent & identical trip coils for each pole of the circuit breaker have been provided. |  |  |  |
|  |  |  | Yes/No |
| 6. | Whether two electrical independent sets of wiring, terminals and protection equipment have been provided. |  |  |  |
|  |  |  | Yes/No |
| 7. | Whether circuit breaker is suitable for trip free and provided with a lockout device preventing closing. |  |  | Yes/No |
| 8.  9.  10.  11. | Provision of anti pumping device/feature Degree of protection of outdoor control cubical Thickness of control cubical sheet  Material of sheet. |  |  | Yes/No |
| 12. | Whether all the shut valves are provided in the operating mechanism |  |  |  |
|  |  |  | Yes/No |

|  |  |  |  |
| --- | --- | --- | --- |
| 13. | Type of operating mechanism:   1. Opening mechanism 2. Closing mechanism |  |  |
|  |  |  |
| 14. | 1. Rated voltage of the charging motor in the operating mechanism 2. Total power consumption of motor | (V)  (Watts) |  |
| 15.  16.  17. | Whether thermal magnetic protection provided for the motor.  Whether emergency manual charging & release of spring is possible without electrical operation  Whether the indicator to show the charged/discharged state of spring has been provided in the operating mechanism |  | Yes/No Yes/No  Yes/No |
| 18. | Whether all the local & remote control indications as mentioned at clause 8 have been available. (If not, give details) |  | Yes/No |
| 19. | Whether all functional requirements as listed in 9.1 have been complied. (If not, give details) |  | Yes/No |
| 20.  21.  22. | No. of close open operation possible with the stored energy  Time required for the motor to recharge the closing spring  Description of safety alarms provided a) MCB supply voltage   1. MCB Motor 2. Motor closing time control | (No.) |  |
| 23. | 1. Whether SF6 gas conforms to IEC 376 2. Normal SF6 gas Pressure at 20oC 3. Maximum SF6 gas Pressure at 20oC 4. Minimum SF6 gas Pressure at 20oC 5. SF6 gas Pressure alarm Stage-I 6. SF6 gas Pressure alarm Stage-II 7. Total volume of SF6 gas per pole 8. Leakage of SF6 gas per year per circuit breaker |  | Yes/No |
|  | (Bars)  (Bars)  (Bars)  (Bars)  (Bars) (Litres) (ml) |

|  |  |  |  |
| --- | --- | --- | --- |
| 24. | No. of earthing terminals for 95mm2 copper conductor | (Nos.) |  |
| 25. | Material of Earthing terminal |  |  |
| 26. | Capability of carrying rated short time current of earthing terminal | (kA) |  |
| 27. | Contacts:   1. Material 2. Type of plating 3. Thickness of plating material 4. Contact pressure 5. Dimensions 6. Current density at continuous current |  |  |
|  | (A/mm2) |  |
| 28. | 1. Total No. of auxiliary switches:    1. Normally Open    2. Normally Closed 2. No. of spare auxiliary switches:    1. Normally Open    2. Normally Closed |  |  |
|  |  |  |
| 29. | Thickness of galvanized steel sheet used for outdoor control cubical | (mm) |  |
| 30. | Dimensions of inspection window of outdoor control cubicle | (mm) |  |
| 31. | Whether all wiring comply with clause 11.9.4 |  | Yes/No |
| 32. | Whether the outdoor control cubicle comply with the requirements of clause 11(if not, give detail) |  |  |
|  |  | Yes/No |
| 33. | Type of gasket to prevent ingress of moisture |  |  |
| 34. | Whether the AC circuit of outdoor control cubicle is fitted with non-flammable transparent plastic cover to prevent accidental contact with lower part |  |  |
|  |  |  |
| 35. | No. of extra terminals for future termination |  |  |
| 36. | Size of cable used in wiring | (mm²) |  |
| 37. | Minimum height of circuit breaker | (mm) |  |

|  |  |  |  |
| --- | --- | --- | --- |
| 38. | Minimum phase spacing between poles | (mm) |  |
| 39. | Minimum earth clearance of circuit breaker | (mm) |  |
| 40. | Minimum clearance between moving and stationary parts when the circuit breaker in the open position | (mm) |  |
|  |  |  |
| 41. | 1. Minimum creepage distance between live terminals 2. Minimum creepage distance phase to earth | (mm)  (mm) |  |
| 42. | Size and section of terminal bolts (attach drawing) | (mm) |  |
| 43. | Impact vertical loading per pole | (kg/kN) |  |
| 44. | Horizontal loading of operating mechanism. | (kg/kN) |  |
| 45. | Impact vertical loading of operating mechanism. | (kg/kN) |  |
| 46. | Maximum shock load on foundation while opening on fault. | (kg) |  |
| 47. | Dimensions for steel support structure:   1. Height 2. Breadth 3. Width   iv.) Structure fixing foundation details |  |  |
|  |  |  |
| 48. | Circuit breaker withstand capability   1. Wind velocity 2. Wind Load 3. Earth quake    1. Richer-scale    2. Horizontal acceleration |  |  |
|  | m/sec m/sec  (g) |  |
| 49. | Foundation Loading details. |  |  |
| 50. | Terminal Connectors suitable for 600 mm2 Al. Conductor (Attach manufacturer’s broucher/drawings with the bid)   1. Manufacturer’s Name 2. Type 3. Weight 4. Current carrying capacity 5. Short circuit withstand current | |  |
|  |  |

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| --- | --- | --- | --- |
|  | 1. Tensile Strength 2. Elongation 3. Hardness 4. Type Tests (Attach copy) |  |  |
| 51. | Weight per pole of circuit breaker | (kg) |  |
| 52. | Weight of complete circuit breaker | (kg) |  |
|  | **E) INSULATOR** |  |  |
| 1. | Manufacturer/country of origin (Attach catalogue/broucher/drawing with the bid) |  |  |
|  |  |  |
| 2 | Type of insulator |  |  |
| 3. | Diameter of insulator |  |  |
| 4. | No. of units per column |  |  |
| 5. | Creepage distance (Phase to Earth) |  |  |
| 6. | Phase to phase clearance |  |  |
| 7. | Type test report issuing lab with No. & date (Attach copy of test report) |  |  |
| 8. | Power frequency withstand test voltage   1. Dry 1 minute 2. Wet 10 sec |  |  |
|  |  |  |
| 9. | Impulse withstand voltage |  |  |
| 10. | Max RIV at 1 MHz |  |  |
| 11. | Ultimate strength of column |  |  |
| 12. | Withstand Pressure   1. Cantilever 2. Tension 3. Torsion 4. Compression 5. Bending |  |  |
|  | (N)  (N)  (N)  (N)  (N) |  |
| 13. | Material and colour |  |  |

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|  | **F) STEEL STRUCTURE** |  |  |
|  | (Attach drawing/photograph with the bid) |  |  |
| 1. | Name of Manufacturer/Country of origin |  |  |
| 2. | Tensile Strength of angles, nuts & bolts Min./Max. | Kg/mm2 |  |
| 3. | Yield point Min. | Kg/mm2 |  |
| 4. | Elongation in 200m guage | (%) |  |
| 5. | Weight of Zinc Coating of angles/nuts & bolts |  |  |
| 6. | Thickness of zinc coating angles/nuts & bolts |  |  |
| 7. | Hardness of nuts & bolts |  |  |
| 8.  9.  10. | Total weight of supporting steel structure with foundation bolts  Designed soil bearing capacity  Seismic withstand stress/magnitude. (Attach design calculations) |  |  |
|  | **G) TERMINAL HEAD:** |  |  |
|  | (Attach drawing/photograph with the bid) |  |  |
| 1. | Name of Manufacturer |  |  |
| 2. | Material of terminal head |  |  |
| 3. | Current Carrying Capacity of terminal head |  |  |
| 4. | Dimensions of terminal head | (mm) |  |
| 5. | Material of terminal head |  |  |
| 6. | Weight of terminal head |  |  |
| 7. | Whether 4 Nos. two way terminal head are provided. |  | Yes/No |
| 8. | Static &dynamic load during open & close operation of circuit breaker |  |  |
|  |  |  |

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| --- | --- | --- | --- |
|  | **H) CONNECTORS** |  |  |
|  | (Attach drawing/photograph with the bid) |  |  |
| 1. | Name of Manufacturer/Country of origin |  |  |
| 2. | Material of connector (Whether Monometallic aluminium alloy or Bimetallic) |  |  |
| 3. | Material of keeper |  |  |
| 4. | Current Carrying Capacity of connector |  |  |
| 5. | Tensile Strength (Aluminium/Copper) |  |  |
| 6. | Elongation (Aluminium/Copper) | % |  |
| 7. | Hardness of Aluminium/Copper |  |  |
| 8. | Electrical conductivity of Aluminium/Copper |  |  |
| 9. | Short Circuit Rating |  |  |
| 10. | Material of Nuts & Bolts |  |  |
| 11. | Tensile Strength of Nuts & Bolts |  |  |
| 12. | Brinell Hardness of Nuts & Bolts |  |  |
|  | **I) NAME PLATE DATA** |  |  |
| 1. | Whether the data listed in clause 14 is engraved on the name plate |  |  |
| 2. | Material/Thickness of name plate |  |  |
|  | **J) SPARES & SPECIAL TOOLS** |  |  |
| 1. | Whether spares & tools as required at clause 15 will be provided with each lot of circuit breakers |  | Yes/No |
| 2. | Whether special tools as per clause 16 been provided with each lot of circuit breaker for maintenance & repair  (Attach detail list) |  | Yes/No |