**VOLUME-2  
PART- II  
Technical Data Sheets**

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# **General Technical Specifications**

To be furnished

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1 |  |  |  |  |
| 1.1 |  |  |  |  |
| 1.2 |  |  |  |  |
| 1.3 |  |  |  |  |
| 1.4 |  |  |  |  |
|  |  |  |  |  |
| 2. |  |  |  |  |
| 2.1 |  |  |  |  |
| 2.2 |  |  |  |  |
| 2.3 |  |  |  |  |
| 2.4 |  |  |  |  |
| 2.5 |  |  |  |  |
| 2.6 |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Hydraulic Turbine and Accessories** | |  |
| **2.1** | **Guaranteed characteristics** |  |  |
| ITEM | DESIGNATION | UNITS VALUE | REMARKS |
| 1. | General |  |  |
| 1.1. | Manufacturer | - |  |
| 1.2. | Place of manufacture | - |  |
| 1.3. | Type designation | - |  |
| 1.4. | Applicable standards | - |  |
| 2. | Main data |  |  |
| 2.1. | Shaft orientation | Horz./  Vert. |  |
| 2.2. | Turbine rated output at rated net head of 125.48 m and at rated | kW |  |
|  | speed |  |  |
| 2.3. | Maximum continuous output at rated net head of 125.48 m | kW |  |
| 2.4. | Best efficiency output at rated net head of 125.48 m. | kW |  |
| 2.5. | Maximum continuous output at maximum net head of 125.65 m | kW |  |
| 2.6. | Maximum continuous output at extreme minimum net head of | kW |  |
|  | 125.15 m |  |  |
| 2.7. | Minimum permissible output at the following heads and at rated speed |  |  |
|  | ® rated net head of 125.48 m | kW |  |
|  | ® maximum net head of 125.65 | kW |  |
|  | m |  |  |
|  | ® minimum net head of 125.15m | kW |  |
| 2.8. | Maximum net head and corresponding output under which turbine can be operated continuously without any adverse | m, kW |  |

|  |  |  |  |
| --- | --- | --- | --- |
| effect | | | |
| 2.9. |  | Minimum net head under and corresponding output which turbine can be operated continuously without any adverse effect | m, kW |
| 2.10. |  | Recommended turbine setting with respect to minimum tail water level of 771.75m | m |
| 2.11. |  | Centre Line of runner | m |
| 2.12. |  | Speed |  |
|  | a. | Specific Speed | m-Kw |
|  | b. | Rotational Speed | rpm |
|  | c. | Critical speed for combined |  |
|  |  | turbine & generator |  |
| 2.13. |  | Maximum runaway speed at following net heads and at generator no-load (except friction losses) |  |
|  |  | ® at max net head of 125.65 m | rpm |
|  |  | ® at rated net head of 125.48 m | rpm |
| 2.14. |  | Duration for which turbine is designed to run at maximum runaway speed | s |
| 2.15. |  | Direction of rotation (viewed from  NDE) | C-wise |
|  |  | /Anti C- wise |
| 2.16. |  | Water discharge under rated turbine output as per 2.2 above | m3/s |
| 2.17. |  | Maximum leakage through wicket gate at maximum static head of | l/s |
|  |  | 130.85 m |  |
| 2.18. |  | Bearing Details |  |
|  |  | ® No. & Type of Turbine Bearings |  |
|  |  | ® Location of Bearings |  |
|  |  |  |  |
|  |  |  |  |

® No. of pads on each bearings

® Material of pads of each bearing

® Type, No. and location of RTDs on each bearing

® Type No. and location of Dial

Type thermometers

® Cooling water requirements - Quantity & Pressure

® Normal working temperature of bearing

o Pads

o Oil

® Maximum permissible temperature of bearing for : -

o Alarm

o Trip

® Operation capability of

bearings in minutes at normal

speed without cooling water supply

® Operation capability of

bearings in minutes at runaway

speed with /without cooling

water supply

® Operation capability of

bearings in minutes at 4-5% of

rated speed at shutdown

without cooling water supply

* 1. Thrust/pedestal bearing loads

X

® Turbine rotating parts

® Maximum Hydraulic Thrust

o with new labyrinths

o with worn out labyrinths

. ® Axial Thrust at 100% rated load

throw off.

* 1. Maximum hydraulic unbalance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | thrust |  |  |  |
|  | ® Axial | kN |  |  |
|  | ® Radial | kN |  |  |
| 2.21. | Fly wheel effect of turbine rotating parts | kg m2 |  |  |
| 2.22. | Fly wheel effect required from the generator for speed rise of 50% | t-m2 |  |  |
|  | and pressure rise of 25%. |  |  |  |
| 3. | Model Test |  |  |  |
| 3.1. | Whether bid is based on existing model or new model |  |  |  |
| 3.2. | If existing model, details of project where the turbine based on the |  |  |  |
|  | existing model is installed with year of installation |  |  |  |
| 3.3. | If new model, whether model test |  |  |  |
|  | is included in the scope |  |  |  |
| 3.4. | If existing model, whether model |  |  |  |
|  | retest is included in the offer |  |  |  |
| 3.5. | Place where model test is |  |  |  |
|  | proposed to be performed |  |  |  |
| 4. | Performance Data |  |  |  |
| 4.1. | Turbine efficiency, discharge & gate opening at rated net head of 125.48 m for following outputs: |  | Efficiency (%) | Discharge Gate opening  (cumec) (%) |
|  | ^ at maximum continuous |  |  |  |
|  | output (110%) |  |  |  |
|  | ^ at 100 % continuous rated |  |  |  |
|  | output |  |  |  |
|  | ^ at 90 % continuous rated |  |  |  |
|  | output |  |  |  |
|  | ^ at 80 % continuous rated |  |  |  |
|  | output |  |  |  |
|  | ^ at 70 % continuous rated |  |  |  |
|  | output |  |  |  |
|  | ^ at 60 % continuous rated |  |  |  |
|  |  |  |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

output

^ at 50 % continuous rated

output

^ at 40 % continuous rated output

* 1. Turbine efficiency, discharge & gate opening at minimum net head of 125.15 m for following outputs:

Efficiency Discharge Gate opening

(%) (cumec) (%)

^ at maximum continuous output

^ at 100 % continuous rated

output

^ at 90 % continuous rated

output

^ at 80 % continuous rated

output

^ at 70 % continuous rated

output

^ at 60 % continuous rated

output

^ at 50 % continuous rated

output

^ at 40 % continuous rated output

* 1. Turbine efficiency, discharge & gate opening at maximum net head of 125.75 m for following outputs:

Efficiency Discharge Gate opening

(%) (cumec) (%)

^ at maximum continuous output

^ at 100 % continuous rated output

^ at 90 % continuous rated output

^ at 80 % continuous rated

Output

^ at 70 % continuous rated

output

^ at 60 % continuous rated

output

^ at 50 % continuous rated

output

^ at 40 % continuous rated

output

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | Output (MW) | Efficiency (%) | Discharge (cumec) | Gate opening (%) |
| 4.4. | Point of best efficiency output at |  |  |  |  |
|  | 125.65m, 125.48m & 125.15 m |  |  |  |  |
|  | net heads, discharge & gate |  |  |  |  |
|  | opening corresponding to best |  |  |  |  |

efficiency point.

Weighted average efficiency (according to clause of technical specification) %

Number of stay vanes pcs

Number of wicket gates pcs

1. Abrasion/Erosion of components

by silt (in given magnitude &characteristic)

Running Hrs Running Hrs

(without special (with special coating) coating)

* 1. Interval between needs for erosion maintenance/replacements of following components with/without special coating

(Plasma)

1. Runner
2. Guide Vanes
3. Runner Labyrinth
4. Stationary Labyrinth

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | 1. Draft Tube Bend & Cone 2. Others |  |  |  |
| 5.2. | Details of abrasion resistant hard coating as regards to material, application process, recoating suitability at site, hardness etc. |  |  |  |
| 6. | Turbine Setting, minimum submergence required | m |  |  |
| 7. | Cavitation’s limit guarantee - | kgs per |  |  |
|  | maximum permissible metal lost | 1000 hrs. |  |  |
|  | from runner and other affected | of oper- |  |  |
|  | parts due to cavitation |  |  |  |
|  | ation |  |  |
| 8. | Maximum sound pressure level at a distance of 1 m at rated operation |  |  |  |
|  | ๏ at scroll case | dB(A) \_\_ |  |  |
|  | ๏ at draft tube bend piece | dB(A) \_\_ |  |  |
| 9. | Speed rise |  |  |  |
| 9.1. | Momentary rise in speed on suddenly reducing load to zero from  ๏ Maximum load  ๏ Full load  ® % full load  ® 1Ẩ full load |  |  |  |
| 9.2. | Time of guide vane closure for above regulation |  |  |  |
| 10. | Speed drop |  |  |  |
| 10.1. | Momentary drop in speed on rapidly increasing load from zero to  ๏ Full load  ๏ % full load |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ 1Ẩ full load |  |  |  |
| 10.2. | Time of guide vane opening for |  |  |  |
|  | above regulation |  |  |  |
| 11. | Maximum water hammer over |  |  |  |
|  | pressure (pressure rise) when all the units at 110% over load simultaneously rejecting load |  |  |  |
| 12. | Time taken (in seconds) |  |  |  |
|  | ๏To reach normal speed from |  |  |  |
|  | zero speed at starting |  |  |  |
|  | ๏ To load the unit from zero to |  |  |  |
|  | full load  ๏ To reach runaway speed from normal speed in case of failure of governing system |  |  |  |
|  |  |  |  |
| 13. | Factor of Safety  i) Guaranteed minimum factor of safety under worst conditions based on minimum yield point of material. |  |  |  |
|  |  |  |  |
|  | ii) Name & location of part having |  |  |  |
|  | factor of safety in (i) above and |  |  |  |
|  | corresponding stress. |  |  |  |
| 14. | Weights |  |  |  |
| 14.1. | Weight of finished-machined runner complete | kg \_ |  |  |
| 14.2. | Weight of shaft | kg \_ |  |  |
| 14.3. | Weight and designation of heaviest part or assembly of the turbine as prepared for shipment | kg \_ |  |  |
| 14.4. | Heaviest turbine assembly to be handled by powerhouse crane during installation | kg \_ |  |  |
| 15. | Dimensions |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | 1 VALUE | REMARKS |
| 15.1. | Turbine shaft diameter | mm |  |  |
| 15.2. | Required entry opening in power house for largest turbine part |  |  |  |
|  | อ width | mm |  |  |
|  | ® height | mm |  |  |
| 16. | Maximum Guide vane torque |  |  |  |
|  | (i) Maximum value of torque in opening direction |  |  |  |
|  | (ii) Maximum value of the torque in closing direction |  |  |  |
| **2.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION |  | UNITS VALUE | REMARKS |
| 1. | Turbine water discharge quantities |  |  |  |
| 1.1. | อ Under rated output operation at maximum (125.65 m) and minimum net heads (125.15 m) | | m3/s |  |
| 1.2. | อ under maximum overload operation at maximum & minimum net heads | | m3/s |  |
| 1.3. | อ at maximum runaway condition |  | m3/s |  |
| 1.4. | อ at no-load at rated net head |  | m3/s |  |
| 2. | Hydraulic Flow velocities in Turbine: |  |  |  |
| 2.1. | At inlet to scroll casing |  |  |  |
| 2.2. | In runner: |  |  |  |
|  | i) Absolute at inlet |  |  |  |
|  | ii) Peripheral at inlet |  |  |  |
|  | iii) Relative at inlet |  |  |  |
|  | iv) Absolute at outlet |  |  |  |
|  |  |  |  |  |

1. Peripheral at outlet
2. Relative at outlet
   1. Draft tube:
3. Velocity of water at elbow end.
4. Velocity at water at exit.
5. Runner
   1. Discharge dia (D3) mm
   2. Inlet dia (D2) mm
   3. No. of blades Pcs.
   4. Method of construction
   5. Material, metallurgical composition &

surface hardness (BHN)

* 1. Weight kg.
  2. Source of runner casting
  3. Runner Labyrinth

1. Material, standard, composition & surface Hardness (BHN)
2. Method of fixing & removal on runner
   1. Material composition of runner cone
   2. Detail of hard-abrasion coatings on (if applicable)
3. Blades
4. Labyrinths 
   1. Whether all runner parts are accessible during re-coating
   2. Transport Dimensions (l x b x h)
   3. Method of supporting or positioning runner

on trailor for transport.

1. Scroll Casing
   1. Method of fabrication
   2. No. of segments/sections
   3. Inlet dia. (mm), flange dia. and thickness
   4. Material, standard & composition
   5. Plate thickness
   6. Nos. of joints to be welded at site and total joint length
   7. Quantity of electrodes for site welding, specifications & make
   8. No. of packages for transport
   9. Weight of spiral case when assembled
   10. Method of fixing of scroll casing to the turbine floor
   11. Volume of spiral case
2. Stay-Ring (Speed Ring)
   1. Nos. of segments/sections
   2. Type of fabrication
   3. Material, standard & composition
   4. Dimension

(Outer dia. x Inner dia. x Height)

* 1. Nos. of stay vanes
  2. No. & total length of joints to be welded at site.
  3. Electrodes for welding (Spec., composition, make & Quantity)
  4. No. of packages for transport
  5. Weight of stay ring assembly kg.
  6. Weight /load transferred on stay vane

1. Daft Tube Elbow & Cone
   1. Method of fabrication
   2. Nos. of segments/sections in DT elbow &

Cone

* 1. Material, standard & composition
  2. Discharge cone material (standard & composition)
  3. Electrodes for welding (specification,

composition, make & quantity)

* 1. Plate thickness used
  2. No. & total length of joints to be welded at site.
  3. No. of packages for transport
  4. Total weight of assembled elbow & cone
  5. Dimensions at runner exit
  6. Dimensions at draft Tube Cone exit
  7. Recommended height of draft tube cone

above tailrace floor

* 1. Length of draft tube cone
  2. Volume of draft tube

1. Generator Side Cover (Head Cover)
   1. Method of fabrication
   2. No. of sections/segments
   3. Material, standard & composition
   4. Dimensions

(outer dia x inner dia & depth)

* 1. No. of packages for transport
  2. Total assembled weight
  3. Means for sealing of leakage water from head cover

1. Suction Side Cover (Draft Tube Side Cover)
   1. Method of fabrication
   2. No. of sections/segments
   3. Material, standard & composition
   4. Dimensions

(outer dia x inner dia & depth)

* 1. No. of packages for transport
  2. Total assembled weight

1. Shaft & Coupling
   1. Diameter of shaft outer & bore, length,

flange dia, flange thickness, No. & dia of

flange bolts (in the above order).

* 1. Type of flange coupling with Generator

shaft.

* 1. Material, standard & method of

manufacture.

* 1. Procedure, method of matching & alignment of turbine shaft with generator

shaft.

* 1. Type of flange coupling with runner
  2. Procedure, method of matching &

alignment of turbine shaft with runner.

* 1. Material of shaft sleeve at bearing location

& method of fixing.

* 1. Material of shaft sleeve if any at shaft seal location & fixing method
  2. Material of renewable wearing rings
  3. Weight of shaft (kg.)
  4. Material of coupling bolts, nuts, washers at its end flange.
  5. Type of Bolts

1. Shaft seal (Gland Box)
   1. Type of gland and locations
   2. Material of gland seal
   3. Quantity of water required
   4. Quality of sealing water required
   5. Pressure at which sealing water is needed at inlet to seal
   6. Maximum leakage through shaft seal under maximum head
   7. Provision of instrumentation
   8. Means for wear indication & measurement
2. Guide vanes and Regulating Mechanism
   1. Method of fabrication
   2. No. of guide vanes, PCD x H x W of each
   3. Material of guide vanes, standard, composition and surface hardness (BHN)
   4. Hard abrasion resistance coating on guide vanes, material, standard & surface hardness (BHN), if applicable
   5. Method of application & surface thickness
   6. Method of erosion repair of hard coated guide vanes
   7. Sealing material on guide vanes sealing/mating surface details
   8. Sealing at end clearances, material of seal
   9. No. of stem gland, material of gland & locations
   10. Type & material of guide vane stem bushings
   11. Lubrication of guide vane stem bushings
   12. Means to prevent ingress of silt past stems
   13. Provision of breaking links / shear pin
   14. Materials of item at (m) standard, specification, composition, yield stress.
   15. Link bearing/bushes materials
3. G.V. Servo Motors 
   1. a) Nos. x bore dia.( m) x full stroke length

(mm)

* 1. b) Normal working pressure & range
  2. c) Rating or capacity (kg-m)
  3. d) Servomotors stroke in mm for rated turbine output at rated head
  4. e) Material of servomotor body, piston, piston rings
  5. f) Leakage of oil past piston rod gland, (litres per hour)

1. Details of Centralized Grease Lubrication

System (if provided)

* 1. a) Points served by system for turbine.
  2. b) Grease pumps

Nos. x type x capacity (lpm) pressure (kg/cm2) x speed x motor capacity (kW)

* 1. c) Make of pumps & motors
  2. d) Grease reservoir capacity
  3. e) Greasing cycle or frequency of lubrication
  4. f) No. of greasing points
  5. g) No. of grease distributor valves
  6. h) Grease-specification, grade, standard,

equivalent Indian standard/grade.

* 1. i) Grease consumption per cycle, per week, per month (kg.)
  2. j) Grease consumption per cycle, per week, per month (kg.)
  3. k) Rate of grease flow into turbine greasing points during application of grease (1 pm)

|  |  |
| --- | --- |
| 14. | Aeration Arrangement |
| 14.1. | a) Necessity of aeration at partial load. |
| 14.2. | b) Partial load below which aeration recommended/ desirable |
| 14.3. | c) Means for providing aeration |
| 14.4. | i) Natural |
| 14.5. | ii) Forced |
| 14.6. | d) Make, material & rating of automatic |

aeration valve

* 1. e) Location of valve at (d)

1. Unit Dewatering Connection
   1. a) Penstock gravity dewatering valve type x size x material x pressure rating x location.
   2. b) Scroll case dewatering valve type x size x material x pressure rating x location
   3. c) Sizes of piping for dewatering
   4. i) Penstock
   5. ii) Scroll casing
2. Weights
   1. Total weight of complete turbine delivery

tons

* 1. Heaviest pieces for erection

๏ spiral case tons

๏ speed ring

๏ draft tube tons

1. Dimensions
   1. Distance between turbine and generator mm

centre lines

* 1. Minimum distance between centrelines of

adjacent units mm

* 1. Outline dimensions of Turbine Assembly

with drawing

1. Instrumentation

(Following details for each type of instrument to be furnished)

* 1. Turbine discharge flow meter

อ Type

® Make

อ Range of flow measurement

อ Brief description (attach catalogue)

* 1. Details of sensors

อ Make & type

อ Principle of operation

อ Catalogue

* 1. Details of indicating instrument/ controller

อ Make & type

อ Analogue or digital or LED

อ Level switches for control

อ Aux. level switches for alarm

อ Output for data acquisition system

อ Input voltage

อ Special cables (as required)

อ Overall accuracy of system including sensor & indicator

* 1. Vibration monitor

อ Make

อ Type

อ location

* 1. Over speed device

อ Make

อ Type

อ location

**2.3 Information to be supplied together with the bid-**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

1. Compute pressure rise at turbine inlet under the most unfavourable conditions (load acceptance and rejection) as per the specification. Computation for pressure rise to be made for guide vane closing time of 6, 7, 8, 9 and 10 seconds. Parameters of water conductor system considered to be clearly indicated in the computations.
2. Compute turbine speed rise for guide vane closing times as above and for following load rejection parameters.

o from maximum output to zero

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| o | from | 100 | % | rated output to zero |
| o | from | 80 | % | rated output to zero |
| o | from | 60 | % | rated output to zero |
| o | from | 50 | % | rated output to zero |

1. Expected flow characteristics during closing and opening of wicket gates as function of time.
2. Expected performance curves giving efficiency, output, discharge, guide vane opening, critical

sigma, limits of operation for the net heads of 125.7 m, 126.01 m and 124 m. The curves shall also show the overload output at maximum possible wicket gates opening extending beyond the guarantee points.

1. Provide dimensional drawing (cross section) of turbine and associated equipment showing main dimensions.
2. Describe various special methods adopted to minimise silt erosion of underwater critical parts & also indicate with drawings/details methods offered for dismantling /replacement of critical components with relative time required for dismantling.
3. Describe proposed shaft seal systems, preferably illustrated by schematic diagram. Figures of the required quantities of sealing water and/or compressed air to be given.
4. Provide information on model or field performance tests performed on a turbine which is hydraulically similar to the proposed turbine. Indicate at least the following:

o Name of Projects

o place of model or field tests

o year of model or field tests

o designed rated turbine output

o rated net head

o rated speed

# **Governing System**

**3.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Type |  |  |  |
| 1.2. | Capacity |  |  |  |
| 1.3. | Manufacturer |  |  |  |
|  | ๏ control unit | - |  |  |
|  | ๏ hydraulic unit | - |  |  |
| 1.4. | Place of manufacture |  |  |  |
|  | ๏ control unit | - |  |  |
|  | ๏ hydraulic unit | - |  |  |
| 1.5. | Type designation |  |  |  |
|  | ๏ control unit | - |  |  |
|  | ๏ hydraulic unit | - |  |  |
| 1.6. | Applicable standards | - |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Sensitivity of governor to respond to |  |  |  |
|  | minimum speed change of rated speed | % \_ |  |  |
| 2.2. | Maximum dynamic pressure for total load rejection of all turbines working in parallel on maximum load at maximum |  |  |  |
|  | net head of 125.65 m | bar \_ |  |  |
| 2.3. | Maximum speed rise for total load rejection of all turbines under working conditions as per section 2.2 in |  |  |  |

percentage of rated speed %

|  |  |  |
| --- | --- | --- |
| 2.4. | Governor operating oil pressure | |
|  | ๏ minimum | bar |
|  | ๏ maximum | bar |
| 2.5. | Range of adjustment of gain control |  |
|  | ๏ proportional gain | - |
|  | ๏ derivative gain | s-1 |
|  | ๏ integral gain | s |
| 2.6. | Range of adjustment of permanent |  |
| speed droop |  |
| 2.7. | Range of adjustment of governor |  |
| opening and closing time |  |
| 2.8. | Speed dead band |  |
| 2.9. | Dead band range |  |
| 2.10. | Speed change adjustable range (no |  |
| load) |  |
| 2.11. | Power change adjustable range |  |
| 2.12. | Type of actuator |  |
| 2.13. | Compatibility with SCADA |  |
| 2.14. | Type of generator provided for |  |
| governor (PMG/SSG) |  |
| 2.15. | Provision of emergency control |  |
| 2.16. | Speed relays (for each type used) |  |
|  | ๏ Type & make |  |
|  | ๏ Adjustable range |  |
|  | ๏ Pickup / drop off ratio |  |
|  | ๏ Contact numbers, type & rating |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **3.2** | **Informative data** | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Arrangement of Oil Pressure Unit (whether common or separate for Turbine governor and inlet valve) |  |  |  |
| 2. | Governor oil pumps |  |  |  |
| 2.1. | Number of main oil pumps | - |  |  |
| 2.2. | Type of oil pumps | - |  |  |
| 2.3. | Unit governor oil pump discharge | l/min \_ |  |  |
| 2.4. | at pressure | bar \_ |  |  |
|  |  |  |
| 2.5. | Power rating of main pump motor | kW \_ |  |  |
| 2.6. | Power rating of jockey pump motor | kW \_ |  |  |
| 2.7. | Type of operation (continuous or |  |  |  |
| intermittent) |  |  |  |
| 3. | Pressurised accumulator tank |  |  |  |
| 3.1. | Material |  |  |  |
| 3.2. | No. of tanks per unit |  |  |  |
| 3.3. | Dimension (internal dia. x wall |  |  |  |
| thickness x height) |  |  |  |
| 3.4. | Total oil volume | l \_ |  |  |

๏ Normal volume of oil & air in each vessel

|  |  |  |
| --- | --- | --- |
|  | ๏ Grade and make of oil |  |
|  | ๏ Weight of each pressure vessel |  |
|  | (with/without oil) |  |
| 3.5. | Design pressure | bar |
| 3.6. | Min. working pressure for safe | bar |
| operation |  |

3.7. Minimum possible operating cycles

|  |
| --- |
|  |

|  |  |
| --- | --- |
| 3.8. | of wicket gates (close-open) without recharging tank -  Pressurising media (Compressed air  or Nitrogen) |
| 4. | Sump tank |
| 4.1. | Total oil volume l |
| 4.2. | Dimension of sump tank |
| 5. | Hydraulic oil |
| 5.1. | Total quantity of oil required for complete system including l  servomotors |
| 5.2. | Oil quality - |
| 6. | Weight of complete governor actuator  cabinet with pump set equipment  kg |
| 7. | Separate item-wise details of oil  system common to governor & main  inlet valve. |
| 8. | Whether specification of oil for governor and bearing oil same |
| 9. | Total volume of oil in oil sump, pressure accumulator, pipes etc. |
| 10. | Cubicle |
| 10.1. | Dimension (L x B x H) |
| 10.2. | Door arrangement |
| 10.3. | Foundation & fixing arrangement |
| 10.4. | Type of enclosure |
| 11. | Permanent magnet generator / speed |

signal generator

* 1. Type

|  |
| --- |
|  |
| ITEM DESIGNATION UNITS VALUE REMARKS |
| 11.2. Rated frequency |
| 11.3. Output characteristics |
| 11.4. No. of speed switches provided (details |
| to be furnished) |
| 12. Instrumentation |
| 12.1. Make |
| 12.2. Details of sensor |

๏ Make & type

๏ Principle of operation

๏ Catalogue

12.3. Details of indicating instruments /

controller

๏ Make & Type

๏ Analogue or digital or LED

๏ Level switches for control

๏ Aux. level switch for alarm

๏ Output for data acquisition system

๏ Input voltage

๏ Special cables (type, no. of cores,

size & screening)

๏ Overall accuracy of the system

including sensor & indicator

12.4 Information to be supplied together with the bid

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or special technical features of his offer by additional documents / descriptions

๏ Description of the governor, including schematic and block diagrams

๏ Drawing showing overall dimensions and general arrangement of equipment

๏ Description and technical data of the programmable, numerical type control unit

* Applicable method and type of speed sensing equipment
* Explanations of fail-safe provisions according to the specification
* Details on the operating time adjustment for wicket gate closing and opening as per technical specification.
* Calculation for Servo motor capacity, Governor oil pump, Pr. Accumulator, sump tank etc
* Description & method of operation (details, description and literature)

# **Main inlet valve with Accessories**

**4.1 Main Inlet Valve**

* + 1. Guaranteed Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Rated discharge | m3/s \_ |  |  |
| 2.2. | Max. discharge capacity | m3/s \_ |  |  |
| 2.3. | Head loss across the valve at rated discharge and head |  |  |  |
| 2.4. | Type of inlet valve |  |  |  |
| 2.5. | Maximum leakage from main inlet valve when fully closed against maximum static head of 130.85 m (with new seal) |  |  |  |
|  | ๏ through service seal | l/min \_ |  |  |
|  | ๏ through maintenance seal | l/min \_ |  |  |
|  | ๏ Maximum head loss through the valve at a flow required for rated turbine output at rated net head | m |  |  |
| 2.6. | Maximum torque required to close the valve with a flow corresponding to |  |  |  |
|  | ๏ rated turbine output at rated net head  ๏ specified turbine overload output at | Nm \_ |  |  |
|  | rated net head | Nm \_ |  |  |

๏ specified turbine overload output at

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | maximum net head of 126.01 m | Nm \_\_ |  |  |
|  | ๏ during balance opening / closing operation | Nm |  |  |
| 2.7. | Maximum unbalanced pressure against which valve is capable of closing & opening. |  |  |  |
|  |  |  |  |
| 2.8. | Main dimensions of main inlet valve |  |  |  |
|  | ๏ inside diameter | mm \_\_ |  |  |
|  | ๏ length of valve body (excluding extensions) | mm \_\_ |  |  |
|  | ๏ maximum distance from horizontal centreline of valve to lowest portion of assembly | mm \_\_ |  |  |
| 2.9. | Lowest factor of safety (referred to design stress) for any hydraulically loaded part of the valve | - |  |  |
| 2.10. | Valve operating oil pressure |  |  |  |
|  | ๏ minimum | bar \_\_ |  |  |
|  | ๏ maximum | bar \_\_ |  |  |
| 2.11. | Operating mechanism for opening of valve |  |  |  |
| 2.12. | Operating mechanism for closing of valve |  |  |  |
| 2.13. | Normal opening time of valve |  |  |  |
| 2.14. | Normal closing time of valve |  |  |  |
| 2.15. | Normal size of bypass valve |  |  |  |
| **4.1.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Head loss through the valve at max. |  |  |  |
|  | discharge capacity |  |  |  |
| 2. | Valve body |  |  |  |
|  | ๏ Material |  |  |  |
|  | ๏ Inside diameter | mm |  |  |

ITEM

DESIGNATION

UNITS

VALUE

REMARKS

® Height mm

อ Width mm

® Length mm

อ Wall thickness mm

อ Eccentricity of valve trunnions mm

อ Material of sealing seat

1. Valve disc

|  |  |  |
| --- | --- | --- |
| อ Type of construction | | |
|  | อ Material & conforming stand.  อ Trunnion bearing bushes  อ Material of trunnion bearing bushes  อ Dia. Of trunnion  อ Details of sealing gland arrangement  อ Type of bearings & details |  |
| 4. | Seal ( Both service & maintenance)  อ Material & conforming standard of seal seat fixed to valve body  อ Material & conforming standard of seal fixed to valve disc  อ Type & construction features of seal  อ Life of seals before replacement. |  |
| 5. | Bypass valve  อ Nos. |  |
|  | อ Size  อ Type & make | mm |

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| ๏ Means of operation | | |
| ๏ Design flow | | m3/s |
|  | ๏ Pressure rating |  |
|  | ๏ Hydrostatic test pressure | Kg/cm2 |
|  | ๏ Details & nos. of guard valve provided |  |
| 6. | Inlet / Outlet connecting pipes and dismantling joint |  |
| 6.1. | Inlet connecting pipe |  |
|  | ๏ Diameter & thickness |  |
|  | ๏ Material and conforming stand. |  |
|  | ๏ Overall length of pipe (with |  |
|  | trimmimg allowance) |  |
|  | ๏ Size of man hole provided |  |
| 6.2. | Outlet connecting pipe |  |
|  | ๏ Diameter & thickness |  |
|  | ๏ Material and conforming stand. |  |
|  | ๏ Overall length of pipe (with |  |
|  | trimming allowance) |  |
|  | ๏ Size of man hole provided |  |
| 6.3. | Dismantling joints |  |
|  | ๏ Type & details |  |
|  | ๏ Diameter |  |
|  | ๏ Overall length |  |
|  | ๏ Material and conforming stand. |  |
| 6.4. | Overall erected length of whole |  |

assembly (Inlet pipe + B.F. valve + Dismantling joint + Outlet pipe)

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| (excluding trimming allowance) | | |
| 7. | Servomotor |  |
| 7.1. | Make | - |
| 7.2. | Nominal design oil pressure | bar |
| 7.3. | Active volume | cm3 |
| 7.4. | Range of opening time | s |
| 7.5. | Range of closing time | s |
| 8. | Oil pressure unit (OPU)( If provided separately for MIV) |  |
| 8.1. | Number of main oil pumps | - |
| 8.2. | Type of oil pumps | - |
| 8.3. | Oil pump discharge capacity | l/min |
| 8.4. | at pressure | bar |
| 8.5. | Power rating of main pump motor | kW |
| 8.6. | Power rating of jockey pump motor | kW |
| 9. | Pressurised accumulator tank (If provided separately for MIV) |  |
| 9.1. | Total oil volume | l |
| 9.2. | Design pressure | bar |
| 9.3. | Minimum possible operating cycles of main inlet valve (close-open) without recharging tank | - |
| 10. | Sump tank (If provided separately for MIV) |  |
| 10.1. | Total oil volume | l |
| 11. | Hydraulic oil |  |
| 11.1. | Total quantity of oil required for complete system including servomotor | l |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 11.2. | Oil quality | - |  |  |
| 12. | Counter weight for closing operation |  |  |  |
|  | ๏ Nos. & weight of each counter | - |  |  |
|  | weight per valve |  |  |  |
|  | ๏ Material & conforming stand. | - |  |  |
|  | ๏ Lever arm length | - |  |  |
|  | ๏ Self-closing torque | - |  |  |
| 13. | Float , inundation switch/devices |  |  |  |
|  | ๏ Make & type | - |  |  |
|  | ๏ Nos. | - |  |  |
| 14. | Weights |  |  |  |
| 14.1. | Weight of complete main inlet valve | kg \_ |  |  |
| 14.2. | Weight of complete oil pressure unit | - |  |  |
| with pump set equipment | kg \_ |  |  |
| 14.3. | Estimated shipping weight of valve | kg \_ |  |  |
| 14.4. | Maximum weight of valve assembly to be handled by powerhouse crane | kg \_ |  |  |
| 15. | Dimensions |  |  |  |
| 15.1. | Minimum floor opening required for valve installation/removal |  |  |  |
|  | ๏ width | mm \_ |  |  |
|  | ๏ length | mm \_ |  |  |
| 15.2. | Largest package for shipment |  |  |  |
|  | ๏ Name |  |  |  |
|  | ๏ Weight | t \_ |  |  |
|  | ๏ Size ( L x B x H) | mm x \_ |  |  |
|  | mm x |  |  |
|  |  | mm |  |  |

**4.1.3 Information to be supplied together with the bid**

๏ Indicate type of construction for valve body and rotor

๏ Describe method of operation on closure of the valve

๏ Specify proposed type of by-pass valve

๏ Describe method of operation of the automatic air inlet and vacuum release valve

๏ Specify proposed type of service seal control valve

๏ Provide dimensional drawing with cross section showing the type of trunnion seal, bearing, general arrangement of major valve parts and main dimensions

๏ Provide schematic and block diagram of complete main inlet valve system

๏ Indicate expected maximum dynamic and static loads on foundation for the most unfavourable conditions (opening/closure)

๏ Provide information on field performance tests performed on a main inlet valve which is similar to the proposed valve. Indicate at least the following:

o Name of Project

o place of field test

o year of field test

o size of valve

o design pressure

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Generator with Excitation System and Auxiliaries** | | |
| 5.1 | Generator |  |  |
| **5.1.1** | **Guaranteed characteristics** |  |  |
| ITEM | DESIGNATION | UNITS | VALUE REMARKS |
| 1. | General |  |  |
| 1.1. | Manufacturer | - |  |
| 1.2. | Place of manufacture | - |  |
| 1.3. | Type designation | - |  |
| 1.4. | Applicable standards | - |  |
| 2. | Main data |  |  |
| 2.1. | Shaft Orientation | Horz./Ve rt |  |
| 2.2. | No. of phases | - |  |
| 2.3. | Guaranteed rated output under conditions of | . |  |
|  | ^ 0.85 power factor (lagging) at any | MVA \_\_ |  |
|  | voltage in the operating range. |  |  |
|  | ^ 0.85 power factor lagging | MVA \_\_ |  |
|  | continuous overload capacity at any voltage in the operating range. |  |  |
| 2.4. | Rated power factor | lagging \_\_ |  |
| 2.5. | Generator rated voltage | kV \_\_ |  |
| 2.6. | Guaranteed voltage range | % \_\_ |  |
| 2.7. | Generator losses at full load, rated voltage and power factor: |  |  |
|  | ^ constant losses | kW \_\_ |  |
|  | ^ load losses | kW \_\_ |  |
| 2.8. | Rated frequency and range | Hz \_\_ |  |
| 2.9. | Rated synchronous speed | rpm \_\_ |  |

|  |  |  |
| --- | --- | --- |
| 2.10. | Direction of rotation (viewed from DE) | ACW /  CW |
| 2.11. | Design runaway speed | rpm |
| 2.12. | Time duration for which generator is designed to run at runaway speed | s |
| 2.13. | Lowest factor of safety (referred to yield strength) for a generator rotating part at runaway speed | - |
| 2.14. | Maximum peripheral speed at runaway speed | m/s |
| 2.15. | Flywheel effect of the generator rotating parts, excluding turbine wheel:  si inertia constant (H) | kW |
|  | Sec/kVA |
|  | ^ Fly wheel effect (GD2) | tm2 |
| 3. | Efficiency |  |
| 3.1. | Generator efficiency at rated voltage, frequency and power factor |  |
|  | ^ at maximum output | % |
|  | ^ at 100 % continuous rated output (MVA) | % |
|  | ^ at 90 % continuous rated output (MVA) | % |
|  | ^ at 80 % continuous rated output (MVA) | % |
|  | ^ at 70 % continuous rated output (MVA) | % |
|  | ^ at 60 % continuous rated output (MVA) | % |
|  | ^ at 50 % continuous rated output (MVA) | % |
|  | ^ at 40 % continuous rated output (MVA) | % |
| 3.2. | Weighted average efficiency | % |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | corresponding to average generator total losses | kW \_ |  |  |

* 1. Inherent regulation i.e. increase in voltage at constant speed and excitation on taking off :-

Full load

80% full load

1. Temperatures
   1. Maximum temperature rise of

following components above inlet cooling air temperature (40°C) with the generator delivering maximum continuous output at rated frequency and power factor and 90% - 110% rated voltage:

*&* stator winding, measured by RTD K

^ field winding, measured by resistance K

^ Bearing by embedded temperature detectors / thermometer. K

^ Other parts by thermometer K

* 1. Maximum temperature rise of following components above cooling water temperature (30°C) with the generator delivering maximum continuous output at rated frequency and power factor and 90% - 110% rated voltage: :

^ Generator bearing pads & oil, measured by embedded K

temperature detector / thermometer

* 1. Temperature limit assigned by the Bidder to the generator parts:

^ stator winding insulation °C

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ^ field winding insulation | °C \_ |  |  |
| 4.4. | Insulation class and permissible temperature limit |  |  |  |
|  | ^ Stator winding | Class /°C \_\_ |  |  |
|  | ^ Field winding | Class /°C \_\_ |  |  |
| 5. | Electrical characteristics |  |  |  |
| 5.1. | Generator short-circuit ratio | p.u. \_\_ |  |  |
| 5.2. | Generator synchronous reactance:  Direct axis (Xd) |  |  |  |
|  | ^ saturated | p.u. \_\_ |  |  |
|  | ^ unsaturated | p.u. \_\_ |  |  |
|  | Quadrature axis (Xq) | p.u. \_\_ |  |  |
| 5.3. | Generator transient reactance:  Direct Axis (X'd) |  |  |  |
|  | ^ saturated | p.u. \_\_ |  |  |
|  | ^ unsaturated | p.u. \_\_ |  |  |
|  | Quadrature axis (X'q) | p.u. \_\_ |  |  |
|  | ^ quadrature axis-unsaturated (Xq’) | p.u. \_\_ |  |  |
| 5.4. | Generator sub-transient reactance: |  |  |  |
|  | Direct axis (X"d)  ^ saturated | p.u. \_\_ |  |  |
|  | ^ unsaturated | p.u. \_\_ |  |  |
|  | Quadrature axis (X"q) | p.u. \_\_ |  |  |
| 5.5. | Generator negative phase sequence |  |  |  |
|  | reactance-saturated, unsaturated X2) | p.u. \_\_ |  |  |
| 5.6. | Generator zero phase sequence |  |  |  |
|  | reactance (X0) | p.u. \_\_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 5.7. | Ratio of X"q to X"d | - |  |  |
|  |  |  |  |
| 5.8. | Telephone harmonic factor as specified in IEC-34 | % \_ |  |  |
| 6. | Excitation conditions |  |  |  |
| 6.1. | Maximum admissible continuous generator output when charging a transmission line under-excited without the generator becoming unstable or self-excited, at rated frequency and rated voltage | MVAr \_ |  |  |
| 6.2. | Ratings of field winding at nominal operating conditions of generator (corrected for 75°C winding temperature) |  |  |  |
|  | ^ field current | A \_ |  |  |
|  | ^ field voltage | V \_ |  |  |
| 6.3. | Maximum permissible continuous field current | A \_ |  |  |
| 7. | Weight |  |  |  |
| 7.1. | Weight of generator rotating parts including shafts | kg \_ |  |  |
| 7.2. | Weight of heaviest assembly or part of the generator to be lifted by the powerhouse crane | kg \_ |  |  |
| 7.3. | Weight and name of heaviest part or assembly of the generator, as required for shipment | kg \_ |  |  |
| 7.4. | Weight of complete generator |  |  |  |
| 8. | Dimensions |  |  |  |
| 8.1. | Minimum required crane hook clearance above erection bay floor elevation for unloading, loading of the generator components from trailer by means of the powerhouse crane | mm |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 8.2. | Minimum required crane hook clearance above service bay floor elevation, for erection, dismantling or maintenance of the generator by means of the powerhouse crane | mm \_ |  |  |
| 8.3. | Overall dimension of largest generator part or assembly, as required for shipment: |  |  |  |
|  | ^ Name |  |  |  |
|  | ^ length | mm \_ |  |  |
|  | ^ height | mm \_ |  |  |
|  | ^ width | mm \_ |  |  |
| 8.4. | Dimensions & name of heaviest package for transportation |  |  |  |
|  | ^ length | mm \_ |  |  |
|  | ^ height | mm \_ |  |  |
|  | ^ width | mm \_ |  |  |
| 9. | Segregated losses at nominal operating conditions |  |  |  |
| 9.1. | Constant losses |  |  |  |
|  | ^ core losses | kW \_ |  |  |
|  | ^ friction and windage loss | kW \_ |  |  |
| 9.2. | Load losses |  |  |  |
|  | ^ I2R losses in armature winding including additional losses (corrected for 75°C) at | kW \_ |  |  |
|  | ๏ Full load |  |  |  |
|  | ๏ 0.8 full load |  |  |  |
|  | ๏ 0.5 load |  |  |  |
|  | ^ I2R losses in field winding (corrected for 75°C) at | kW \_ |  |  |
|  | ๏ Full load |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ 0.8 full load |  |  |  |
|  | ๏ 0.5 full load |  |  |  |
|  | ^ excitation system at | kW \_ |  |  |
|  | ๏ full load |  |  |  |
|  | ๏ 0.8 full load |  |  |  |
|  | ๏ 0.5 full load |  |  |  |
| 9.3. | Stray load loss | kW \_ |  |  |
| 9.4. | Friction losses in bearings |  |  |  |
|  | ^ total losses caused by generator rotor, turbine runner and hydraulic thrust | kW \_ |  |  |
|  | ^ losses caused by generator rotor only | kW \_ |  |  |
| 9.5. | Total losses at | kW \_ |  |  |
|  | ๏ full load |  |  |  |
|  | ๏ 80% full load |  |  |  |
|  | ๏ 50% full load |  |  |  |
| **5.1.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Generator time constants |  |  |  |
| 1.1. | ^ direct axis, open circuit transient time constant (Tdo) | s \_ |  |  |
| 1.2. | ^ direct axis, short-circuit transient time constant (Ta) | s \_ |  |  |
| 1.3. | ^ quadrature axis transient short circuit time constant | s |  |  |
| 1.4. | ^ direct axis sub-transient time constant | s |  |  |
| 1.5. | ^ armature short-circuit time constant (Tn) | s \_ |  |  |
|  |  |  |  |  |

* 1. si Short-circuit time constant of s

damper windings with excitation

winding short circuited

1. Characteristic curves
   1. ^ no load saturation curve
   2. ^ full load saturation curve at zero

power factor leading

* 1. ^ full load saturation curve at zero

power factor lagging

* 1. ^ full load saturation on curve at unity

power factor

* 1. ^ full load saturation curve at 0.85

power factor lagging

* 1. ^ short circuit impedance
  2. ^ capability curves (power chart) for

rated output and overload at 0.85

power factor and + 10% rated terminal voltage

1. Maximum (I2/ In)2 value
2. Maximum (I2/ In)2 x t value
3. Generator Stator
   1. ^ material of stator core
   2. ^ number of sections in which stator

is divided for transportation

* 1. ^ grade thickness and insulation of

stator laminations

* 1. ^ insulation of winding

๏ slot portion

๏ overhang portion

* 1. ^ stator core

๏ length without/with air ducts

๏ inside diameter

๏ outside diameter

๏ total number of slots

๏ finished slot size

๏ net weight of active iron

๏ compression pressure of stator core

* 1. ^ outside diameter of stator frame
  2. ^ Details of stator foundation block
  3. ^ width of air gap at centre of pole

top

* 1. ^ flux density at rated voltage on no

load in

๏ air gap

๏ stator core

๏ teeth

๏ pole body

* 1. ^ no. of parallel paths per phase of

stator winding

* 1. ^ current density in stator winding
  2. ^ cross-sectional area of copper

winding, stator, each bar

* 1. ^ weight of copper in winding, stator
  2. ^ resistance of stator winding, per

phase at 250C

* 1. ^ calculated capacitance of stator

winding per phase

* 1. ^ details of transposition of stator

bars

* 1. ^ total weight

1. Generator Rotor
   1. ^ Material

๏ pole punching

๏ rim punching

๏ spider arms

๏ spider hub

๏ pole and plates

* 1. ^ type of rotor rim construction
  2. ^ construction of field poles
  3. ^ method of attaching field

poles to the rotor rim

* 1. ^ class of insulation of field winding
  2. ^ material and thickness of inter-turn

insulation

* 1. ^ width and height of pole body
  2. ^ weight of active iron in each field

pole

* 1. ^ maximum current density in rotor

winding

* 1. ^ cross-sectional area of copper in

field winding

* 1. ^ weight of copper in field winding

per pole

* 1. ^ damper winding

๏ number and diameter of damper

bars per pole

® whether connected between poles

* 1. ^ resistance of field winding at 25

deg. C

* 1. ^ factor of safety at maximum speed

based on yield strength of material

* 1. ^ material of collector rings
  2. ^ type of collector rings
  3. ^ number of brushes/collector rings
  4. ^ diameter of assembled rotor
  5. ^ total weight of rotor

1. Shaft
   1. ^ material and construction
   2. ^ diameter (nominal)
   3. ^ length
   4. ^ diameter of axial bore
   5. ^ diameter and length of coupling

flanges

* 1. ^ weight
  2. ^ factor of safety (based on the yield

strength of the material)

* 1. ^ computed critical speed of the shaft

system

® without considering unbalanced

magnetic force (pull)

® considering unbalanced magnetic force (pull)

* 1. ^ tolerance for shaft alignment

1. A.C Exciter
   1. Model
   2. Design Standard
   3. Frequency
   4. No. of Phases
   5. Rated Output of the exciter/exciter

rotor

๏ Voltage

๏ Current

* 1. Source of supply to the exciter stator
  2. Supply voltage to stator
  3. Arrangement for rectification of supply

voltage

* 1. Class of Insulation

๏ Armature

๏ Stator

* 1. Temperature Rise

๏ Armature

๏ Stator

* 1. weight

1. Excitation Transformer for exciter

(covered under Excitation system)

1. Rotating Diodes
   1. si No. of bridge rectifiers
   2. ^ Rectified voltage output
   3. ^ Protection device for the rectifier

diodes

1. Details of Bearings
   1. ^ No. of bearings at DE
   2. ^ No. of bearings at NDE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 11.3. | ^ Lubrication arrangement of each | Forced/ |  |  |
|  | bearing | Self |  |  |
| 11.4. | ^ If oil forced, type & rating of main pump motor |  |  |  |

*^* Type & rating of standby pump motor

* 1. ^ number of pads and size
  2. ^ effective bearing area
  3. ^ composition of pad babbit material
  4. ^ type, number and location of

๏ temperature detectors

๏ dial type thermometer

* 1. ^ cooling water requirement

๏ quantity

๏ pressure range

1. ^ Heat exchanger oil/water

๏ number

๏ material

๏ maximum safe working pressure

๏ pressure drop of water through the heat exchanger

๏ redundancy in heat exchanger

1. ^ normal working temperature of

bearings (pad)

1. ^ maximum permissible temperature

๏ alarm

๏ trip

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 11.13. | ^ total load on thrust bearing including hydraulic thrust |  |  |  |
|  | ๏ design load |  |  |  |
|  | ๏ actual during working conditions |  |  |  |
| 11.14. | ^ operation capability of DE & NDE bearing (in minutes) for following conditions of operation |  |  |  |
|  | ๏ at rated speed without cooling water supply |  |  |  |
|  | ๏ at runaway speed with cooling water supply |  |  |  |
|  | ๏ at runaway speed without cooling water supply |  |  |  |
|  | ๏ at low speed of 4-5 percent of rated load |  |  |  |
| 12. | Oil |  |  |  |
| 12.1. | ^ type and grade or specifications |  |  |  |
| 12.2. | ^ standard to which conform |  |  |  |
| 12.3. | ^ quantity of oil for first filing of |  |  |  |
|  | ๏ DE bearing oil reservoir |  |  |  |
|  | ๏ NDE bearing oil reservoir |  |  |  |
|  | ๏ equivalent brand name available in India |  |  |  |
| 13. | Generator brakes |  |  |  |
| 13.1. | ^ Type of brake | Hyd/ pneum |  |  |
| 13.2. | ^ number of brake units |  |  |  |
| 13.3. | ^ size of brake shoe |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
| 13.4. | ^ material of brake ring/shoe |  |  |  |
| 13.5. | ^ pressure required for operation |  |  |  |
| 13.6. | ^ speed at which brakes are applied |  |  |  |
|  | ® in case of normal operation |  |  |  |
|  | ® in case of emergency shutdown |  |  |  |

* 1. si time required for bringing the

machine to rest by applying mechanical brakes

® in normal shutdown

® in emergency shutdown

* 1. ^ time required for bringing the

machine to rest by applying brakes

® in normal shutdown

® in emergency shutdown

1. Generator air cooing
   1. ^ type and method of cooling
   2. ^ number and location of fans
   3. ^ number of air coolers/fans required

for maximum output of the generator

* 1. ^ temperature of air entering

generator for cooling

* 1. ^ Temperature of hot air leaving the

generator after cooling

1. Fire protection equipment
   1. ^ name of manufacturer
   2. ^ no. of temperature detectors

provided in each housing

* 1. ^ type of temperature detector
  2. si range and recommended setting for

sensing elements of temperature

detectors

* 1. ^ no. of CO2 cylinders
  2. ^ weight of each CO2 cylinder
  3. ^ volume of CO2 in each cylinder
  4. ^ amount of concentration of CO2 in

stator housing on initial discharge

* 1. ^ minimum concentration maintained
  2. ^ time of delayed discharge

1. Cooling Water System
   1. Arrangement of cooling water System

(Open /Closed Loop)

* 1. Source of cooling water
  2. Details of cooling water Pumps

๏ No. of cooling water pumps per

unit

๏ make

๏ type designation

๏ Applicable standard

๏ Rated Capacity of pumps m3/s

๏ Pressure

๏ Maximum head and discharge

capacity

๏ Minimum head and discharge

capacity

๏ Motor kW capacity, voltage &

frequency for each pump

* 1. Details of Strainers

๏ No. of strainers per unit

๏ Type of strainer (Duplex/simplex)

๏ Material of straining element

๏ Method of cleaning of straining element

๏ Rated capacity when unclogged

๏ Capacity under clogged condition

๏ Head loss in the strainer when unclogged

๏ Head loss in the strainer when clogged

๏ Whether annunciation provided for clogged condition

๏ Quality of filtration

๏ Whether arrangement provided for removal of pumps for maintenance

๏ Whether suction strainer provided for each pump

๏ Details of instrumentation

* 1. Details of Fine Filter

๏ Degree of filtration with fine strainer

๏ Degree of filtration required for shaft seal

๏ No. of fine filters for each unit

๏ Head loss through fine filter

๏ Details of instrumentation

* 1. Whether cooling water system caters to requirements of Turbine as well as generators
  2. Whether all piping, valves, fittings included in the scope of offer
  3. Whether cooling water schematic

drawing enclosed with the bid

1. Generator space heaters
   1. si number of units pcs
   2. ^ total rating of all units kW
2. LAVT Cubicle
   1. Potential Transformers

® Make

อ Type

* Rated Transformation ratio of PTs

o for protection kV/V

o for measuring kV/V

o for AVR kV/V

o for synchronizing kV/V

อ Accuracy class / rated burden

* for protection
* for measuring
* for AVR
* for synchronizing
  1. Surge Arrestors

อ Rated System Voltage (Ur) kV

อ Rated Arrestor voltage kV

อ Maximum continuous operating kV

voltage

๏ Nominal discharge current (8/20^s) A

|  |
| --- |
|  |
| ITEM DESIGNATION UNITS VALUE REMARKS |
| ๏ Power frequency withstand voltage kV |
| of housing |
| ๏ Lightning impulse withstand kVpeak |
| voltage of housing |
| ๏ Maximum residual voltage for 8/20 kVpeak |
| discharge |
| o at 0.5 times nominal discharge kVpeak |
| current |
| o at nominal discharge current kVpeak |
| o at twice the nominal discharge kVpeak |

current

๏ Steep front current impulse residual voltage with 1 front time current wave of 10 kA peak

๏ Residual voltage for switching current 1 kA (peak)

๏ Creepage distance mm

๏ Impulse spark over voltage (1.2/50 kVpeak ^s)

* Time of spark over
* rate of rise

1. Neutral Grounding Transformer

๏ Type (oil/dry)

๏ Rated Continuous power rating kVA

๏ Rated Voltages (no load)

o HV winding kV

o LV winding V

๏ Short time kVA rating for

o 5 minutes

o 1 minute

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | o 30 seconds |  |  |  |
|  | ® Whether suitable to receive 11 kV, 500 mm2 multi-run Al. conductor XLPE cable |  |  |  |
|  | ® Whether isolating switch provided |  |  |  |
|  | ® Short time rating of isolating switch |  |  |  |
| 20. | Grounding Resistor |  |  |  |
|  | ® Material |  |  |  |
|  | ® Resistance | Ohm |  |  |
|  | ® Rated Voltage | V |  |  |
|  | ® Continuous current rating | A |  |  |
|  | ® Short time current rating for 1 minute | A |  |  |
|  | ® Short time current rating for 30 seconds | A |  |  |
| 21. | Dimensions of Terminal Cubicles |  |  |  |
| 21.1. | Dimensions of complete 3 phase PT and surge protection cubicle |  |  |  |
|  | ® Length | mm |  |  |
|  | ® depth | mm |  |  |
|  | ® height | mm |  |  |
| 21.2. | Protection provided on primary and secondary side of PTs |  |  |  |
| 21.3. | Dimensions of Neutral grounding cubicle, |  |  |  |
|  | ® Length | mm |  |  |
|  | ® depth | mm |  |  |
|  | ® height | mm |  |  |

21.4. Arrangement of grounding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |

1. Whether generator erection/ assembly proposed to be carried out in service bay/at generator installation pad
2. Name & Transportation weight of

heaviest generator package

1. Weight of completely assembled

generator

tons

|  |  |  |
| --- | --- | --- |
| 25. | Weight of generator assembly to be lifted by PH crane | |
| 26. | Transportation weight of each stator /stator sector | tons |
| 27. | Transport dimension of each stator / stator sector | L x B x H |
| 28. | Heaviest package for transport | tons |
| 29. | Largest package for transport | L x B x H |
| 30. | . Whether following generator parts individually suitable for lifting by power house crane  ๏ generator stator assembly  ๏ generator rotor assembly |  |
| 31. | Whether lifting device /slings for lifting of following assemblies with power house crane included in offer  ๏ rotor  ๏ stator |  |
| 32. | Type of lifting device offered for lifting of:  ๏ rotor  ๏ stator |  |
| 33. | Whether drawing showing lifting arrangement and requirement of minimum crane hook clearances above |  |

ITEM DESIGNATION UNITS VALUE REMARKS

the unloading bay floor level and on u/s & d/s furnished for

๏ rotor lifting

๏ stator lifting

1. Whether drawing showing assembly / disassembly of generator enclosed with the bid
2. Any other information required.

35.2 Excitation and Automatic Voltage Regulator (AVR)

* + 1. Guaranteed Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 1.5. | Type of Excitation System | Brushless /Static |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Ratings of excitation system at rated generator output and power factor (hot rotor winding) |  |  |  |
|  | o field voltage | V \_ |  |  |
|  | o field current | A \_ |  |  |
|  | o field power | kW \_ |  |  |
| 2.2. | Ratings of excitation system at maximum generator output and power factor (hot rotor winding) |  |  |  |
|  | o field voltage | V \_ |  |  |
|  | o field current | A \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | o field power | kW \_ |  |  |
| 2.3. | Ceiling voltage in per units of rated field voltage |  |  |  |
|  | o ceiling voltage at no load | p.u. |  |  |
|  | o ceiling voltage at rated load | p.u. |  |  |
|  | o ceiling voltage at maximum load | p.u. |  |  |
| 2.4. | Field current at rated ceiling voltage | A |  |  |
| 2.5. | Excitation system voltage response ratio |  |  |  |
| 2.6. | Response time to reach 95 % of the difference |  |  |  |
|  | between rated ceiling voltage and full load field voltage | s |  |  |
| 2.7. | Time to reach +0.5 % of ceiling voltage from rated field voltage | s |  |  |
| 2.8. | Maximum time period for operation at ceiling |  |  |  |
|  | voltage without damage | s |  |  |
| 2.9. | Data of excitation system at 100% rated generator terminal voltage, power factor 0.85 and maximum generator power |  |  |  |
|  | o field voltage | V |  |  |
|  | o field current | A |  |  |
| 2.10. | Maximum continuous output capability of one 100 % excitation system |  |  |  |
|  | o maximum field current | A |  |  |
|  | o maximum field voltage | V |  |  |
| 2.11. | Maximum duration of over excitation period | s |  |  |
| 2.12. | Time to reach 5 % limit of generator terminal |  |  |  |
|  | voltage in case of load rejection | s |  |  |
| 2.13. | Maximum overshot of generator terminal voltage in case of load rejection | % |  |  |
| 2.14. | Settling time to reach 0.5 % limit of generator terminal voltage after over speed conditions | s |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2.15. | Range of voltage level setting | % . |  |  |
| 2.16. | Range for manual control of excitation | % |  |  |
| 3. | Excitation transformer (for AC Exciter) |  |  |  |
| 3.1. | Type of excitation transformer | Dry/oil filled |  |  |
| 3.2. | Transformer continuous three-phase power |  |  |  |
|  | rating on any tapping to meet excitation requirements for maximum generator/exciter output | kVA |  |  |
| 3.3. | Transformer no-load losses (three-phase) at rated voltage, principal tapping and rated | kW |  |  |
|  | frequency |  |  |  |
| 3.4. | Transformer total losses (75°C three-phase) at full load and on principal tapping | kW |  |  |
| 3.5. | No-load current at rated voltage and frequency, | % |  |  |
|  | and on principal tapping |  |  |  |
| 3.6. | Impedance voltage (75°C) at rated frequency, on 100 % rated kVA and: |  |  |  |
|  | o on principal tapping | % |  |  |
|  | o on extreme plus tapping | % |  |  |
|  | o on extreme minus tapping | % |  |  |
| 3.7. | Transformer temperature rise after continuous operation with rated kVA (suitable to meet excitation requirements for maximum generator/exciter output), under rated conditions and on tapping giving highest losses |  |  |  |
|  | o windings (by resistance) | °K |  |  |
| 3.8. | Transformer rated voltage at rated frequency and no-load |  |  |  |
|  | o high-voltage, principal tapping | kV |  |  |
|  | o high-voltage, extreme plus tapping | kV |  |  |

|  |  |  |
| --- | --- | --- |
|  | o high-voltage, extreme minus tapping | kV |
|  | o low voltage | kV |
| 3.9. | Type of cooling arrangement provided |  |
| 3.10. | Whether transformer cubicle enclosed |  |
| 3.11. | Enclosure protection provided for Excitation transformer |  |
| 4. | Voltage Regulating System |  |
| 4.1. | Voltage regulator, make | - |
| 4.2. | Voltage regulator, type | - |
| 4.3. | CT ratio and accuracy class of CT for AVR |  |
| 4.4. | Ratio and VA burden of PT for AVR |  |
| 4.5. | Approximate minimum time required from standstill to full load generation (automatic operation with sequential control) | Minutes |
|  |  |
| 4.6. | Break up of time required for starting, |  |
|  | synchronising and loading |  |
| 5. | Rectifiers (Rotating Diodes) |  |
| 5.1. | Type of thyristors/Diodes | - |
| 5.2. | Number of thyristors/diodes per interchangeable module | pcs |
| 5.3. | Number of modules per bridges or stacks | pcs |
| 5.4. | Number of bridges or stacks | pcs |
| 5.5. | Number of parallel paths | pcs |
| 5.6. | Redundancy available in bridges |  |
| 5.7. | Rated current of rectifier | A |
| 5.8. | Rated voltage of rectifier | V |
| 5.9. | Maximum safe operating temperature | °C |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 5.10. | Maximum surge current rating | A |  |  |
| 5.11. | Max. permissible duration of surge current | s |  |  |
| 6. | Field circuit breaker |  |  |  |
| 6.1. | Rated current | A |  |  |
| 6.2. | Rated voltage | V |  |  |
| 6.3. | Rated breaking current | kA |  |  |
| 6.4. | Total opening time | s |  |  |
| 6.5. | Total closing time | s |  |  |
| 6.6. | Operating sequence |  |  |  |
| 7. | AC - field flashing equipment for exciter |  |  |  |
| 7.1. | Duration of flashing | s |  |  |
| 7.2. | Power rating & voltage rating of field flashing transformer | kVA |  |  |
| 7.3. | Rated voltages of transformer |  |  |  |
|  | o primary side | V |  |  |
|  | o secondary side | V |  |  |
| 8. | DC - field flashing equipment for exciter |  |  |  |
| 8.1. | Power requirements, if such equipment is provided | kW |  |  |
| 8.2. | Supply voltage | V |  |  |
| 8.3. | Duration of flashing | s |  |  |
| 8.4. | Power requirements for DC field flashing |  |  |  |
| 9. | Control |  |  |  |
| 9.1. | No. of auto-channels |  |  |  |
| 9.2. | No. of manual channels |  |  |  |
| 9.3. | Whether changeover from Auto-I to Auto-II |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | automatic on failure of Auto I channel |  |  |  |
| 9.4. | Whether changeover from Auto-I to Auto-II or changeover from auto to manual channel is bumpless |  |  |  |
| **5.2.2** | **Informative Data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Overall dimensions of AVR cubicles |  |  |  |
|  | o length | mm \_ |  |  |
|  | o width | mm \_ |  |  |
|  | o height | mm \_ |  |  |
| 1.2. | Weight of cubicles with all equipment | kg \_ |  |  |
| 2. | Excitation transformer |  |  |  |
| 2.1. | Make of transformer |  |  |  |
| 2.2. | Type of transformer |  |  |  |
| 2.3. | Overall dimensions of complete transformer including housing |  |  |  |
|  | o length | mm \_ |  |  |
|  | o width | mm \_ |  |  |
|  | o height | mm \_ |  |  |
| 2.4. | Weight of complete transformer and housing | kg \_ |  |  |

**5.1.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or special technical features of his offer by additional documents / descriptions

๏ Description of proposed construction and procedure for erection at site for the generator stator and rotor with view to transport limitations

® Description of applicable stator winding insulation (material, insulation method etc.)

๏ Cross section through a slot with winding

๏ description of rotor pole fitting including type of rotor rim construction

๏ Description of proposed bearing insulation to prevent shaft currents

๏ Description of bearing seal system including measures to prevent discharge of oil from bearing

๏ Description and schematic diagram of the braking system

๏ Applicable method and type of vibration monitoring system

๏ Dimensional drawing of the generator with major dimensions

๏ Diagrams with electrical characteristics

o no load

o short circuit curve

o capability curves (power chart) for rated output at nominal power factor and 0.9 / 1.0 / 1.1 x nominal voltage

o load curves (V-curves)

o inverse current I2 = f (t)

๏ Calculated no-load harmonics in the voltage wave form

๏ Supporting documents for the guaranteed generator output and efficiencies (references)

๏ Description of proposed on line machine health monitoring system.

๏ Description and schematic diagram of the proposed excitation system including field flashing equipment

๏ Description of the voltage regulating system giving technical characteristics and all necessary information on automatic and manual control, change over from automatic to manual control and vice versa, as well as on the protective and limiting devices

๏ Describe method of equal load sharing between rectifier elements

๏ Describe method used to prevent damage due to reverse field current during pull-out conditions

๏ Information on field winding monitoring system

Describe method used to provide a signal to annunciate failure of rotating diodes/bridge

# **Generator Step-up Transformers and Station Auxiliary Transformers**

6.1 Generator Transformers

* + 1. **Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Main data |  |  |  |
| 2.1. | ~~R~~a~~t~~e~~d Output with ONAF coo~~l~~ing~~ | kVA |  |  |
| 2.2. | Rated Output with ONAN cooling | kVA |  |  |
| 2.3. | No. of phases |  |  |  |
| 2.4. | Three phase units or single phase |  |  |  |
|  | units |  |  |  |
| 2.5. | Installation (Indoor / outdoor) |  |  |  |
| 2.6. | Insulation class of windings | - |  |  |
| 2.7. | No. of windings | - |  |  |
| 2.8. | Type of cooling |  |  |  |
| 2.9. | ~~Rat~~e~~d continuous kVA of~~ e~~ach winding at a~~ll ~~tapping and with 50% forc~~e~~d air coo~~l~~ing syst~~e~~m (with on~~e ~~coo~~l~~ing unit out of s~~e~~rvic~~e) | kVA |  |  |
| 2.10. | Rated frequency | Hz |  |  |
| 2.11. | Rated voltages (no-load) |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ HV winding (at principal tapping) | kV |  |  |
|  | ๏ LV winding | kV |  |  |
| 2.12. | Voltage adjustment (on HV side) | % |  |  |
| 2.13. | Highest voltage of equipment Um for |  |  |  |
|  | ๏ HV winding | kV |  |  |
|  | ๏ LV winding | kV |  |  |
| 2.14. | Vector group | - |  |  |
| 2.15. | Per cent impedance voltages at rated power referred to 75°C winding temperature |  |  |  |
|  | ๏ at principal tapping | % |  |  |
|  | ๏ at tapping with highest voltage | % |  |  |
|  | ๏ at tapping with lowest voltage | % |  |  |
| 3. | Losses |  |  |  |
| 3.1. | No-load losses at rated voltage and |  |  |  |
|  | rated frequency | kW |  |  |
| 3.2. | Load losses at rated power, frequency and at principal tapping, |  |  |  |
|  | referred to 75°C winding temperature | kW |  |  |
| 3.3. | Auxiliary losses at rated power, frequency and at principal tapping, |  |  |  |
|  | referred to 75°C winding temperature | kW |  |  |
| 3.4. | Total losses (as per 3.1, 3.2 and 3.3) | kW |  |  |
| 4. | Temperatures |  |  |  |
| 4.1. | Maximum temperature rise at rated power, on tap producing highest losses |  |  |  |
|  | ๏ top oil (measured by thermometer) | K |  |  |
|  | ๏ windings (measured by resistance) | K |  |  |

|  |  |  |
| --- | --- | --- |
| ITEM | DESIGNATION | |
| 4.2. | Limit of hot spot temp. for which the transformer is designed. |  |
| 5. | Efficiency |  |
| 5.1. | Efficiencies at rated voltage and rated frequency at tap position with max. losses and unity P.F. |  |
|  | ๏ At full load | % |
|  | ๏ At 75% of full load | % |
|  | ๏ At 50% of full load | % |
|  | ๏ At 25% of full load | % |
| 5.2. | Efficiencies at rated voltage and rated frequency at tap position with max. losses and 0.85 p.f. lagging. |  |
|  | At full load | % |
|  | At 75% of full load | % |
|  | At 50% of full load | % |
|  | At 25% of full load | % |
| 5.3. | Load at which max. efficiency occurs |  |
| 5.4. | Maximum efficiency |  |
| 5.5. | Permissible short time and continuous overloading |  |
| 5.6. | External short-circuit withstand capacity (MVA) and duration (seconds) |  |
| 6. | Electrical characteristics |  |
| 6.1. | Short duration separate source power frequency withstand voltage |  |
|  | ๏ HV winding (design value) | kV |
|  | ๏ HV neutral | kV |
|  | ๏ LV winding | kV |

UNITS

rms

rms

rms

VALUE

REMARKS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 6.2. | Lightning impulse withstand voltage |  |  |  |
|  | อ HV winding |  |  |  |
|  | อ LV winding | kVpeak \_ |  |  |
| 6.3. | Induced AC withstand voltage |  |  |  |
|  | อ HV winding | kVrms \_ |  |  |
|  | อ LV winding | kVrms \_ |  |  |
| 6.4. | Maximum partial discharge | pC \_ |  |  |
|  | at voltage (HV side) | kVrms \_ |  |  |
| 6.5. | Rated flux density at rated voltage & frequency |  |  |  |
|  | อ Core |  |  |  |
|  | อ Yoke |  |  |  |
| 7. | Tap changer |  |  |  |
| 7.1. | Make | - |  |  |
| 7.2. | Type | On Load/off \_ |  |  |
|  | circuit type |  |  |
| 7.3. | Number of steps | - |  |  |
| 7.4. | Rated through current | A \_ |  |  |
| 7.5. | Rated step voltage | V \_ |  |  |
| 8. | Maximum sound pressure level (according to IEC 551) |  |  |  |
|  | อ at no-load | dB(A) \_ |  |  |
|  | อ at rated current | dB(A) \_ |  |  |
| 9. | Weights |  |  |  |
|  | อ weight of oil filling | kg \_ |  |  |
|  | อ transportation weight with | kg \_ |  |  |
|  | nitrogen filling |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ Total weight of 3 phase | kg |  |  |
|  | transformer |  |  |
| 10. | Dimensions of three phase transformer |  |  |  |
|  | ๏ overall length | mm |  |  |
|  | ๏ overall width | mm |  |  |
|  | ๏ overall height | mm |  |  |
| 11. | Electrical Losses |  |  |  |
| 11.1. | Calculated no-load losses at rated frequency and |  |  |  |
|  | ๏ at 95 % rated voltage | KW |  |  |
|  | ๏ at 105 % rated voltage | kW |  |  |
| 11.2. | Calculated load losses at rated power, frequency and |  |  |  |
|  | ๏ at highest tapping | kW |  |  |
|  | ๏ at lowest tapping | kW |  |  |
| 6.1.2 | Informative data |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Electrical characteristics |  |  |  |
| 1.1. | Nominal currents |  |  |  |
|  | ๏ HV principal tapping | A |  |  |
|  | ๏ HV highest tapping | A |  |  |
|  | ๏ HV lowest tapping | A |  |  |
|  | ๏ LV | A |  |  |
| 1.2. | Design current density at nominal rating |  |  |  |
|  | ๏ HV winding | A/mm2 |  |  |
|  | ๏ LV winding | A/mm2 |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1.3. | No-load current on HV side at rated |  |  |  |
|  | voltage and frequency | A |  |  |
| 1.4. | Inherent voltage regulation at rated power, principal tapping and |  |  |  |
|  | ๏ power factor 1.0 | % |  |  |
|  | ๏ power factor 0.85 | % |  |  |
|  | ® power factor 0.8 | % |  |  |
| 1.5. | Coupling capacitance between HV |  |  |  |
|  | and LV winding, per phase | nF |  |  |
| 1.6. | Zero sequence impedance Xo | ohm |  |  |
| 1.7. | Reactance | ohm |  |  |
| 2. | Constructional features |  |  |  |
| 2.1. | Type of core | - |  |  |
| 2.2. | Minimum vacuum withstand of the tank | Pa |  |  |
| 2.3. | Minimum overpressure withstand of the tank | bar |  |  |
| 3. | Transformer bushings |  |  |  |
| 3.1. | HV bushings |  |  |  |
|  | ® manufacturer | - |  |  |
|  | ® type | - |  |  |
|  | ® current rating | A |  |  |
|  | ® voltage rating | kV |  |  |
|  | ® cantilever strength | kN |  |  |
|  | ® creepage distance | mm |  |  |

๏ terminal details - material, ACSR conductor size

๏ Whether suitable for 3 core

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  bushing CT mounting | UNITS | VALUE | REMARKS |
| 3.2. | HV neutral bushing |  |  |  |
|  | ® manufacturer | - |  |  |
|  | อ type | - |  |  |
|  | ® current rating | A |  |  |
|  | อ voltage | kV |  |  |
|  | อ cantilever strength | kN |  |  |
|  | อ creepage distance in air | mm |  |  |
| 3.3. | LV bushings |  |  |  |
|  | อ manufacturer | - |  |  |
|  | อ type (kind) | - |  |  |
|  | อ current rating | A |  |  |
|  | อ voltage rating | kV |  |  |
|  | อ cantilever strength | kN |  |  |
|  | อ creepage distance in air | mm |  |  |
| 3.4. | Bushing CT’s details | - |  |  |
| 4. | Cooling system for three phase transformer |  |  |  |
| 4.1. | Natural / Radiator fans |  |  |  |
|  | อ manufacturer | - |  |  |
|  | อ type | - |  |  |
|  | อ number of coolers / fans in each cooling group and capacity of each cooling group  อ required no. of fans for 100% cooling  อ No. of fans provided  อ Whether spare fans shall be | pcs |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | available in each cooling group |  |  |  |
|  | ๏ Capacity of transformer when | kVA \_ |  |  |
|  | main fans in one cooling group have failed but spare fans are available |  |  |  |
|  | ๏ Capacity of transformer when all | kVA \_ |  |  |
|  | the fans including spare fans in one cooling group have failed |  |  |  |
|  | ๏ Capacity of transformer when all | kVA \_ |  |  |
|  | the fans in two cooling groups have failed |  |  |  |
| 5. | Insulating oil |  |  |  |
|  | ๏ supplier | - |  |  |
|  | ๏ type and trademark | - |  |  |
|  | ๏ Oil quantity |  |  |  |
|  | ๏ Oil quality |  |  |  |
|  | ๏ Inter surface tension at 27°C | N/m \_ |  |  |
|  | ๏ Flash point (min) | °C |  |  |
|  | ๏ Pour point (max.) | °C |  |  |
|  | ๏ Neutralisation value (total | Mg KOH/gm \_ |  |  |
|  | acidity) (max.) |  |  |  |
|  | ๏ Total sulphur (max.) | % \_ |  |  |
|  | ๏ Dielectric dissipation factor (tan |  |  |  |
|  | delta) at 90°C (Max.) |  |  |  |
| 6. | Dimensions |  |  |  |
| 6.1. | Rail gauges for |  |  |  |
|  | ๏ longitudinal movement | mm \_ |  |  |
|  | ๏ transversal movement | mm \_ |  |  |
| 7. | Whether provision for mounting of neutral CT made on three phase transformer |  |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

1. Whether high altitude correction

provided for (if applicable)

๏ Electrical clearance

๏ Test voltage

1. Crane lift above rail level required for m

un-tanking in service bay

1. Minimum clearance /height from rail m

track for handling the bushings

1. Type of conservator
2. Instrumentation
   1. Gas and oil operated relay (Make &

type)

* 1. Oil temperature indicators

๏ Make & type

๏ Permissible setting range for

alarm and trip

* 1. Winding temperature indicator

๏ Make & type

๏ Permissible setting range for

alarm and trip

๏ Whether winding temperature indicator for repeat indication included in scope

**6.2 Auxiliary transformers**

(Separate particulars shall be furnished for each of 500 kVA station Aux. Transformers, 100 kVA Intake Aux. Transformers and 25 kVA Surge Shaft Aux Transformer)

* + 1. **Guaranteed characteristics**

ITEM DESIGNATION UNITS VALUE REMARKS

1. General (applicable to aux.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | transformers) |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designations | - |  |  |
| 1.4. | Applicable standards |  |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Installation Indoor/outdoor |  |  |  |
| 2.2. | Number of phases | - |  |  |
| 2.3. | Number of windings | - |  |  |
| 2.4. | Transformer rated voltages at rated frequency and no-load |  |  |  |
|  | ^ high-voltage, principal tapping | kV |  |  |
|  | ^ high-voltage, extreme plus tapping | kV |  |  |
|  | ^ high-voltage extreme minus tapping | kV |  |  |
|  | ^ low voltage | kV |  |  |
| 2.5. | Number of taps on HV-winding | - |  |  |
| 2.6. | Rated frequency | Hz |  |  |
| 2.7. | Short duration separate source power frequency withstand voltage, 1 minute |  |  |  |
|  | ^ HV winding | kVrms |  |  |
|  | ^ LV winding | kVrms |  |  |
| 2.8. | Lightning impulse withstand voltage for HV winding | kVpeak |  |  |
| 2.9. | Power frequency withstand voltage for HV winding | kVrms |  |  |
|  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.10. | Transformer continuous three- phase power rating on principal | kVA |  |  |
|  | tapping |  |  |  |
| 2.11. | Transformer no-load losses (three- phase) at rated voltage, principal tapping and rated frequency | kW |  |  |
| 2.12. | Transformer load losses (75°C three-phase) at full load and on principal tapping | kW |  |  |
| 2.13. | Maximum temperature rise in winding at rated power, frequency and on tap producing highest losses (measured by resistance) | K |  |  |
| 2.14. | Temperature class of insulation | - |  |  |
|  |  |  |
| 2.15. | Percent impedance voltage at rated power, referred to 75°C and on principal tapping | % |  |  |
| 2.16. | Vector group | - |  |  |
| 2.17. | Type of cooling | - |  |  |
| 2.18. | Class of insulation |  |  |  |
|  | ^ HV winding | - |  |  |
|  | ^ LV winding | - |  |  |
| 2.19. | Maximum sound pressure level |  |  |  |

(according to IEC 551) dB(A)

|  |  |
| --- | --- |
| 6.2.2 | Informative Data |
| ITEM | DESIGNATION UNITS VALUE REMARKS |
| 1. | Other Particulars |
| 1.1. | Nominal currents at principal |
|  | tapping |
|  | ^ HV winding A |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ^ LV winding | A |  |  |
| 1.2. | No-load current at rated voltage and frequency | A |  |  |
| 1.3. | Protection class for transformer housing | - |  |  |
| 1.4. | Weight of complete transformer including housing | kg |  |  |
| 1.5. | Overall dimensions of  transformer housing (cubicle) |  |  |  |
|  | ^ length | mm |  |  |
|  | ^ width | mm |  |  |
|  | ^ height | mm |  |  |

**6.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer for Generator Transformers, Station Auxiliary Transformers, Intake Auxiliary Transformer and Surge Shaft Aux. transformer . The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Describe lap procedure for core lamination and lamination (magnetic losses) being used

๏ Give details of types of windings and their arrangement

๏ Description of radiator fan coolers including protective devices

๏ Provide dimensional drawing of transformers showing main dimensions and weights

๏ Details of rails

๏ List of references of comparable transformers already supplied and installed, comprising of at least:

๏ power rating

๏ rated voltages

๏ year of delivery

๏ name of station (client) and country

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **11 kV Switchgear** |  |  |  |
| **7.1** | **Guaranteed characteristics** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards |  |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Installation - Indoor / outdoor |  |  |  |
| 2.2. | Rated voltage | kV \_ |  |  |
| 2.3. | Highest voltage for equipment Um | kV \_ |  |  |
| 2.4. | Rated frequency | Hz \_ |  |  |
| 2.5. | Rated short duration power frequency withstand voltage, 1 min. | kVrms \_ |  |  |
| 2.6. | Rated lightning impulse withstand voltage |  |  |  |
|  |  |  |  |
| 2.7. | Correction factor for high altitude |  |  |  |
| 2.8. | Corrected short duration power | kVrms \_ |  |  |
|  | frequency withstand voltage |  |  |  |
| 2.9. | Corrected lightning impulse withstand voltage | kVpeak |  |  |
| 3. | Switchgear cubicles |  |  |  |
| 3.1. | Insulation medium | - |  |  |
| 3.2. | Rated current of bus bar | A \_ |  |  |
| 3.3. | Rated short time withstand current, 1 s | kArms \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 3.4. | Short time dynamic withstand current | kApeak \_ |  |  |
| 3.5. | Power frequency withstand voltage | kVrms \_ |  |  |
| 3.6. | Lightning impulse withstand voltage (1.2/50 is) | kVpeak |  |  |
| 3.7. | Conductor material | - |  |  |
| 3.8. | Material of enclosures | - |  |  |
| 3.9. | Protection class | - |  |  |
| 3.10. | Max. temperature rise at rated continuous current |  |  |  |
|  | - Conductor | K \_ |  |  |
|  | - Enclosure | K \_ |  |  |
| 4. | 11 kV Circuit breakers |  |  |  |
| 4.1. | Make | - |  |  |
| 4.2. | Type | - |  |  |
| 4.3. | Number of breakers | nos. \_ |  |  |
| 4.4. | Arc quenching medium | - |  |  |
| 4.5. | Rated Voltage | kV |  |  |
| 4.6. | Rated current | A \_ |  |  |
| 4.7. | Rated short-circuit breaking current |  |  |  |
|  | (symmetrical) | kArms \_ |  |  |
| 4.8. | Rated short-circuit making current | kA \_ |  |  |
| 4.9. | Rated operating sequence | - |  |  |
| 4.10. | Operating mechanism |  |  |  |
|  | ๏ for closing | - |  |  |
|  | ๏ for opening | - |  |  |
| 5. | Current transformers |  |  |  |
| 5.1. | Make | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  5.2. | DESIGNATION  Type | UNITS - | VALUE | REMARKS |
| 5.3. | Number of CT's | nos. \_ |  |  |
| 5.4. | Primary current ratings | A \_ |  |  |
| 5.5. | Rated secondary current | A \_ |  |  |
| 5.6. | Short time thermal current, 1 s | kArms \_ |  |  |
| 5.7. | Rated dynamic current | kApeak \_ |  |  |
| 5.8. | Number of secondary cores | - |  |  |
| 5.9. | Metering core  ๏ rated burden | VA \_ |  |  |
|  | ๏ accuracy class | - |  |  |
| 5.10. | Protection core  ๏ rated burden | VA \_ |  |  |
|  | ๏ accuracy class | - |  |  |
| 6.  6.1. | Voltage transformers  Make | - |  |  |
| 6.2. | Type | - |  |  |
| 6.3. | Number of VT's | nos. \_ |  |  |
| 6.4. | Rated primary voltage | kV \_ |  |  |
| 6.5. | Rated secondary voltage | V \_ |  |  |
| 6.6. | Number of secondary winding | - |  |  |
| 6.7. | Rated burden | VA \_ |  |  |
| 6.8. | Accuracy class | - |  |  |
| 7.  7.1. | Surge Arresters  Make |  |  |  |
| 7.2. | Type |  |  |  |
| 7.3. | Applicable Standard |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  7.4. | DESIGNATION  Rated Voltage (Un) | UNITS | VALUE | REMARKS |
| 7.5. | Maximum continuous operating |  |  |  |
|  | Voltage (MCOV) |  |  |  |
| 7.6. | Nominal discharge current (8/20 ^sec) |  |  |  |
| 7.7. | Pressure relief rated current |  |  |  |
| 7.8. | High Current short duration test valve |  |  |  |
| 7.9. | Minimum thermal capability |  |  |  |
| 7.10. | Residual voltage with wave form 8/20 |  |  |  |
|  | ^ sec at discharge current |  |  |  |
|  | 5kA |  |  |  |
|  | 10kA |  |  |  |
|  | 20 kA |  |  |  |
| 7.11. | Line discharge class |  |  |  |
| **7.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Circuit breaker |  |  |  |
| 1.1. | Spring charging motor |  |  |  |
|  | ๏ rated voltage | V \_ |  |  |
|  | ๏ rated power | W \_ |  |  |
| 1.2. | Making coil |  |  |  |
|  | ๏ number of coils | - |  |  |
|  | ๏ rated voltage | V \_ |  |  |
|  | ๏ rated power | W \_ |  |  |
| 1.3. | Trip coil |  |  |  |
|  | ๏ number of coils | - |  |  |
|  | ๏ rated voltage | V \_ |  |  |
|  | ๏ rated power | W \_ |  |  |
| 1.4. | Weight of with-drawable breaker unit | kg \_ |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE |
| 2. | Protection relays |  |  |
| 2.1. | Make | - |  |
| 2.2. | Type | - |  |
| 2.3. | Designation of relay | - |  |
| 3. | Cubicles |  |  |
| 3.1. | Heat losses per feeder at rated power | kW \_ |  |
| 3.2. | Weight per feeder (ready for operation) | kg \_ |  |
| 3.3. | Dimension per feeder cubicle |  |  |
|  | ® length | mm \_ |  |
|  | อ depth | mm \_ |  |
|  | ® height | mm \_ |  |
| 4. | Auxiliary Relays  ^ Make  ^ Type  ^ Rated current / voltage and permissible variation |  |  |
|  | ^ Rated burden | ^ \_ |  |
|  | ^ No. and type of contacts (whether  ‘NO’ or ‘NC’) | ^ \_ |  |
|  | ^ Rating of contacts | ^ \_ |  |
|  | ^ Total operating time of relays | ^ \_ |  |
|  | ^ One minute power frequency withstand voltage | ^ \_ |  |
|  | ^ Detailed literature furnished with reference | ^ \_ |  |
|  | ^ Details of testing facilities provided | ^ \_ |  |
| 5. | Indicating Lamp |  |  |

REMARKS

ITEM DESIGNATION UNITS VALUE REMARKS

*&* Make

* Type
* Rated voltage
* Rated power consumption (watts)
* Series resistor provided

1. Indicating meters

* Make
* Type of Movement
* Size (square mm)
* Scale size in degree
* Accuracy
* Range offered in line with specification
* VA burden
* Applicable standard

1. Energy meters

* Make
* Type
* Range
* Detailed literature furnished
* Standard to which it conform to
* Rated current
* Rated Voltage and frequency
* Drawout / non drawout
* Class of accuracy

ITEM DESIGNATION UNITS VALUE REMARKS

* Rated VA burden

1. Current coil VA
2. Voltage coil VA

^ Test plug / test blocks / testing terminal with links

1. Miniature Circuit breaker

^ Make

* Rated voltage

^ Rated current

* Rupturing capacity

^ Setting for short circuit

^ Setting range for over load

^ Operating time

^ No. of auxiliaries contacts

^ Rating for auxiliary contacts

^ Operating characteristics furnished

1. Control Wiring

^ Make

^ Type

^ Material and size conductor

1. For CT circuit
2. For other circuit

^ Solid / standard conductor

^ Tinned / untinned

^ Material of insulation and sheath

^ Voltage grade of control wiring

^ Colour coding of wires

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| a) For AC metering circuit |
|  | b) For DC control circuit |  |  |  |
|  | c) AC auxiliary power circuit like panel space heater |  |  |  |
|  | d) Earthing |  |  |  |
|  | e) Numbered ferrules at both ends |  |  |  |
|  | f) Insulator sleeves provided at both ends |  |  |  |
|  | g) Terminals |  |  |  |
|  | h) Make |  |  |  |
|  | i) Current rating |  |  |  |
|  | j) Clamp type or bolt type |  |  |  |
|  | k) Maximum conductor size and no. of conductor which it can receive |  |  |  |
|  | l) Disconnecting type of CT circuit |  |  |  |
|  | m) Terminal marking facility provided |  |  |  |
|  | n) Crimp type connectors provided at the terminals |  |  |  |
|  | o) Spare terminals |  |  |  |
| 10. | Conditions of transport |  |  |  |
| 10.1 | Heaviest part for transportation |  |  |  |
|  | - Weight | kg. \_ |  |  |
|  | - Dimension (LxWxH) | m x m x \_ m |  |  |
| 10.2 | Largest part for transportation |  |  |  |
|  | - Weight | kg \_ |  |  |
|  | - Dimension (LxWxH) | m x m x \_ m |  |  |

**7.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Pamphlets of the proposed 11 kV switchgear equipment with detailed description of

* segregation of various compartments
* circuit breaker handling
* grounding devices
* interlocking features
* description of the control and measuring equipment as provided
* Dimensional Details

# **Supervisory Control and Data Acquisition System**

**8.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Central control system |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Type | - |  |  |
| 1.3. | Applicable standards | - |  |  |
| 1.4. | System structure | - |  |  |
| 1.5. | Number of system levels | nos. \_\_ |  |  |
| 1.6. | Number of communication levels | nos. \_\_ |  |  |
| 1.7. | Configuration of field levels | - |  |  |
| 1.8. | Minimum/maximum system components | nos. \_\_ |  |  |
| 1.9. | Hardware - details | - |  |  |
| 1.10. | Communication details | - |  |  |
| 1.11. | Details of equipment / instruments to be supplied with number, size, weight, etc. |  |  |  |
| 2. | Unit control boards |  |  |  |
| 2.1. | อ Size (l x w x h) | mm \_\_ |  |  |
| 2.2. | ® Weight | kg \_\_ |  |  |
| 2.3. | Temperature Monitoring Unit  อ Manufacturer |  |  |  |
|  | อ Type | - |  |  |
|  | อ Power Supply | V DC \_\_ |  |  |
|  | อ Power Consumption | W \_\_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ Accuracy | Class \_ |  |  |
|  | ๏ Number of Inputs |  |  |  |
|  | ๏ Other Technical details |  |  |  |
| 2.4. | Automatic Synchronizer |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | ๏ Power Consumption | W \_ |  |  |
|  | ๏ Other Technical details |  |  |  |
| 2.5. | Transducers for Electrical Measurements |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | ๏ Power Consumption | W \_ |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 2.6. | Analogue Instruments |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Scale Length |  |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 2.7. | Process Control Computer / processor |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Power Supply Voltage | V DC \_ |  |  |
|  | ๏ Power Consumption | VA \_ |  |  |

|  |  |  |
| --- | --- | --- |
| อ | Ambient Temperature Range | oC |
| อ | Meantime Between faults(MTBF) |  |
| อ | System Configuration |  |
| อ | Redundancy in processor units |  |
| 2.8. Interface System | |  |
| อ | Digital Inputs |  |
| o | Type |  |
| o | Inputs per Module |  |
| o | Number of Modules |  |
| o | Input Signal |  |
| 2.9. อ | Digital Outputs |  |
| o | Type |  |
| o | Number of Modules |  |
| o | Outputs per Module |  |
| o | Contract Capability |  |
| o | Voltage |  |
| o | Max. Load | VA |
| 2.10. อ | Analogue Inputs |  |
| o | Type |  |
| o | Number of Modules |  |
| o | Inputs per Modules |  |
| 2.11. อ | Analogue Outputs |  |
| o | Type | DC |
| o | Number of Modules | mA |
| o | Outputs per Module | VA |

ITEM DESIGNATION

UNITS

VALUE

REMARKS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.12. | ๏ Other technical Details |  |  |  |
| 2.13. | ๏ Power Supply (DC/DC Converters) |  |  |  |
|  | o Manufacturer | - |  |  |
|  | o Type | - |  |  |
|  | o Rated Power Input/Output | W \_ |  |  |
|  | o Rated Voltage Input/Output | V DC \_ |  |  |
| 2.14. | ๏ Remote Terminal Unit |  |  |  |
|  | o Manufacturer | - |  |  |
|  | o Type | - |  |  |
|  | o Ambient Temperature Range | oC \_ |  |  |
|  | o Power Supply | V DC \_ |  |  |
|  | o Power Consumption | W \_ |  |  |
| 2.15. | RTU Interface modules |  |  |  |
| 2.16. | No. of Turbine signals |  |  |  |
| 2.17. | No. of Generator signals (DIs/Dos/AIs/AOs) |  |  |  |
| 2.18. | No. of Transformer signals (DIs/Dos/AIs/AOs) |  |  |  |
| 2.19. | No. of Inlet valve signals (DIs/Dos/AIs/AOs) |  |  |  |
| 2.20. | No. of condition monitoring of machines signals (DIs/Dos/AIs/AOs) |  |  |  |
| 2.21. | No. of unit aux. switchgear signals (DIs/Dos/AIs/AOs) |  |  |  |
| 2.22. | No. of protection signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3. | Common Station Auxiliary Board |  |  |  |
| 3.1. | Size (l x w x h) | mm \_ |  |  |
| 3.2. | Weight | kg \_ |  |  |

3.3. Transducers for Electrical Measurements

๏ Manufacturer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ Type | - |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | อ Power Consumption | W \_ |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 3.4. | Analogue Instruments  ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Scale Length |  |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 3.5. | Process Control Computer / processor |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type |  |  |  |
|  | ๏ Power Supply Voltage | V DC \_ |  |  |
|  | ๏ Power Consumption | VA \_ |  |  |
|  | ๏ Ambient Temperature Range | oC \_ |  |  |
|  | ๏ Meantime Between faults(MTBF) |  |  |  |
|  | ๏ System Configuration |  |  |  |
|  | ๏ Redundancy in processor units |  |  |  |
| 3.6. | Interface System  ๏ Digital Inputs |  |  |  |
|  | o Type |  |  |  |
|  | o Inputs per Module |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Input Signal |  |  |  |
| 3.7. | ๏ Digital Outputs |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | o Type |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Outputs per Module |  |  |  |
|  | o Contract Capability |  |  |  |
|  | o Voltage |  |  |  |
|  | o Max. Load | V DC \_ |  |  |
| 3.8. | ๏ Analogue Inputs |  |  |  |
|  | o Type |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Inputs per Modules |  |  |  |
| 3.9. | ๏ Analogue Outputs |  |  |  |
|  | o Type | DC \_ |  |  |
|  | o Number of Modules | mA \_ |  |  |
|  | o Outputs per Module | VA \_ |  |  |
|  | o Other technical Details |  |  |  |
| 3.10. | Power Supply (DC/DC Converters) |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Rated Power Input/Output | W \_ |  |  |
|  | ๏ Rated Voltage Input/Output | V DC \_ |  |  |
| 3.11. | Remote Terminal Unit |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Ambient Temperature Range | oC \_ |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ Power Consumption | W \_ |  |  |
| 3.12. | RTU Interface modules |  |  |  |
| 3.13. | No. of 415 V Station service switchgear signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3.14. | No. of DC switchgear signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3.15. | No. of Fire protection signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3.16. | No. of 11 kV switchgear signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3.17. | No. drainage pump signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3.18. | No. Compressor signals (DIs/Dos/AIs/AOs) |  |  |  |
| 3.19. | No. DG set signals (DIs/Dos/AIs/AOs) |  |  |  |
| 4. | 33 kV switchgear board |  |  |  |
| 4.1. | Size (l x w x h) | mm \_ |  |  |
| 4.2. | Weight | kg \_ |  |  |
| 4.3. | Transducers for Electrical Measurements  ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | ๏ Power Consumption | W \_ |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 4.4. | Analogue Instruments  ๏ Manufacturer |  |  |  |
|  | ๏ Type  ๏ Scale Length | - |  |  |
|  | ๏ Accuracy | Class \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 4.5. | Process Control Computer / processor |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type |  |  |  |
|  | ๏ Power Supply Voltage | V DC \_ |  |  |
|  | ๏ Power Consumption | VA \_ |  |  |
|  | ๏ Ambient Temperature Range | oC \_ |  |  |
|  | ๏ Meantime Between faults(MTBF) |  |  |  |
|  | ๏ System Configuration |  |  |  |
|  | ๏ Redundancy in processor units |  |  |  |
| 4.6. | Interface System |  |  |  |
|  | ๏ Digital Inputs |  |  |  |
|  | o Type |  |  |  |
|  | o Inputs per Module |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Input Signal |  |  |  |
|  | ๏ Digital Outputs |  |  |  |
|  | o Type |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Outputs per Module |  |  |  |
|  | o Contract Capability |  |  |  |
|  | o Voltage |  |  |  |
|  | o Max. Load | V DC \_ |  |  |

๏ Analogue Inputs

o Type

o Number of Modules

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | o Inputs per Modules  ๏ Analogue Outputs |  |  |  |
|  | o Type | DC \_ |  |  |
|  | o Number of Modules | mA \_ |  |  |
|  | o Outputs per Module  o Other technical Details | VA \_ |  |  |
| 4.7. | Power Supply (DC/DC Converters) |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Rated Power Input /Output | W \_ |  |  |
|  | ๏ Rated Voltage Input / Output | V DC \_ |  |  |
| 4.8. | Remote Terminal Unit |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Ambient Temperature Range | oC \_ |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | ๏ Power Consumption | W \_ |  |  |
| 4.9. | RTU Interface modules |  |  |  |
| 4.10. | Generator Transformer feeder I signals (DIs/Dos/AIs/AOs) |  |  |  |
| 4.11. | Generator Transformer feeder II signals (DIs/Dos/AIs/AOs) |  |  |  |
| 4.12. | 33 kV transmission Line feeder I signals (DIs/Dos/AIs/AOs) |  |  |  |
| 5. | Intake Control Board |  |  |  |
| 5.1. | Size (l x w x h) | mm \_ |  |  |
| 5.2. | Weight | kg \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 5.3. | Transducers for Electrical Measurements |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | อ Power Consumption | W \_ |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 5.4. | Analogue Instruments |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Scale Length |  |  |  |
|  | ๏ Accuracy | Class \_ |  |  |
| 5.5. | Process Control Computer / processor |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type |  |  |  |
|  | ๏ Power Supply Voltage | V DC \_ |  |  |
|  | ๏ Power Consumption | VA \_ |  |  |
|  | ๏ Ambient Temperature Range | 0C \_ |  |  |
|  | ๏ Meantime Between faults(MTBF) |  |  |  |
|  | ๏ System Configuration |  |  |  |
|  | ๏ Redundancy in processor units |  |  |  |
| 5.6. | Interface System |  |  |  |
|  | ๏ Digital Inputs |  |  |  |
|  | o Type |  |  |  |
|  | o Inputs per Module |  |  |  |
|  | o Number of Modules |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | o Input Signal |  |  |  |
|  | ๏ Digital Outputs |  |  |  |
|  | o Type |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Outputs per Module |  |  |  |
|  | o Contract Capability |  |  |  |
|  | o Voltage |  |  |  |
|  | o Max. Load | V DC \_ |  |  |
|  | ๏ Analogue Inputs |  |  |  |
|  | o Type |  |  |  |
|  | o Number of Modules |  |  |  |
|  | o Inputs per Modules |  |  |  |
|  | ๏ Analogue Outputs |  |  |  |
|  | o Type | DC \_ |  |  |
|  | o Number of Modules | mA \_ |  |  |
|  | o Outputs per Module | VA \_ |  |  |
|  | o Other technical Details |  |  |  |
| 5.7. | Power Supply (DC/DC Converters) |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |
|  | ๏ Rated Power Input /Output | W \_ |  |  |
|  | ๏ Rated Voltage Input / Output | V DC \_ |  |  |
| 5.8. | Remote Terminal Unit |  |  |  |
|  | ๏ Manufacturer | - |  |  |
|  | ๏ Type | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ Ambient Temperature Range | oC |  |  |
|  | ๏ Power Supply | V DC \_ |  |  |
|  | ® Power Consumption | W \_ |  |  |
| 5.9. | RTU Interface modules |  |  |  |
| 5.10. | Intake Gate control and monitoring signals |  |  |  |
|  | (DIs/Dos/AIs/AOs) |  |  |  |
| 5.11. | Spillway Gate control and monitoring signals |  |  |  |
|  | (DIs/Dos/AIs/AOs) |  |  |  |
| 5.12. | Surge shaft Gate control and monitoring |  |  |  |
|  | signals (DIs/Dos/AIs/AOs) |  |  |  |
| 6. | Station Control Centre |  |  |  |
| 6.1. | Operator Control Stations |  |  |  |
|  | ® MMC Interface |  |  |  |
|  | o Manufacturer |  |  |  |
|  | o Type |  |  |  |
|  | o Cubicle Size( H x W x D) | mm \_ |  |  |
|  | o Power Supply Voltage | V AC \_ |  |  |
|  | o Power Consumption | VA \_ |  |  |
|  | o Ambient Temperature range | oC \_ |  |  |
|  | o Meantime between faults (MTBF) | Months \_ |  |  |
|  | ® CPU Unit |  |  |  |
|  | o Number |  |  |  |
|  | o Type |  |  |  |
|  | o Configuration |  |  |  |
|  | o Displays |  |  |  |

๏ Max. Number of process displays

๏ Average display exchange time

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ® Updating time of dynamical values |  |  |  |
|  | ® Memory Module |  |  |  |
|  | o Type |  |  |  |
|  | o Capacity |  |  |  |
| 6.2. | Printer (details to be furnished for all type of |  |  |  |
|  | printers) |  |  |  |
|  | ® Manufacturer |  |  |  |
|  | ® Print technology |  |  |  |
|  | ® Resolution | Pixels |  |  |
|  | ® Print speed |  |  |  |
|  | o Black - ppm |  |  |  |
|  | o Colour - ppm |  |  |  |
|  | ® No. of paper trays, size & capacity |  |  |  |
|  | ® Paper Size (s) |  |  |  |
|  | ® Paper handling options |  |  |  |
|  | ® Power supply voltage | V AC \_ |  |  |
|  | ® Power Consumption for |  |  |  |
|  | o Printing mode | Watts \_ |  |  |
|  | o Standby mode | Watts \_ |  |  |
|  | ® Duty cycle | Pages \_ /month |  |  |
|  | ® RAM | MB \_ |  |  |
|  | ® Interface |  |  |  |
|  | ® O.S. Compatibility |  |  |  |
|  | ® Weight | Kg \_ |  |  |
|  | ® Dimension (H x W x D) | Mm \_ |  |  |
| 6.3. | Video Display Unit (VDU) |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type |  |  |  |
|  | ๏ Picture Size (diagonal) | Inches \_ |  |  |
|  | อ Resolution | Pixels \_ |  |  |
|  | ๏ Power Supply Voltage | V AC \_ |  |  |
|  | ๏ Power Consumption | VA \_ |  |  |
|  | ๏ Ambient temperature range | oC \_ |  |  |
|  | ๏ Mean lifetime (MTBF) | Years \_ |  |  |
|  | ๏ No. of Colours |  |  |  |
|  | ๏ No. of Colours combinations |  |  |  |
| 6.4. | Keyboard/Touch board |  |  |  |
|  | ๏ Manufacturer |  |  |  |
|  | ๏ Type |  |  |  |
|  | ๏ Alphanumeric keys |  |  |  |
|  | ๏ Type of contract |  |  |  |
|  | ๏ Control/special function keys |  |  |  |
|  | ๏ Size | mm \_ |  |  |
|  | ๏ Total Number |  |  |  |
|  | ๏ Number of free keys that can be |  |  |  |
|  | programmed |  |  |  |
|  | ๏ Dimensions (H x W x D) | mm \_ |  |  |
|  | ๏ Enclose preliminary layout drawing. |  |  |  |
| 7. | Station Control Computer |  |  |  |
| 7.1. | Manufacture |  |  |  |
| 7.2. | Type |  |  |  |
| 7.3. | Cubical size |  |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| 7.4. | Power supply voltage | |
| 7.5. | Ambient temperature range |  |
| 7.6. | CPU Type |  |
| 7.7. | Configuration of Processor |  |
| 7.8. | Other Details |  |
| 8. | Engineering station |  |
| 8.1. | Manufacturer |  |
| 8.2. | Type |  |
| 8.3. | Cubicle Size (H x W x D) | mm |
| 8.4. | Power Supply Voltage | V DC |
| 8.5. | Ambient temperature range | oC |
| 8.6. | CPU-Type |  |
| 8.7. | Configuration |  |
| 8.8. | Other details |  |
| 9. | Mass Storage Device |  |
| 9.1. | Type |  |
| 9.2. | Storage Capacity |  |
| 10. | Plant Control Network |  |
| 10.1. | Type |  |
| 10.2. | Redundancy |  |
| 10.3. | Data Transfer speed |  |
| 11. | Control Room Network |  |
| 11.1. | Type |  |
| 11.2. | Redundancy |  |
| 11.3. | Data Transfer speed |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 12. | Ethernet Switch |  |  |  |
| 12.1. | Furnish details |  |  |  |
| 13. | Provision for Remote Control through Optic fibre link and Satellite Communication |  |  |  |
| 13.1. | Furnish details |  |  |  |
| 14. | Transmitter and Receiver system for Global Positioning System |  |  |  |
| 14.1. | Furnish Details |  |  |  |

**8.2 Requirement of process signals for SCADA system**

|  |  |  |  |
| --- | --- | --- | --- |
| Sl. No. | Description | Interface with control system | Number of process signals |
|  |  | RTU Serial Link Direct | DI DO AI AO |
|  |  | Field Bus |  |

1. Data acquisition and control signals for each Unit control board
   1. Generator
   2. Turbine
   3. Generator Transformer
   4. 132 kV switchgear
   5. Electronic turbine governor
   6. Main Inlet valve
   7. Excitation systems
   8. Electrical protection
   9. Temperature monitoring

unit

* 1. Automatic synchroniser
  2. Speed monitoring unit

Sl. No. Description Interface with control system Number of process signals

RTU Serial Link Direct DI DO AI AO

Field Bus

* 1. Vibration Monitoring unit
  2. Electrical transducers unit
  3. Other monitors
  4. 11kV & 415 V unit auxiliary

& station services systems.

* 1. 110V DC equipment
  2. 48 V DC equipment

1. Data acquisition & control

signals for each station computer

1. Data acquisition and control signals for common station service system
2. Data acquisition and control signals for the 132kV - switchgear
3. Generator & generator

transformer

1. Line protection
2. Bus bar protection
3. AC and DC distribution

panels.

1. Interface for Weir control

system

1. Interface for Remote

Control Centre

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.3 | Optical fibre cable |  |  |  |
| 8.3.1 | Guaranteed characteristics |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Fibre material | - |  |  |
| 2.2. | Fibre core/cladding diameter | Om/Om |  |  |
| 2.3. | Fibre optic mode | - |  |  |
| 2.4. | Total number of fibres | nos. \_ |  |  |
| 2.5. | Number of fibres per tube | nos. \_ |  |  |
| 2.6. | Tube diameter | mm \_ |  |  |
| 2.7. | Type of cable armouring | - |  |  |
| 2.8. | Tensile strength | N \_ |  |  |
| 2.9. | Outer cable diameter | mm \_ |  |  |
| 2.10. | Minimum permissible bending diameter |  |  |  |
|  | - temporary | mm \_ |  |  |
|  | - permanent | mm \_ |  |  |
| 2.11. | Maximum bending induced loss per 10 turns | dB \_ |  |  |
| 2.12. | Repeated bending cycles | nos. \_ |  |  |
| 2.13. | Water tightness | m/24h \_ |  |  |
| 2.14. | Temperature range | °C \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.4 | Optical transmitter/receiver |  |  |  |
| 8.4.1 | Guaranteed characteristics |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Numbers transm./receiver | nos. \_ |  |  |
| 2.2. | Supply voltage | V \_ |  |  |
| 2.3. | Power required | W \_ |  |  |
| 2.4. | Capacity of each | W \_ |  |  |

**8.5 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Principle schematic diagram showing the proposed structure of the control and monitoring system with operator console, CPU’s, local control computer, peripheral equipment (printers, VDU’s, long term storage drives etc.), input / output stations, bus system, control panels, recorders, communication links etc.

๏ Pamphlets with functional description and technical data of the main components.

๏ Pamphlet of proposed optical fibre cable with technical characteristics

# **Protection system**

**9.1 Guaranteed characteristics**

DESIGNATION

1.1 General features

Protective devices

1. manufacturer
2. entire system from same manufacturer
3. numeric type
4. year of commissioning of first plant with identical equipment
5. D.C. in feed:

๏ supply voltage

๏ D.C./D.C. converter included

๏ tolerances of supply voltage

1. overload protection
2. short-circuit protection
3. power consumption per cubicle
4. insulation acc. to IEC 60255-4
5. indication:

๏ hand reset flag

๏ light emitting diodes

a) accuracy:

๏ time error of calibration / repeatability

Protection cubicles

a) type

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1.2 | b) protection class | IP \_ |  |  |
|  | c) dimension (L/W/H) | mm \_ |  |  |
|  | d) maximum weight | kg \_ |  |  |
| 1.3. | Trip circuit supervision |  |  |  |
|  | a) type/designation | - |  |  |
|  | b) continuous/on command | - |  |  |
|  | c) time delay: |  |  |  |
|  | ๏ fixed setting approx. | s \_ |  |  |
|  | d) auxiliary elements: |  |  |  |
|  | ๏ hand reset | yes/no \_ |  |  |
|  | e) supervision current: |  |  |  |
|  | ๏ max. trip circuit supervision current | mA \_ |  |  |
| 1.4. | Test device |  |  |  |
|  | a) type/designation | - |  |  |
|  | b) provided for each assembly | yes/no \_ |  |  |
| 2. | Generator Protection |  |  |  |
| 2.1. | Whether duplicated generator |  |  |  |
|  | protection offered |  |  |  |
| 2.2. | Multifunction generator protection relay |  |  |  |
|  | for main protection |  |  |  |
| 2.3. | Multifunction generator protection relay |  |  |  |
|  | for back up protection |  |  |  |
| 2.4. | List of functions available in main |  |  |  |
|  | protection multifunction relay |  |  |  |
| 2.5. | List of functions available in back up |  |  |  |
|  | protection multifunction relay |  |  |  |
| 2.6. | No. of functions which can be selected |  |  |  |
|  | from main multifunction relay |  |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

* 1. No. of functions which can be selected

from back up multifunction relay

* 1. CT characteristic requirements for multifunction generator protection relays for the following particulars

๏ Accuracy class

๏ Burden

๏ Minimum Knee point voltage

๏ CT secondary resistance

๏ Maximum exciting current at 0.5

knee point voltage

Any other requirements

* 1. The functional, setting & operating

details for following protection functions shall be furnished

1. Generator Differential relay function

(87G)

1. Voltage restraint over-current relay

function (50/51V)

1. Stator ground fault 95% & 100 % relay

function (64G1) & (64G2)

1. Generator over voltage relay function

(59G)

1. Voltage balance relay function (60G)
2. Field failure relay function (40G)
3. Negative phase sequence relay function

(46G)

1. Reverse power relay function (32G)
2. Instantaneous and IDMT over- current

relay (50/51)

1. Over / Under Frequency relay function

(81G)

1. Volts per hertz relay function (99G)

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE |
| (xii) | Generator impedance backup relay |  |  |
|  | function (21G) |  |  |
| (xiii) | Under voltage relay function (27) |  |  |
| (xiv) | (Out of step relay) |  |  |
| (xv) | Other additional functions as available |  |  |
| 2.10. | For each of function described in 2.9 |  |  |
|  | above, minimum following details shall |  |  |
|  | be furnished |  |  |
| (i) | current rating | A \_ |  |
| (ii) | current setting and setting range |  |  |
|  | ® differential elements | - |  |
|  | ® differential current | % \_ |  |
|  | ® bias | % \_ |  |
| (iii) | Voltage setting and setting range |  |  |
| (iv) | Operating time: |  |  |
| (v) | Setting time |  |  |
| (vi) | harmonic restraint: |  |  |
| (vii) | Applicable harmonic restraint may be |  |  |
|  | indicated |  |  |
| (viii) | relay stability for through fault |  |  |
| (ix) | Impedance setting if applicable |  |  |
| (x) | Other specific features applicable to the |  |  |
|  | selected function |  |  |
|  | Generator Step-up Transformer |  |  |
| 3. | multifunction relay - main protection |  |  |
| 3.1. | Available functions |  |  |
|  |  |  |
| 3.2. | Selected functions |  |  |
|  |  |  |
| 3.3. | Parametric details as in 2.10 for each |  |  |
| selected function |  |  |
|  | Generator Step-up transformer |  |  |
| 4. | multifunction relay - duplicate |  |  |
|  | protection |  |  |

REMARKS

4.1.

4.2.

4.3.

5.1.

5.2.

5.3.

6.1.

6.2.

6.3.

7.1.

7.2.

7.3.

7.4.

7.5.

Available functions

Selected functions

Parametric details as in 2.10 for each selected function

Unit Aux. transformer multifunction relay

Available functions

Selected functions

Parametric details as in 2.10 for each selected function

Overhead line differential multifunction relay, if applicable

Available functions

Selected functions

Parametric details as in 2.10 for each selected function

Transmission line multifunction relays

Whether duplicated transmission line protection offered

List of protection functions available in transmission line multifunction relays

No. of functions which can be selected from available functions

CT characteristics requirements for transmission line multifunction relays for following particulars

๏ Accuracy class

๏ Burden

๏ Minimum Knee point voltage

๏ CT secondary resistance

๏ Maximum exciting current at 0.5 knee point voltage

Any other requirements

The functional, setting & operating details for following protection functions

ITEM DESIGNATION UNITS VALUE REMARKS

shall be furnished

1. Phase distance protection function (21P)
2. Ground distance protection function

(21E)

1. Directional phase over-current

protection function (67)

1. Directional earth fault protection

function (67N)

1. Switch on to fault protection function

(50/27)

1. Out of step protection function (68)
2. Auto-reclosing relay function (79)
3. Fault locater function (64L)
4. Synchronising check relay (25)
5. Under voltage relay
6. Non-directional Instantaneous and IDMT

over current protection functions

1. Non-directional Instantaneous and IDMT

earth fault protection functions

7.6. For each of function described in 7.5

above, minimum following details shall be furnished

1. current rating
2. current setting and setting range

® differential elements

® differential current

® bias

1. Voltage setting and setting range
2. Operating time:
3. Setting time
4. harmonic restraint:

Applicable harmonic restraint may be indicated

(vii)

(viii) Relay stability for through fault Impedance setting if applicable

Time setting t1, t2, t3 and t4 for distance relay functions

Other specific features applicable to the selected function

8.

8.1.

8.2.

8.3.

Bus differential multifunction relay, if applicable

Whether duplicated bus bar differential protection offered

List of protection functions available in bus bar multifunction relays

No. of functions which can be selected from available functions

CT characteristics requirements for transmission line multifunction relays for following particulars

๏ Accuracy class

๏ Burden

๏ Minimum Knee point voltage

๏ CT secondary resistance

๏ Maximum exciting current at 0.5 knee point voltage

Any other requirements

* 1. The functional, setting & operating details for following protection functions shall be furnished

1. Bus bar protection function for Zone A
2. Bus bar protection function for Zone B
3. Breaker fail protection function
4. Supervision relay function

(viii)

9.

9.1.

9.2.

9.3.

9.4.

10.

.

* 1. For each of function described in 8.2/8.3 above, minimum following details shall be furnished

1. current rating
2. current setting and setting range

® differential elements

® differential current

® bias

1. Voltage setting and setting range
2. Operating time:
3. Setting time
4. harmonic restraint:
5. Applicable harmonic restraint may be indicated

Relay stability for through fault

Multifunction relay for breaker fail application

Available functions

Selected functions

Parametric details as in 9.1 / 9.2 for each selected function

For each of function listed under 9.1 /9.2 above, minimum following details as in 7.6 shall be furnished.

Multifunction relay for bus coupler bay protection, if applicable

Available functions

Selected functions

Parametric details for each selected function s

For each of function listed

11.

11.1.

11.2.

11.3.

11.4.

12.

13.

13.4.

(i)

(ii)

(iii)

(iv)

(v)

Multifunction relay for station auxiliary bay protection

Available functions

Selected functions

Parametric details for each selected

function in 11.1/11.2

For each of function listed under 11.1

/11.2 above, minimum following details as in 7.6 shall be furnished.

Multifunction relay for station auxiliary

transformer protection

Available functions

Selected functions

Parametric details of functions as in 7.6 for each selected function

Multifunction meters for monitoring of

generator feeder

Available functions

Selected functions

Parametric details for each of selected

function under 13.1/13.2

For each of function listed under 13.1

/13.2 above, minimum following details shall be furnished as applicable

Accuracy class

Current range

MW range

MVAR range

Voltage range

PF range - leading and lagging side

MWH range

ITEM

DESIGNATION

UNITS

VALUE

REMARKS

14.

14.1.

Available functions

14.2.

Selected functions

14.3.

Parametric details of functions for each selected function under 14.1/14.2

14.4.

For each of function listed under 14.1 /14.2 above, minimum following details shall be furnished as applicable

Accuracy class

Current range

MW range

MVAR range

Voltage range

PF range - leading and lagging side

MWH range

15.

Multifunction meters for monitoring of outgoing feeder

15.1.

Available functions

15.2.

Selected functions

Multifunction meters for monitoring of generator transformer feeder

Parametric details of functions for each selected function under 15.1/15.2

For each of function listed under 15.1/15.2 above, minimum following details shall be furnished as applicable

15.3

(i)

Accuracy class

(ii)

Current range

(iii)

MW range

(iv)

MVAR range

(v)

Voltage range

ITEM DESIGNATION UNITS VALUE REMARKS

1. PF range - leading and lagging side
2. MWH range

**9.2 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Pamphlets of each type of the proposed multifunction protection relays as well as of cubicle assemblies for complete systems

๏ Description of the proposed power supply concept as well as of the trip function arrangement for the protection system to receive an adequate safety and some kind of redundancy or back­up protection

๏ Describe processing and indication of trip signals coming from protective devices or actuators outside of this section (e.g. transformer Buchholz relays etc.)

๏ Indicate deviations from the specification

# **415 V Switchgear**

**10.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General (applicable to all switchgear) |  |  |  |
| 1.1. | Nominal voltage | V \_ |  |  |
| 1.2. | Rated insulation class |  |  |  |
| 1.3. | Highest voltage for equipment Um | V \_ |  |  |
| 1.4. | Rated frequency | Hz \_ |  |  |
| 1.5. | Power frequency withstand voltage, 1 minute |  |  |  |
|  | - for main circuits | V \_ |  |  |
|  | - for control circuits | V \_ |  |  |
| 1.6. | Applicable standards | - |  |  |
| 2. | Unit auxiliary board |  |  |  |
| 2.1. | Cubicle assemblies |  |  |  |
| 2.1.1. | Make | - |  |  |
| 2.1.2. | Type designation | - |  |  |
| 2.1.3. | Rated current of bus bar and board | A \_ |  |  |
| 2.1.4. | Maximum temperature rise of bus bar at rated current | K \_ |  |  |
| 2.1.5. | Short circuit rating of main circuits |  |  |  |
|  | - initial symmetrical short time current, 1 s | kArms \_ |  |  |
|  | - peak withstand current |  |  |  |
| 2.1.6. | Protection class | - |  |  |
| 2.2. | Air Circuit breakers (incoming circuit) |  |  |  |
| 2.2.1. | Manufacturer | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2.2.2. | Type | - |  |  |
| 2.2.3. | Number of poles | - |  |  |
| 2.2.4. | Rated current (at 40°C) | A \_ |  |  |
| 2.2.5. | Rated short circuit breaking current |  |  |  |
|  | - symmetrical | kArms \_ |  |  |
|  | - asymmetrical | kArms \_ |  |  |
| 2.2.6. | Rated short circuit making current | kApeak \_ |  |  |
| 2.2.7. | Permissible short time current 1 s | kA\_  kArms \_ |  |  |
| 2.2.8. | Dynamic short time current | kApeak \_ |  |  |
| 2.2.9. | Total opening time (instantaneous) | s \_ |  |  |
| 2.2.10. | Total closing time | s \_ |  |  |
| 2.2.11. | Type of over current relay | - |  |  |
| 2.2.12. | Basic functions of release system | - |  |  |
| 2.2.13. | Adjustable range of overload protection | % Ir \_ |  |  |
| 2.2.14. | Adjustable range of over current |  |  |  |
|  | protection | % Ir \_ |  |  |
| 2.2.15. | Adjustable range of delay time for over |  |  |  |
|  | current protection | s \_ |  |  |
| 2.3. | Moulded case circuit breakers (outgoing circuits) |  |  |  |
| 2.3.1. | Manufacturer | - |  |  |
| 2.3.2. | Type | - |  |  |
| 2.3.3. | Applicable standards | - |  |  |
| 2.3.4. | Number of poles | - |  |  |
| 2.3.5. | Short-circuit current limiting |  |  |  |
|  | characteristic | yes/no \_ |  |  |

2.3.6. Symmetrical short-circuit breaking

|  |  |  |
| --- | --- | --- |
| current | | kA.\_  Arms |
| 2.3.7. | Short-circuit making current | kApeak |
| 2.3.8. | Adjustable range of overload | % Ir |
|  | protection |  |
| 2.3.9. | Instantaneous over current protection | % Ir |
| 2.4. | Current transformers (incoming |  |
|  | circuits) |  |
| 2.4.1. | Make | - |
| 2.4.2. | Type | - |
| 2.4.3. | Applicable standards | - |
| 2.4.4. | Number of CT’s | - |
| 2.4.5. | Rated current primary side | A |
| 2.4.6. | Rated current secondary side | A |
| 2.4.7. | Thermal short time current 1 sec. | A  rms |
| 2.4.8. | Short time dynamic current | kApeak |
| 2.4.9. | Number of measuring/protection cores | - |
| 2.4.10. | Measuring cores |  |
|  | - accuracy class | - |
|  | - rated burden | VA |
| 2.4.11. | Protection cores |  |
|  | - accuracy class | - |
|  | - rated burden | VA |
| 2.5. | Voltage Transformer |  |
| 2.5.1. | Make |  |
| 2.5.2. | Type |  |
| 2.5.3. | Applicable Standard |  |
| 2.5.4. | No. of VT’s |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.5.5. | Impulse withstand voltage |  |  |  |
| 2.5.6. | Rated transformation ratio |  |  |  |
| 2.5.7. | Max. temp rise over ambient |  |  |  |
| 2.5.8. | Class of insulation |  |  |  |
| 2.5.9. | No. of Secondary winding |  |  |  |
| 2.5.10. | Winding connection |  |  |  |
| 2.5.11. | Rated secondary voltage |  |  |  |
| 2.5.12. | Rated for dual purpose of protection |  |  |  |
|  | and measurement |  |  |  |
| 2.5.13. | Rated output of each secondary |  |  |  |
|  | winding |  |  |  |
| 2.5.14. | Accuracy class of each secondary |  |  |  |
|  | winding |  |  |  |
| 2.5.15. | Rated voltage factor |  |  |  |
| 3. | Station service board |  |  |  |
| 3.1. | Cubicle assemblies | - |  |  |
| 3.1.1. | Make | - |  |  |
| 3.1.2. | Type designation | - |  |  |
| 3.1.3. | Rated current of bus bar and board | A \_ |  |  |
| 3.1.4. | Maximum temperature rise of bus bar |  |  |  |
|  | at rated current | K \_ |  |  |
| 3.1.5. | Short circuit rating of main circuits |  |  |  |
|  | - initial symmetrical short time |  |  |  |
|  | current, 1 s | kArms \_ |  |  |
|  | - peak withstand current | kApeak \_ |  |  |
| 3.1.6. | Protection class | - |  |  |
| 3.2. | Air Circuit breakers (incoming circuit) |  |  |  |
| 3.2.1. | Manufacturer | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 3.2.2. | Type | - |  |  |
| 3.2.3. | Applicable standards | - |  |  |
| 3.2.4. | Number of poles | - |  |  |
| 3.2.5. | Rated current (at 40°C) | A \_ |  |  |
| 3.2.6. | Rated short circuit breaking current |  |  |  |
|  | - symmetrical | kArms \_ |  |  |
|  | - asymmetrical | kArms \_ |  |  |
| 3.2.7. | Rated short circuit making current | kApeak \_ |  |  |
| 3.2.8. | Permissible short time current 1 s | kArms \_ |  |  |
| 3.2.9. | Dynamic short time current | kApeak \_ |  |  |
| 3.2.10. | Total opening time (instantaneous) | s \_ |  |  |
| 3.2.11. | Total closing time | s \_ |  |  |
| 3.2.12. | Type of over current relay | - |  |  |
| 3.2.13. | Basic functions of release system | - |  |  |
| 3.2.14. | Adjustable range of overload protection | % Ir \_ |  |  |
| 3.2.15. | Adjustable range of over current protection | % Ir \_ |  |  |
| 3.2.16. | Adjustable range of delay time for over-current protection | s \_ |  |  |
| 3.3. | Moulded case circuit breakers (outgoing circuits) |  |  |  |
| 3.3.1. | Manufacturer | - |  |  |
| 3.3.2. | Type | - |  |  |
| 3.3.3. | Applicable standards | - |  |  |
| 3.3.4. | Number of poles | - |  |  |

3.3.5. Short-circuit current limiting

|  |  |  |
| --- | --- | --- |
| characteristic | | yes/no |
| 3.3.6. | Symmetrical short-circuit breaking current | kA\_  rms |
| 3.3.7. | Short-circuit making current | kApeak |
| 3.3.8. | Adjustable range of overload | % Ir |
|  | protection |  |
| 3.3.9. | Instantaneous over current protection | % Ir |
| 3.4. | Current transformers (incoming circuits) |  |
| 3.4.1. | Make | - |
| 3.4.2. | Type | - |
| 3.4.3. | Applicable standards | - |
| 3.4.4. | Number of CT’s | - |
| 3.4.5. | Rated current primary side | A |
| 3.4.6. | Rated current secondary side | A |
| 3.4.7. | Thermal short time current 1 sec. | kArms |
| 3.4.8. | Short time dynamic current | kApeak |
| 3.4.9. | Number of measuring/protection cores | - |
| 3.4.10. | Measuring cores |  |
|  | - accuracy class | - |
|  | - rated burden | VA |
| 3.4.11. | Protection cores |  |
|  | - accuracy class | - |
|  | - rated burden | VA |
| 3.5. | Voltage Transformer |  |
| 3.5.1. | Make |  |
| 3.5.2. | Type |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3.5.3. | Applicable Standard |  |  |  |
| 3.5.4. | No. of VT’s |  |  |  |
| 3.5.5. | Impulse withstand voltage |  |  |  |
| 3.5.6. | Rated transformation ratio |  |  |  |
| 3.5.7. | Max. temp rise over ambient |  |  |  |
| 3.5.8. | Class of insulation |  |  |  |
| 3.5.9. | No. of Secondary winding |  |  |  |
| 3.5.10. | Winding connection |  |  |  |
| 3.5.11. | Rated secondary voltage |  |  |  |
| 3.5.12. | Rated for dual purpose of protection |  |  |  |
|  | and measurement |  |  |  |
| 3.5.13. | Rated output of each secondary |  |  |  |
|  | winding |  |  |  |
| 3.5.14. | Accuracy class of each secondary |  |  |  |
|  | winding |  |  |  |
| 3.5.15. | Rated voltage factor |  |  |  |
| 4. | Intake Auxiliary board |  |  |  |
| 4.1. | Cubicle assemblies | - |  |  |
| 4.1.1. | Make | - |  |  |
| 4.1.2. | Type designation | - |  |  |
| 4.1.3. | Rated current of bus bar and board | A \_ |  |  |
| 4.1.4. | Maximum temperature rise of bus bar |  |  |  |
|  | at rated current | K \_ |  |  |
| 4.1.5. | Short circuit rating of main circuits |  |  |  |
|  | -initial symmetrical short time current, |  |  |  |
|  | 1 s | kArms \_ |  |  |
|  | -peak withstand current | kApeak \_ |  |  |
| 4.1.6. | Protection class | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4.2. | Circuit breakers (incoming circuit) |  |  |  |
| 4.2.1. | Manufacturer | - |  |  |
| 4.2.2. | Type | - |  |  |
| 4.2.3. | Applicable standards | - |  |  |
| 4.2.4. | Number of poles | - |  |  |
| 4.2.5. | Rated current (at 40°C) | A \_ |  |  |
| 4.2.6. | Rated short circuit breaking current |  |  |  |
|  | - symmetrical | kArms \_ |  |  |
|  | - asymmetrical | kArms \_ |  |  |
| 4.2.7. | Rated short circuit making current | kApeak \_ |  |  |
| 4.2.8. | Permissible short time current 1 s | kArms \_ |  |  |
| 4.2.9. | Dynamic short time current | kApeak \_ |  |  |
| 4.2.10. | Total opening time (instantaneous) | s \_ |  |  |
| 4.2.11. | Total closing time | s \_ |  |  |
| 4.2.12. | Type of over current relay | - |  |  |
| 4.2.13. | Basic functions of release system | - |  |  |
| 4.2.14. | Adjustable range of overload | % Ir \_ |  |  |
|  | protection |  |  |  |
| 4.2.15. | Adjustable range of over current | % Ir \_ |  |  |
|  | protection |  |  |  |
| 4.2.16. | Adjustable range of delay time for over |  |  |  |
|  | current protection | s \_ |  |  |
| 4.3. | Moulded case circuit breakers |  |  |  |
|  | (outgoing circuits) |  |  |  |
| 4.3.1. | Manufacturer | - |  |  |
| 4.3.2. | Type | - |  |  |
| 4.3.3. | Applicable standards | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4.3.4. | Number of poles | - |  |  |
| 4.3.5. | Short-circuit current limiting |  |  |  |
|  | characteristic | yes/no \_ |  |  |
| 4.3.6. | Symmetrical short-circuit breaking |  |  |  |
|  | current | kArms \_ |  |  |
| 4.3.7. | Short-circuit making current | kApeak \_ |  |  |
| 4.3.8. | Adjustable range of overload | % Ir \_ |  |  |
|  | protection |  |  |  |
| 4.3.9. | Instantaneous over current protection | % Ir \_ |  |  |
| 4.4. | Current transformers (incoming |  |  |  |
|  | circuits) |  |  |  |
| 4.4.1. | Make | - |  |  |
| 4.4.2. | Type | - |  |  |
| 4.4.3. | Applicable standards | - |  |  |
| 4.4.4. | Number of CT’s | - |  |  |
| 4.4.5. | Rated current primary side | A \_ |  |  |
| 4.4.6. | Rated current secondary side | A \_ |  |  |
| 4.4.7. | Thermal short time current 1 sec. | kArms \_ |  |  |
| 4.4.8. | Short time dynamic current | kApeak \_ |  |  |
| 4.4.9. | Number of measuring/protection cores | - |  |  |
| 4.4.10. | Measuring cores |  |  |  |
|  | - accuracy class | - |  |  |
|  | - rated burden | VA \_ |  |  |
| 4.4.11. | Protection cores |  |  |  |
|  | - accuracy class | - |  |  |
|  | - rated burden | VA \_ |  |  |
| 4.5. | Voltage Transformer |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 4.5.1. | Make |  |  |  |
| 4.5.2. | Type |  |  |  |
| 4.5.3. | Applicable Standard |  |  |  |
| 4.5.4. | No. of VT’s |  |  |  |
| 4.5.5. | Impulse withstand voltage |  |  |  |
| 4.5.6. | Rated transformation ratio |  |  |  |
| 4.5.7. | Max. temp rise over ambient |  |  |  |
| 4.5.8. | Class of insulation |  |  |  |
| 4.5.9. | No. of Secondary winding |  |  |  |

* + 1. Winding connection
    2. Rated secondary voltage
    3. Rated for dual purpose of protection

and measurement

* + 1. Rated output of each secondary winding
    2. Accuracy class of each secondary winding
    3. Rated voltage factor

**10.2 Informative data**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Unit auxiliary board |  |  |  |
| 1.1. | Weight of complete board | kg \_ |  |  |
| 1.2. | Dimensions of complete board |  |  |  |
|  | a) length | mm \_ |  |  |
|  | b) width | mm \_ |  |  |
|  | c) height | mm \_ |  |  |

1.3. Weight of withdraw-able portion of circuit

|  |  |  |
| --- | --- | --- |
| breaker | | kg |
| 1.4. | CB motor drive (for stored-energy operating mechanism) |  |
|  | a) nominal voltage | V |
|  | b) power consumption | W |
| 1.5. | CB closing and tripping coils |  |
|  | a) nominal voltage | V |
|  | b) power consumption | W |
| 2. | Station service board |  |
| 2.1. | Weight of complete board | kg |
| 2.2. | Dimensions of complete board |  |
|  | a) length | mm |
|  | b) width | mm |
|  | c) height | mm |
| 2.3. | Weight of withdraw-able portion of circuit |  |
|  | breaker | kg |
| 2.4. | CB motor drive (for stored-energy operating mechanism) |  |
|  | a) nominal voltage | V |
|  | b) power consumption | W |
| 2.5. | CB closing and tripping coils |  |
|  | a) nominal voltage | V |
|  | b) power consumption | W |
| 3. | Weir Auxiliary board |  |
| 3.1. | Weight of complete board | kg |
| 3.2. | Dimensions of complete board |  |
|  | d) length | mm |
|  | e) width | mm |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  | f) height | mm \_ |  |  |
| 3.3. | Weight of withdraw-able portion of circuit breaker | kg \_ |  |  |
| 3.4. | CB motor drive (for stored-energy operating mechanism) |  |  |  |
|  | c) nominal voltage | V \_ |  |  |
|  | d) power consumption | W \_ |  |  |
| 3.5. | CB closing and tripping coils |  |  |  |
|  | c) nominal voltage | V \_ |  |  |
|  | d) power consumption | W \_ |  |  |
| 4. | Auxiliary Relays |  |  |  |

*&* Make

& Type

& Rated current / voltage and permissible variation

& Rated burden

& No. and type of contacts (whether ‘NO’ or ‘NC’)

& Rating of contacts

& Total operating time or relays

& One minute power frequency withstand voltage

& Detailed literature furnished with reference

& Details of testing facilities provided

1. Indicating Lamp

& Make

& Type

& Rated voltage

*^* Rated power consumption (watts)

^ Series resistor provided

1. Indicating meters

^ Make

^ Type of Movement

^ Size (square mm)

^ Scale size in degree

^ Accuracy

^ Range offered in line with specification

^ VA burden

^ Applicable standard

1. Energy meters

^ Make

^ Type

^ Range

^ Detailed literature furnished

^ Standard to which it conform to

^ Rated current

^ Rated Voltage and frequency

^ Drawout / non drawout

^ Class of accuracy

^ Rated VA burden

1. Current coil VA
2. Voltage coil VA

^ Test plug / test blocks / testing terminal with links

1. Miniature Circuit breaker

*&* Make

& Rated voltage

& Rated current

& Rupturing capacity

& Setting for short circuit

& Setting range for over load

& Operating time

& No. of auxiliaries contacts

& Rating for auxiliary contacts

& Operating characteristics furnished

1. Control Wiring
2. Make
3. Type

& Material and size conductor

1. For CT circuit
2. For other circuit

& Solid / standard conductor

& Tinned / untinned

& Material of insulation and sheath

& Voltage grade of control wiring

& Colour coding of wires

1. For AC metering circuit
2. For DC control circuit
3. AC auxiliary power circuit like panel space

heater

1. Earthing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ^ Numbered ferrules at both ends |  |  |  |
|  | ^ Insulator sleeves provided at both ends |  |  |  |
|  | ^ Terminals |  |  |  |
|  | a) Make |  |  |  |
|  | b) Current rating |  |  |  |
|  | c) Clamp type or bolt type |  |  |  |
|  | d) Maximum conductor size and no. of |  |  |  |
|  | conductor which it can receive |  |  |  |
|  | e) Disconnecting type of CT circuit |  |  |  |
|  | f) Terminal marking facility provided |  |  |  |
|  | g) Crimp type connectors provided at the |  |  |  |
|  | terminals |  |  |  |
|  | h) Spare terminals |  |  |  |
| 10. | Conditions of transport |  |  |  |
| 10.1. | Heaviest part for transportation |  |  |  |
|  | - With a weight of | kg. \_ |  |  |
|  | - Overall shipping dimension (L x W x | m x m x \_ |  |  |
|  | H) | m |  |  |
| 10.2. | Largest part for transportation |  |  |  |
|  | - With a weight of | kg. \_ |  |  |
|  | - Overall shipping dimension  (L x W x H) | m x m x \_ |  |  |
|  | m |  |  |
| 10.3. | Heaviest part for erection  - With a weight of | kg. \_ |  |  |
|  |  |  |  |
|  | - Dimension | m x m x \_ |  |  |
|  | (L x W x H) | m |  |  |

**10.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

® Pamphlets of the proposed switchgear showing the following

* Principle of segregation of various compartments
* Air circuit breaker handling and control including interlocking features
* Type, basic functions and characteristics of CB protection relay

® Illustration of the draw out type MCCB.

® Information on energy meters installed.

# **Grounding system**

(Separate particulars shall be furnished for powerhouse and switchyard)

**11.1 Guaranteed characteristics**

ITEM DESIGNATION UNITS VALUE REMARKS

1. GROUNDING CONDUCTOR
   1. Size of the Conductor for earth Mat
   2. Size of the conductor for riser
   3. Size of the conductor for equipment

connection

* 1. Material of conductor for earth Mat,

riser, equipment connection

* 1. Fault current for calculation of size of

the conductor

* 1. Duration of Fault
  2. Type of Joints in the earth mat

(Welded / bolted)

* 1. Corrosion Allowance
  2. Maximum conductor temperature

(assumed) during the fault

1. GROUNDING RODS
   1. Dia of the rod
   2. Length of the Rod
   3. No of rods provided
   4. Arrangement of connection of rod to

the Mat

1. EARTH MAT
   1. Soil Resistivity
   2. Area of the Mat
   3. Size of the grid
   4. Size of the conductor for the earth Mat
   5. Length of the conductor
   6. Resistance of the Mat
   7. Calculated Resistance of the ground

Rods

* 1. Combined resistance of Mat & Rods
  2. Effective Resistance of Mat Conductor

& Rods) and Penstocks (1& 2 Penstocks)

1. STEP & TOUCH POTENTIAL
   1. Resistively of the concrete
   2. Fault clearing time for calculation of

touch/step potential

* 1. Fault current
  2. Grid current
  3. Allowable touch & step potential
  4. Actual Potential of the Mat during

Fault

* 1. Whether Mat potential is safe / unsafe
  2. If unsafe, measures adopted for

limiting the potential within safe value

* 1. Whether penstocks included in the

Mat calculations

1. Interconnection of power house and switchyard mats
   1. Resistance of power house mat
   2. Resistance of switchyard mat
   3. Combined resistance of power house

and switchyard mats

1. Details of junction Boxes

* Dimension (L x W x H)
* Fixing details
* Metal Sheet Thickness
* Termination details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **110 V & 48 V DC** |  |  |  |
| 12.1 | **Guaranteed characteristics** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | 110 V DC battery charger |  |  |  |
| 1.1. | Make | - |  |  |
| 1.2. | Type | - |  |  |
| 1.3. | Applicable standards | - |  |  |
| 1.4. | Number of chargers | - |  |  |
| 1.5. | AC supply |  |  |  |
|  | ๏ voltage | V \_ |  |  |
|  | ๏ number of phases | - |  |  |
|  | ๏ frequency | Hz \_ |  |  |
|  | ๏ maximum power consumption at rated output | kVA \_ |  |  |
| 1.6. | DC output |  |  |  |
|  | ๏ rated voltage UN | V \_ |  |  |
|  | ๏ adjustable voltage range | % UN \_ |  |  |
|  | ๏ rated current IN | A \_ |  |  |
|  | ๏ adjustable current limitation | % IN \_ |  |  |
|  | ๏ stability of output voltage (from no-load to full load) | % UN \_ |  |  |
| 1.7. | Maximum ripple of output voltage (peak to peak) |  |  |  |
|  | ๏ with the battery connected | % UN \_ |  |  |
|  | ๏ without any battery connected | % UN \_ |  |  |

1.8. Maximum temperature drift of the output voltage % UN/°C

|  |  |  |
| --- | --- | --- |
| 1.9. | Percentage taps provided on mains input transformer | +/- |
| 1.10. | Range of potential meters for setting DC voltage across battery terminals for: |  |
|  | i) float charging (volt to volt) |  |
|  | ii) boost charging (volt to volt) |  |
| 1.11. | Whether selection between present float charging and boost charging voltages can be made by means of a switch on front panel (yes/no) |  |
|  |  |
| 1.12. | DC voltage regulation across battery terminals for 0 to 100% load changes | % |
|  | and specified main voltage and frequency variations |  |
| 1.13. | DC voltage across battery terminals under specified mains voltage and frequency variations when a load corresponding to 125% of rated | volts |
|  | charger output is drawn |  |
| 1.14. | DC voltage range across load terminals for 0 to 100% load changes and specified mains voltages and frequency variations whilst the battery is in on |  |
|  | i) float charger (volt to volt) |  |
|  | ii) boost charger (volt to volt) |  |
| 1.15. | Whether mains & charger failure | - |
|  | alarms are provided (yes/no) |  |
| 1.16. | Details of indicating instruments on |  |
|  | the panels |  |
| 2. | 110 V DC battery |  |
| 2.1. | Make | - |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2.2. | Type & designation | - |  |  |
| 2.3. | Applicable standards | - |  |  |
| 2.4. | Number of batteries | - |  |  |
| 2.5. | Ampere-hour capacity of each battery |  |  |  |
| 2.6. | Type of battery |  |  |  |
| 2.7. | Battery cells |  |  |  |
|  | ๏ type of cells | - |  |  |
|  | ๏ number of cells per battery | - |  |  |
|  | ๏ Nominal cell voltage | V \_ |  |  |
|  | ๏ No. of positive plates per cell | - |  |  |
|  | ๏ Total no. of plates | - |  |  |
| 2.8. | Battery data |  |  |  |
|  | i) rated voltage UN | V \_ |  |  |
|  | 1. float charging voltage 2. maximum variation of voltage | V \_ |  |  |
|  | under all conditions of service | % UN \_ |  |  |
|  | 1. normal charging current 2. maximum permissible charging | A \_ |  |  |
|  | current  vi) battery capacity at 27°C | A \_ |  |  |
|  | a) at 10 hours discharge rate | Ah \_ |  |  |
|  | b) at 1 hour discharge rate | Ah \_ |  |  |
|  | c) at 5 hour discharge rate | Ah \_ |  |  |
|  | vii) Short-circuit amps | KA \_ |  |  |
|  | viii) Material of containers | - |  |  |
|  | ix) Thickness, type and material of | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | separators  x) Electrolyte required for first | ltr \_ |  |  |
|  | filling (including 10% extra)  xi) Sp. Gravity of electrolyte at 27 | - |  |  |
|  | deg. C with all cells fully charged  xii) Sp. Gravity of the electrolyte at | - |  |  |
|  | 10hr discharge rate  xiii) Recommended float charge current & voltage  ๏ amp | A |  |  |
|  | ๏ volt | V |  |  |
|  | xiv) Recommended boost charger current & voltage  ๏ Amp | A |  |  |
|  | ๏ Volt | V |  |  |
| 2.9. | Maximum permissible ambient |  |  |  |
|  | temperature | °C \_ |  |  |
| 3. | 110 V DC main distribution board |  |  |  |
| 3.1. | Manufacturer | - |  |  |
| 3.2. | Type designation | - |  |  |
| 3.3. | Number of boards | - |  |  |
| 3.4. | Number of outgoing feeders | nos. \_ |  |  |
| 3.5. | Rated voltage | V \_ |  |  |
| 3.6. | Power frequency withstand voltage, |  |  |  |
|  | 1 min. | kV \_ |  |  |
| 3.7. | Rated current of incoming feeder and |  |  |  |
|  | bus bar | A \_ |  |  |
| 3.8. | Short-circuit withstand current (1 s) | kA \_ |  |  |
| 4. | 415 V AC supply panel, if applicable |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |

4.1. Manufacturer

|  |  |  |
| --- | --- | --- |
| 4.2. | Type designation | - |
| 4.3. | Number of boards | - |
| 4.4. | Number of outgoing feeders | nos. |
| 4.5. | Rated voltage | V |
| 4.6. | Power frequency withstand voltage, 1 min. | kV |
| 4.7. | Rated current of incoming MCCB and bus bar | A |
| 4.8. | Short-circuit withstand current (1 s) | kA |
| 5. | 240V UPS panel |  |
| 5.1. | Manufacturer | - |
| 5.2. | Type designation | - |
| 5.3. | Number of boards | - |
| 5.4. | Number of outgoing feeders | nos. |
| 5.5. | Rated voltage | V |
| 5.6. | Power frequency withstand voltage, 1 min. | kV |
| 5.7. | Rated current of incoming MCCB and bus bar | A |
| 5.8. | Short-circuit withstand current (1 s) | kA |
| 6. | 48 V DC battery charger |  |
| 6.1. | Make | - |
| 6.2. | Type | - |
| 6.3. | Applicable standards | - |
| 6.4. | Number of chargers | - |
| 6.5. | AC supply |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ voltage | V \_ |  |  |
|  | ๏ number of phases | - |  |  |
|  | ๏ frequency | Hz \_ |  |  |
|  | ๏ maximum power consumption at rated output | kVA \_ |  |  |
| 6.6. | DC output |  |  |  |
|  | ๏ rated voltage UN | V \_ |  |  |
|  | ๏ adjustable voltage range | % UN \_ |  |  |
|  | ๏ rated current IN | A \_ |  |  |
|  | ๏ adjustable current limitation | % IN \_ |  |  |
|  | ๏ stability of output voltage (from no-load to full load) | % UN \_ |  |  |
| 6.7. | Maximum ripple of output voltage (peak to peak) |  |  |  |
|  | ๏ with the battery connected | % UN \_ |  |  |
|  | ๏ without any battery connected | % UN \_ |  |  |
| 6.8. | Maximum temperature drift of the output voltage | % UN/°C \_ |  |  |
|  | Percentage taps provided on mains input transformer | +/- |  |  |
| 6.9. | Range of potential meters for setting DC voltage across battery terminals for: |  |  |  |
|  | i) float charging (volt to volt) |  |  |  |
|  | ii) boost charging (volt to volt) |  |  |  |
| 6.10. | Whether selection between present float charging and boost charging voltages can be made by means of a switch on front panel (yes/no) |  |  |  |
|  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 6.11. | DC voltage regulation across battery terminals for 0 to 100% load changes and specified main voltage and frequency variations | % |  |  |
|  |  |  |  |
| 6.12. | DC voltage across battery terminals under specified mains voltage and frequency variations when a load corresponding to 125% of rated charger output is drawn | volts |  |  |
|  |  |  |  |
| 6.13. | DC voltage range across load terminals for 0 to 100% load changes and specified mains voltages and frequency variations whilst the battery is in on |  |  |  |
|  | i) float charger (volt to volt) |  |  |  |
|  | ii) boost charger (volt to volt) |  |  |  |
| 6.14. | Whether mains & charger failure alarms are provided (yes/no) |  |  |  |
| 6.15. | Details of indicating instruments on the panels |  |  |  |
| 7. | 48 V DC battery |  |  |  |
| 7.1. | Make | - |  |  |
| 7.2. | Type designation | - |  |  |
| 7.3. | Applicable standards | - |  |  |
| 7.4. | Number of batteries | - |  |  |
| 7.5 | Ampere-hour capacity of each battery |  |  |  |
|  | Type of each battery |  |  |  |
| 7.5. | Battery cells |  |  |  |
|  | i) type of cells | - |  |  |
|  | ii) number of cells per battery | - |  |  |
|  | iii) Nominal cell voltage | V \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | iv) No. of positive plate per cell | - |  |  |
|  | v) Total no. of plates | - |  |  |
| 7.6. | Battery data |  |  |  |
|  | i) rated voltage UN | V \_ |  |  |
|  | ii) float charging voltage | V \_ |  |  |
|  | iii) maximum variation of voltage under all conditions of service | % UN \_ |  |  |
|  | iv) normal charging current | A \_ |  |  |
|  | v) maximum permissible charging current | A \_ |  |  |
|  | vi) battery capacity at 27°C |  |  |  |
|  | a) at 10 hours discharge rate | Ah \_ |  |  |
|  | b) at 1 hour discharge rate | Ah \_ |  |  |
|  | c) at 5 hour discharge rate | Ah \_ |  |  |
|  | vii) Short-circuit amps | KA \_ |  |  |
|  | viii) Material of containers | - |  |  |
|  | ix) Thickness, type and material of | - |  |  |
|  | separators |  |  |  |
|  | x) Electrolyte required for first | lt \_ |  |  |
|  | filling (including 10% extra) |  |  |  |
|  | xi) Sp. Gravity of electrolyte at 27 | - |  |  |
|  | deg. C with all cells fully charged |  |  |  |
|  | xii) Sp. Gravity of the electrolyte at | - |  |  |
|  | 10hr discharge rate |  |  |  |
|  | xiii) Recommended float charge current & voltage |  |  |  |
|  | ® amp | A |  |  |
|  | ® volt | V |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 7.7. | xiv) Recommended boost charger current & voltage  Maximum permissible ambient |  |  |  |
|  | temperature | °C \_ |  |  |
| 8. | 48 V DC main distribution board |  |  |  |
| 8.1. | Manufacturer | - |  |  |
| 8.2. | Type designation | - |  |  |
| 8.3. | Number of boards | - |  |  |
| 8.4. | Number of outgoing feeders | - |  |  |
| 8.5. | Rated voltage | V \_ |  |  |
| 8.6. | Power frequency withstand voltage, |  |  |  |
|  | 1 min. | kV \_ |  |  |
| 8.7. | Rated current of incoming feeder and |  |  |  |
|  | busbar | A \_ |  |  |
| 8.8. | Short-circuit withstand current (1 s) | kA \_ |  |  |
| 9. | Static inverter |  |  |  |
| 9.1. | Manufacturer | - |  |  |
| 9.2. | Type designation | - |  |  |
| 9.3. | Applicable standards | - |  |  |
| 9.4. | Number of inverters | - |  |  |
| 9.5. | DC supply |  |  |  |
|  | ๏ input voltage | V \_ |  |  |
|  | ๏ maximum admissible variation of input voltage | % \_ |  |  |
|  | ๏ input current at rated output | A \_ |  |  |
| 9.6. | AC output |  |  |  |
|  | ๏ rated voltage UN | V \_ |  |  |
|  | ๏ number of phases | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ๏ rated frequency fN | Hz \_ |  |  |
|  | ๏ rated output | kVA \_ |  |  |
|  | ๏ at power factor | cosphi \_ |  |  |
|  | ๏ rated current IN | A \_ |  |  |
| 9.7. | Voltage stability of load variation | % UN \_ |  |  |
|  | from no-load to full load |  |  |  |
| 9.8. | Frequency stability (island operation) | % fN \_ |  |  |
| 9.9. | Range of load power factor |  |  |  |
|  | ๏ inductive | cos0 |  |  |
|  | ๏ capacitive | cos0 |  |  |
| 9.10. | Short time overload capability |  |  |  |
|  | ๏ for 1 second | % IN \_ |  |  |
|  | ๏ for 1 minute | % IN \_ |  |  |
| 9.11. | Maximum distortion factor of voltage wave form | % \_ |  |  |
| **12.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | 110 V DC battery charger |  |  |  |
| 1.1. | Heat losses at rated output | kW \_ |  |  |
| 1.2. | Kind of cooling (natural / forced) | - |  |  |
| 1.3. | Protection class of cubicle | - |  |  |
| 1.4. | Weight of complete charger cubicle | kg \_ |  |  |
| 1.5. | Overall dimensions of complete charger cubicle |  |  |  |
|  | ๏ length | mm \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ® height | mm \_ |  |  |
|  | อ width | mm \_ |  |  |
| 2. | 110 V DC battery |  |  |  |
| 2.1. | Battery fuse rating | A \_ |  |  |
| 2.2. | Internal resistance |  |  |  |
|  | อ of one cell | ohm \_ |  |  |
|  | อ of complete battery | ohm \_ |  |  |
| 2.3. | Weights |  |  |  |
|  | อ of one cell | kg \_ |  |  |
|  | อ of complete battery including racks | kg \_ |  |  |
| 2.4. | Overall dimensions of complete battery including racks |  |  |  |
|  | อ length | mm \_ |  |  |
|  | อ width | mm \_ |  |  |
|  | อ height | mm \_ |  |  |
| 3. | 110 V DC main distribution board |  |  |  |
| 3.1. | Protection class of cubicle | - |  |  |
| 3.2. | Overall dimensions of complete distribution board |  |  |  |
|  | อ length | mm \_ |  |  |
|  | อ width | mm \_ |  |  |
|  | อ height | mm \_ |  |  |
| 4. | 415V AC supply panel, if applicable |  |  |  |
| 4.1. | Protection class of cubicle | - |  |  |
| 4.2. | Overall dimensions of complete panel |  |  |  |
|  | อ length | mm \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | อ width | mm \_ |  |  |
|  | ® height | mm \_ |  |  |
| 5. | 240V UPS panel |  |  |  |
| 5.1. | Protection class of cubicle | - |  |  |
| 5.2. | Overall dimensions of complete distribution board |  |  |  |
|  | อ length | mm \_ |  |  |
|  | อ width | mm \_ |  |  |
|  | อ height | mm \_ |  |  |
| 6. | 48 V DC battery charger |  |  |  |
| 6.1. | Heat losses at rated output | kW \_ |  |  |
| 6.2. | Kind of cooling (natural / forced) | - |  |  |
| 6.3. | Protection class of cubicle | - |  |  |
| 6.4. | Weight of complete charger cubicle | kg \_ |  |  |
| 6.5. | Overall dimensions of complete charger cubicle |  |  |  |
|  | อ length | mm \_ |  |  |
|  | อ height | mm \_ |  |  |
|  | อ width | mm \_ |  |  |
| 7. | 48 V DC battery |  |  |  |
| 7.1. | Battery fuse rating | A \_ |  |  |
| 7.2. | Internal resistance |  |  |  |
|  | อ of one cell | ohm \_ |  |  |
|  | อ of complete battery | ohm \_ |  |  |
| 7.3. | Weights |  |  |  |
|  | อ of one cell | kg \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |

|  |  |  |
| --- | --- | --- |
|  | ๏ of complete battery including racks | kg |
| 7.4. | Overall dimensions of complete battery including racks |  |
|  | ๏ length | mm |
|  | ๏ width | mm |
|  | ๏ height | mm |
| 8. | 48 V DC main distribution board |  |
| 8.1. | Protection class of cubicle | - |
| 8.2. | Overall dimensions of complete distribution board |  |
|  | ๏ length | mm |
|  | ๏ width | mm |
|  | ๏ height | mm |

|  |  |  |
| --- | --- | --- |
| 9. | Static inverter |  |
| 9.1. | Heat losses at rated output | kW |
| 9.2. | Kind of cooling | - |
| 9.3. | Protection class of enclosure | - |
| 9.4. | Weight of complete inverter cubicle | kg |
| 9.5. | Overall dimension of complete inverter cubicle |  |
|  | ๏ length | mm |
|  | ๏ width | mm |
|  | ๏ height | mm |

**12.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Pamphlets of 110 V & 48 V batteries with main characteristics

๏ Installation arrangement of the batteries

๏ Space requirements for 110 V & 48 V batteries

๏ Layout of battery room etc.

# **DIESEL GENERATOR SETS**

(Separate particulars shall be furnished for Powerhouse DG set & Weir Site DG Set)

**13.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Diesel engine |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Type designation | - |  |  |
| 1.3. | Applicable standards | - |  |  |
| 1.4. | Whether DG set provided with acoustic enclosure |  |  |  |
| 1.5. | Whether DG set CPCB (Central  Pollution Control Board) compliant |  |  |  |
| 1.6. | Whether noise level less than 75 dB(A) at a distance of 1 meter |  |  |  |
| 1.7. | Engine gross power | kW \_ |  |  |
| 1.8. | Engine net power (rated continuous output) | kW \_ |  |  |
| 1.9. | Engine overload capacity (output) for one hour | kW \_ |  |  |
| 1.10. | Radiator capacity | kW \_ |  |  |
| 1.11. | Lubrication oil consumption (max.) | l/h \_ |  |  |
| 1.12. | Fuel consumption |  |  |  |
|  | - 110% load | l/kWh \_ |  |  |
|  | - 100 % load | l/kWh \_ |  |  |
|  | - 75 % load | l/kWh \_ |  |  |
|  | - No Load (Idle running) | l/kWh \_ |  |  |
| 1.13. | Air aspiration | m3/min. |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM  1.14. | DESIGNATION  Cooling air flow | UNITS  m3/min. \_ | VALUE |
| 1.15. | Exhaust outlet diameter | mm \_ |  |
| 1.16. | Exhaust flow (total) | m3/min. \_ |  |
| 1.17. | Exhaust gas temperature | °C \_ |  |
| 1.18. | Engine speed | rpm \_ |  |
| 1.19. | Maximum starting time (from starting |  |  |
|  | signal up to full output) | s \_ |  |
| 2. | Generator |  |  |
| 2.1. | Manufacturer | - |  |
| 2.2. | Type designation | - |  |
| 2.3. | Applicable standards | - |  |
| 2.4. | Rated generator output | kVA \_ |  |
| 2.5. | Rated power factor | cos^ \_ |  |
| 2.6. | Generator efficiency at rated output |  |  |
|  | and power factor | % \_ |  |
| 2.7. | Diesel generator set continuous output | kW \_ |  |
| 2.8. | Rated voltage | V \_ |  |
| 2.9. | Voltage variation | % \_ |  |
| 2.10. | Rated frequency | Hz \_ |  |
| 2.11. | Frequency variation | % \_ |  |
| 2.12. | Rated speed | rpm \_ |  |
| 2.13. | Noise level  (Taking complete machine into account) | db \_ |  |
| 3. | Starting battery |  |  |
| 3.1. | Applicable standards | - |  |
| 3.2. | Rated voltage | V \_ |  |

REMARKS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 3.3. | Battery capacity at 25°C |  |  |  |
|  | - at 10 hours | Ah \_ |  |  |
|  | - at 1 hour | Ah \_ |  |  |
|  | enough for number of consecutive starting cycles of DG set | nos. \_ |  |  |
| 3.4. | Battery charger rating | Amp \_ |  |  |
|  | - Battery charger input/output | V \_ |  |  |
|  | voltage |  |  |  |
|  | - Winding connection |  |  |  |
|  | - Overload capacity | % \_ |  |  |
|  | - Type of earthing |  |  |  |
| 3.5. | Type of battery | - |  |  |
| **13.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Diesel engine |  |  |  |
| 1.1. | Number of cylinders | - |  |  |
| 1.2. | Cylinder arrangement | - |  |  |
| 1.3. | Cylinder bore | mm \_ |  |  |
| 1.4. | Cylinder stroke | mm \_ |  |  |
| 2. | Generator |  |  |  |
| 2.1. | Insulation class of winding | - |  |  |
| 2.2. | Winding temperature rise at rated output | K \_ |  |  |
| 2.3. | Protection class of enclosure | - |  |  |
| 2.4. | Protection class of panel |  |  |  |
| 2.5. | Details of generator excitation |  |  |  |

system

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 3. | DG auxiliaries |  |  |  |
| 3.1. | Power requirements |  |  |  |
|  | - cooling fan motor | kW \_ |  |  |
|  | - fuel oil transfer pump | kW \_ |  |  |
|  | - total power requirements for complete system | kW \_ |  |  |
| 3.2. | Capacity of day tank | l \_ |  |  |
| 3.3. | Capacity of main oil storage tank | l x พ3 |  |  |

|  |  |  |
| --- | --- | --- |
| 4. | Weight | |
| 4.1. | Weight of complete DG set including base frame | kg |
| 4.2. | Weight of |  |
|  | - engine | kg |
|  | - generator | kg |
| 5. | Dimensions |  |
| 5.1. | Complete diesel generator set including base frame |  |
|  | - length | mm |
|  | - height | mm |
|  | - width | mm |
| 5.2. | Radiator heat exchanger |  |
|  | - depth | mm |
|  | - height | mm |
|  | - width | mm |
| 5.3. | Main oil storage tank |  |
|  | - length | mm |
|  | - height | mm |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | - width | mm \_ |  |  |
| 5.4. | Day tank |  |  |  |
|  | - length | mm \_ |  |  |
|  | - height | mm \_ |  |  |
|  | - width | mm \_ |  |  |
| 6. | Conditions of transport |  |  |  |
| 6.1. | Heaviest part for transportation |  |  |  |
|  | - With a weight of | Kg. \_ |  |  |
|  | - Overall shipping dimension | m x m x \_ |  |  |
|  | (LxWxH) | m |  |  |
| 6.2. | Largest part for transportation |  |  |  |
|  | - With a weight of | Kg. \_ |  |  |
|  | - Overall shipping dimension | m x m x \_ |  |  |
|  | (LxWxH) | m |  |  |
| 6.3. | Heaviest part for erection |  |  |  |
|  | - With a weight of | Kg. \_ |  |  |
|  | - Dimension | m x m x \_ |  |  |
|  | (LxWxH) | m |  |  |

**13.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Station layout and foundation details for DG set

๏ Pamphlet of proposal DG set with description of

o fuel injection

o governor characteristics

o voltage regulation

o control and protection

o cooling arrangement

o Handling equipment capacity

# **Drainage and Dewatering System**

(Details shall be furnished separately for drainage & dewatering equipment’s).

**14.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Manufacturer of pumps | - |  |  |
| 2. | Type designation | - |  |  |
| 3. | Applicable standards | - |  |  |
| 4. | Number of pumps | pcs \_ |  |  |
| 5. | Type of pumps |  |  |  |
| 6. | Maximum dynamic head | m \_ |  |  |
| 7. | Unit discharge corresponding to head | l/min. \_ |  |  |
| 8. | Maximum shut-off head of pumps | m \_ |  |  |
| 9. | Speed of pump | rpm \_ |  |  |
| 10. | Pump impeller |  |  |  |
|  | ^ diameter | - |  |  |
|  | ^ material of impeller | - |  |  |
| 11 | Column Pipe |  |  |  |
|  | ^ Length | - |  |  |
|  | ^ Diameter | - |  |  |
| 12 | Type of motor | - |  |  |
| **14.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Pump motor rating |  |  |  |
|  | ^ rated power | kW \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | ^ supply voltage | V \_ |  |  |
|  | ^ frequency | Hz \_ |  |  |
| 2. | Kind of measures to prevent water hammer, if any | - |  |  |
| 3. | Piping |  |  |  |
|  | ^ nominal pressure | kPa \_ |  |  |
|  | ^ pipe material | - |  |  |
|  | ^ lagging material | - |  |  |
| 4. | Weight of complete pump (with motor) | kg \_ |  |  |
| 5. | Type of level sensors |  |  |  |
| 6. | Total time for dewatering unit |  |  |  |
| 7. | Gate / Valve Sizes |  |  |  |
| 8. | Check valve sizes |  |  |  |

**14.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Pamphlets of the proposed pumps for drainage and dewatering systems giving the following information

* pump flow characteristics for drainage and dewatering pumps
* cross section of drainage and dewatering pumps with motor
* description of the mechanical sealing system
* description of the leakage detection system
* method of level sensing for operation of pumps
* description of starter panel

# **Electric overhead travelling (EOT) cranes for Powerhouse and Valve House**

(Details shall be furnished separately for both Powerhouse and valve house cranes as per  
specification)

**15.1 Guaranteed characteristics:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type & designation | - |  |  |
| 1.4. | Type of control (VVVF / conventional) |  |  |  |
| 1.5. | Applicable standards | - |  |  |
| 2. | Main data |  |  |  |
| 2.1. | Mechanism class of crane | - |  |  |
| 2.2. | Rated capacity |  |  |  |
|  | ^ main hoist | t \_ |  |  |
|  | ^ auxiliary hoist | t \_ |  |  |
| 2.3. | Crane span (centre to centre of rails) | m \_ |  |  |
| 2.4. | Normal operating speeds (at rated load) |  |  |  |
|  | ^ bridge travel (long) | m/min. \_ |  |  |
|  | ^ trolley travel (cross) | m/min. \_ |  |  |
|  | ^ main hoist lift / lower | m/min. \_ |  |  |
|  | ^ auxiliary hoist lift / lower | m/min. \_ |  |  |
| 2.5. | Creeping speeds (at rated load) |  |  |  |
|  | ^ bridge travel (long) | m/min. \_ |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| ^ trolley travel (cross) | | m/min. |
|  | ^ main hoist lift / lower | m/min. |
|  | ^ auxiliary hoist lift / lower | m/min. |
| 2.6. | Jog movement |  |
|  | ^ bridge travel (long) | mm |
|  | ^ trolley travel (cross) | mm |
|  | ^ main hoist lift / lower | mm |
|  | ^ auxiliary hoist lift / lower | mm |
| 2.7. | Total lift (from unloading bay) |  |
|  | ^ main hook | m |
|  | ^ auxiliary hook | m |
| 2.8. | Total lift (from erection bay) |  |
|  | ^ main hook | m |
|  | ^ auxiliary hook | m |
| 2.9. | Total drop of hook below erection bay |  |
|  | ^ main hook | m |
|  | ^ auxiliary hook | m |
| 2.10. | Hook reaches on U/S from rail C.L. |  |
|  | ^ Main hook | m |
|  | ^ Auxiliary hook | m |
| 2.11. | Hook reaches on D/S from rail C.L. |  |
|  | ^ Main hook | m |
|  | ^ Auxiliary hook | m |
| 2.12. | Working clearance for crane between C.L. of crane rail and nearest side obstruction | mm |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | อ On U/S อ On D/S | mm \_ |  |  |
| 2.13. | Main Hook reach in longitudinal direction from unloading bay wall | m \_ |  |  |
| 2.14. | Main Hook reach in longitudinal direction from power house end wall | m \_ |  |  |
| 2.15. | Method of achieving creep speed |  |  |  |
| 2.16. | Acceleration / deceleration |  |  |  |
|  | ^ bridge travel | m/sec2 \_ |  |  |
|  | ^ trolley travel | m/sec2 \_ |  |  |
| 2.17. | Lowest factor of safety (referred to yield strength)  ^ for most strained structural crane |  |  |  |
|  | part | - |  |  |
|  | ^ for wire rope | - |  |  |
| 2.18. | Maximum vertical deflection of bridge girder |  |  |  |
|  | ^ at rated load | mm \_ |  |  |
|  | ^ at test overload | mm \_ |  |  |
| 2.19. | Typical values of unit stresses assumed on most critical items (with |  |  |  |
|  | designation) | N/mm2 \_ |  |  |
| 2.20. | Test overloads |  |  |  |
|  | ^ on main hoist | kg \_ |  |  |
|  | ^ on auxiliary hoist | kg \_ |  |  |
| 2.21. | Hoisting rope - Main hook  ^ Diameter of hoisting rope  ^ Rope construction  ^ Applicable standard |  |  |  |

*&* No. of falls

si Minimum Factor of safety

& Quality of steel

& Name of manufacturer

2.22. Hoisting rope - Auxiliary hook

& Diameter of hoisting rope

& Rope construction

& Applicable standard

& No. of falls

& Minimum Factor of safety

& Quality of steel

& Name of manufacturer

**14.1 Informative data**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Bridge travel mechanism |  |  |  |
| 1.1. | Number of motors  & Type of motor  & Make |  |  |  |
|  | & normal speed | pcs \_ |  |  |
|  | & creeping speed | pcs \_ |  |  |
| 1.2. | Rated power of motor |  |  |  |
|  | & normal speed | kW \_ |  |  |
|  | & creeping speed | kW \_ |  |  |
| 1.3. | Rated voltage | V \_ |  |  |
| 1.4. | Rated frequency | Hz \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1.5. | Relative duty factor |  |  |  |
|  | ^ normal speed | % \_ |  |  |
|  | ^ creeping speed | % \_ |  |  |
| 1.6. | Cyclic duty factor (cdf) |  |  |  |
| 1.7. | No. of starts per hour - > 150 |  |  |  |
| 1.8. | Number of wheels | pcs \_ |  |  |
| 1.9. | Diameter of wheels |  |  |  |
| 1.10. | Material / chemical composition |  |  |  |
| 1.11. | Type of bearings |  |  |  |
| 1.12. | Type of brake provided |  |  |  |
| 2. | Trolley drive mechanism |  |  |  |
| 2.1. | Number of motors |  |  |  |
|  | si Type of motor |  |  |  |
|  | ^ Make |  |  |  |
|  | ^ normal speed | pcs \_ |  |  |
|  | ^ creeping speed | pcs \_ |  |  |
| 2.2. | Rated power of motor |  |  |  |
|  | ^ normal speed | kW \_ |  |  |
|  | ^ creeping speed | kW \_ |  |  |
| 2.3. | Rated voltage | V \_ |  |  |
| 2.4. | Rated frequency | Hz \_ |  |  |
| 2.5. | Relative duty factor |  |  |  |
|  | ^ normal speed | % \_ |  |  |
|  | ^ creeping speed | % \_ |  |  |
| 2.6. | Cyclic duty factor (cdf) |  |  |  |
| 2.7. | No. of starts per hour - > 150 |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.8. | Number of wheels | pcs \_ |  |  |
| 2.9. | Diameter of wheels |  |  |  |
| 2.10. | Material / chemical composition |  |  |  |
| 2.11. | Type of bearings |  |  |  |
| 2.12. | Type of brake provided |  |  |  |
| 3. | Hoisting mechanism of main hook |  |  |  |
| 3.1. | Number of motors |  |  |  |
|  | ^ Type of motor |  |  |  |
|  | ^ Make |  |  |  |
|  | ^ normal speed | pcs \_ |  |  |
|  | ^ creeping speed | pcs \_ |  |  |
| 3.2. | Rated power of motor |  |  |  |
|  | ^ normal speed | kW \_ |  |  |
|  | ^ creeping speed | kW \_ |  |  |
| 3.3. | Rated voltage | V \_ |  |  |
| 3.4. | Rated frequency | Hz \_ |  |  |
| 3.5. | Relative duty factor |  |  |  |
|  | ^ normal speed | % \_ |  |  |
|  | ^ creeping speed | % \_ |  |  |
| 3.6. | Cyclic duty factor (cdf) |  |  |  |
| 3.7. | No. of starts per hour - > 150 |  |  |  |
| 3.8. | Type of load brake | - |  |  |
| 3.9. | Type of holding brake | - |  |  |
| 4. | Hoisting mechanism of auxiliary hook |  |  |  |
| 4.1. | Number of motors |  |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

*&* Type of motor

si Make

^ normal speed pcs

* 1. Rated power of motor

si normal speed kW

* 1. Rated voltage V
  2. Rated frequency Hz
  3. Relative duty factor

^ normal speed %

* 1. Cyclic duty factor (cdf)
  2. No. of starts per hour - > 150
  3. Type of load brake -
  4. Type of holding brake -

1. Crane Bridge
   1. Type of main girder
   2. Material
   3. Details of construction
   4. Slenderness ratio

® Main compression members

® Bracing and secondary members

* 1. Maximum stress and F. O. S
  2. Whether bridge girder will be

transported as single piece or with splicing

* 1. Details of splicing, if applicable

1. Cabin
   1. Location of cabin

ITEM DESIGNATION UNITS VALUE REMARKS

* 1. Dimensions of cabin

1. Winding Drums
   1. Material and type of construction
   2. Diameter and length
   3. Depth of grooves
   4. Pitch diameter of rope grooves
   5. Thickness of drum from bottom of

grooves

* 1. Crushing and bending stresses for hoist

drums

1. Sheaves
   1. Material
   2. Groove diameter
   3. Number of rope falls
   4. Bearing arrangement
   5. Diameter of sheaves
   6. No. of pulleys
2. Crane hooks
   1. Type and lifting capacity of main hook
   2. Type and lifting capacity of auxiliary

hook

* 1. Applicable standard
  2. Material of hooks
  3. Bearing arrangement
  4. Name of manufacturer
  5. Whether test certificates for type and

ITEM DESIGNATION UNITS VALUE REMARKS

routine tests can be furnished

1. Gears, Gear box casing (details for each type of bearing to be furnished)
   1. Type of drive
   2. Material
   3. Gear ratio
   4. Type of lubrication
   5. Type of enclosure for gears
   6. Type of coupling between motor and

gear box

* 1. Type of coupling between gear box and

shaft

1. Current Collectors
   1. Type, size, current carrying capacity

and voltage drop in

๏ Main runway conductors

๏ Cross conductor

* 1. Material of conductors
  2. Whether current collection

arrangement spark free - details to be furnished

* 1. Power supply requirements for crane

1. Protective panel
   1. List of the protections provided for

various crane drives

* 1. Provision of emergency push button

control

* 1. Particulars of safety devices

1. Illumination
   1. Illumination arrangement below bridge

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 13.2. | Number, wattage and type of fixture |  |  |  |
|  |  |  |
| 13.3. | Illumination arrangement on bridge |
|  |  |  |
| 13.4. | and cabin  Provision for hand lamp |
|  |  |  |
| 14. | Rails |  |  |  |
| 14.1. | Section  Length |  |  |  |
| 14.2. |  |  |  |
|  |  |  |
| 14.3. | Weight per meter run |
|  |  |  |
| 14.4. | Applicable standard |
|  |  |  |
| 14.5. | Arrangement of joints between two |
|  |  |  |
|  | lengths of rails |
| 15. | Weights |  |  |  |
| 15.1. | Weight of complete crane (excl. rails) | kg \_ |  |  |
| 15.2. | Weight of trolley | \_ g |  |  |
|  |  |  |
| 15.3. | Weight of each bridge girder | kg \_ |  |  |
| 16. | Transportation |  |  |  |
| 16.1. | Largest package for shipment |  |  |  |
|  | ^ length | mm \_ |  |  |
|  | ^ width | mm \_ |  |  |
|  | ^ height | mm \_ |  |  |
| 16.2. | Heaviest package for shipment |  |  |  |
|  | ^ Name |  |  |  |
|  | ^ Weight | g. |  |  |
|  | \_ |  |  |
|  | ^ Dimensions (L x B x H)  Miscellaneous | mxmxm \_ |  |  |
| 17.  17.1. |  |  |  |
| Maximum height of the main hook |
|  |  |  |
|  | above unloading bay floor |
|  |  |  |  |  |

ITEM DESIGNATION UNITS VALUE REMARKS

* 1. Maximum height of the Auxiliary hook

above unloading bay floor

* 1. Minimum clearance from highest part

on crane to the nearest overhead obstruction

18. Details/catalogue

* 1. - Brakes
  2. si Down shop lead
  3. ^ Gears
  4. ^ Hooks
  5. ^ Control & protection panel
  6. ^ Cables
  7. ^ Down shop lead

**15.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions.

๏ Dimensional drawing of the crane showing:

o main dimensions.

o approach distances on all four sides for main hook and auxiliary hook.

o maximum height of main and auxiliary hook above erection bay floor level as well as top

of crane rail.

o minimum clearances required for crane operation above top of crane rail.

๏ Detailed calculation of capacity of the main hoist of the EOT cranes.

๏ Detailed drawings showing lifting arrangement of assembled generator, stator assembly & rotor with pole & shafts assembly & clearances.

|  |  |
| --- | --- |
|  | **132 kV Switchgear** |
| 16.1  ITEM | Guaranteed characteristics  DESIGNATION UNITS VALUE REMARKS |
| A)  1.  1.1.  1.2.  1.3.  1.4.  2.  2.1.  2.2.  2.3.  2.4.  2.5.  2.6.  2.7.  2.8.  2.9. | Circuit breaker  General  Manufacturer -  Place of manufacture -  Type designation -  Applicable standards -  Technical data  Nominal system voltage UN kV  Highest system voltage for kV  equipment Um  Rated frequency Hz  No. of poles  Rated continuous current A  Rated short time current and A, Sec  time  Maximum temperature rise of OC  different parts over an ambient of 40OC  Rated operating duty cycle  ๏ Generator transformer feeder  breaker  ๏ Outgoing feeder breaker  Operating mechanism (gang  /individual pole) for  ๏ Generator transformer feeder breaker |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION  ๏ Outgoing feeder breaker | UNITS | VALUE |
| 2.10. | Interrupting capacity based on specified duty cycle |  |  |
|  | a) Symmetrical | kArms \_ |  |
|  | b) Asymmetrical | kArms \_ |  |
| 2.11. | Maximum interrupting capacity under phase opposition | kA\_  kArms \_ |  |
| 2.12. | Rated making current capacity | kApeak \_ |  |
| 2.13. | Latching current | kApeak \_ |  |
| 2.14. | Percent d.c component | kApeak \_ |  |
| 2.15. | Maximum line charging current |  |  |
|  | breaking capacity | A \_ |  |
| 2.16. | Small inductive current breaking |  |  |
|  | capacity | A \_ |  |
| 2.17. | Cable charging current breaking capacity  First pole to clear factor  Maximum difference in the instants of closing / opening of contacts  ๏ Within a pole  ๏ Between poles | A |  |
| 2.18. | Contacts details : |  |  |

REMARKS

1. Type of contact
2. Material of contact
3. Whether contacts are silver plated or not
4. Thickness of silver plating
5. Current rating of contacts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.19. | One-minute power frequency |  |  |  |
| (i) | withstand voltage |  |  |  |
|  | a) between line terminals and |  |  |  |
|  | ground parts. |  |  |  |
|  | b) between terminals, with |  |  |  |
|  | breaker contacts open |  |  |  |
| (ii) | Impulse withstand voltage |  |  |  |
|  | a) between line terminals and |  |  |  |
|  | ground parts |  |  |  |
|  | b) between terminals with |  |  |  |
|  | breakers contacts open |  |  |  |
| 2.20. | Minimum clearance between |  |  |  |
|  | phases |  |  |  |
| 2.21. | Minimum clearance between live |  |  |  |
|  | parts to earth |  |  |  |
| 2.22. | Pole to pole spacing |  |  |  |
| 2.23. | Maximum and minimum reclosing time at full rated interrupting capacity from the instant of trip |  |  |  |
|  |  |  |  |
| coil energisation |
| 2.24. | Minimum dead time for |  |  |  |
|  | a) 3 phase auto-reclosing |  |  |  |
|  | b) single phase auto-reclosing |  |  |  |
| 2.25. | Noise level of circuit breaker |  |  |  |
| 2.26. | Impact loading during closing | Newton \_ |  |  |
|  | operation on operating mechanism |  |  |  |
| 2.27. | Load imposed on foundation | Newton \_ |  |  |
|  | when opening under fault conditions for each pole |  |  |  |
| 2.28. | Maximum radio interference | Micro- |  |  |
|  | voltage (micro-volts) between 0.5 MHz and 2 MHz at 92 kV rms in all positions of the equipment | volts |  |  |

| ITEM  B) | DESIGNATION UNITS  Isolators and Isolators cum earthing switches | VALUE |
| --- | --- | --- |
| 1. | General |  |
| 1.1. | Manufacturer - \_\_ |  |
| 1.2. | Place of manufacture - \_\_ |  |
| 1.3. | Type designation - \_ |  |
| 1.4. | Applicable standards - \_ |  |
| 2. | Technical data |  |

REMARKS

* 1. Nominal system voltage UN kV
  2. Highest system voltage for kV

equipment Um

* 1. Rated frequency Hz
  2. Maximum permissible continuous kV

service voltage

* 1. Whether single break or double

break type

* 1. Clearance in air (minimum)

1. Between phases mm
2. Between live parts and earth mm
3. Distance between centres of mm

outer stacks of insulators

1. Between fixed contacts and mm blade in open position
   1. Power frequency withstand test voltage for complete assembled isolating switches
2. Against ground
3. Dry KV
4. Wet KV
5. Across open contacts

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  a) Dry KV | UNITS | VALUE | REMARKS |
|  | b) Wet KV |  |  |  |
|  | iii) Between phases |  |  |  |
|  | a) Dry KV |  |  |  |
|  | b) Wet KV |  |  |  |
| 2.8. | Impulse withstand test voltage of completely assembled isolating switch without arcing horns with 1.2/50 microsecond impulse wave |  |  |  |
|  | a) Against ground | Peak \_ |  |  |
|  | b) Across the open ends of the | kVPeak \_ |  |  |
|  | same phase |  |  |  |
|  | c) Between phases | kVPeak \_ |  |  |
| 2.9. | 100% impulse flashover voltage of completely assembled switch with arcing horns with 1.2/50 microsecond impulse wave against ground. | kVPeak \_ |  |  |
|  |  |  |  |
| 2.10. | Particulars of the main contacts, viz. |  |  |  |
|  | a) Type |  |  |  |
|  | b) Material |  |  |  |
|  | c) Surface treatment and |  |  |  |
|  | thickness of surface coating |  |  |  |
|  | d) Contact area |  |  |  |
|  | e) Contact pressure |  |  |  |
| 2.11. | Current density at the minimum | amp/sq. \_ |  |  |
|  | cross section of switch blade | mm |  |  |
| 2.12. | Max. continuous current rating | amp \_ |  |  |
| 2.13. | Short time current rating |  |  |  |
|  | i) for 1 sec. | KArms \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  ii) for 3 sec. | UNITS  KArms \_ | VALUE | REMARKS |
| 2.14. | Rated peak short circuit current | KAPeak \_ |  |  |
| 2.15. | Rated peak short circuit current of | KAPeak \_ |  |  |
|  | earthing blade |  |  |  |
|  | a) For Isolator |  |  |  |
|  | b) For Earthing Switch |  |  |  |
| 2.16. | Temperature rise corresponding |  |  |  |
|  | to |  |  |  |
|  | a) Maximum continuous current |  |  |  |
|  | rating and 40OC ambient | OC \_ |  |  |
|  | temperature |  |  |  |
|  | b) Short time current rating |  |  |  |
|  | i) for 1 sec. | OC \_ |  |  |
|  | ii) for 3 sec. | OC \_ |  |  |
| 2.17. | Total operating time (Closing cycle |  |  |  |
|  | / opening cycle) |  |  |  |
| 2.18. | Fault current which can be made |  |  |  |
|  | by earth switch. |  |  |  |
| 2.19. | Maximum transformer |  |  |  |
|  | magnetizing breaking current |  |  |  |
|  | which can be safely interrupted by |  |  |  |
|  | the switch. |  |  |  |
| 2.20. | Maximum capacitive current |  |  |  |
|  | which can be safely interrupted by |  |  |  |
|  | the switch |  |  |  |
| 2.21. | Maximum current that can be |  |  |  |
|  | safely interrupted between equi- |  |  |  |
|  | potential bus bars |  |  |  |
| 2.22. | Phase to phase distance |  |  |  |
| 2.23. | Torque required |  |  |  |

1. to open
2. to close the isolators (Kg-m)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.24. | Maximum radio interference | Micr- |  |  |
|  | voltage for frequency between 0.5 | volts |  |  |
|  | MHz and 2 MHz at 92 kV rms |  |  |  |
| C) | 132 kV Current Transformer |  |  |  |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for | kV \_ |  |  |
|  | equipment Um |  |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Transformer feeder CT’s |  |  |  |
|  | - rated primary current | A \_ |  |  |
|  | - rated secondary current | A \_ |  |  |
|  | Current ratio/Accuracy |  |  |  |
|  | class/burden/minimum knee |  |  |  |
|  | point voltage/CT secondary |  |  |  |
|  | resistance, exciting current at |  |  |  |
|  | knee point voltage of CT - core 1 |  |  |  |
|  | - do - of core 2 |  |  |  |
|  | - do - of core 3 |  |  |  |
|  | - do - of core 4 |  |  |  |
|  | - do - of core 5 |  |  |  |
| 2.5. | Outgoing feeder CT’s |  |  |  |
|  | - rated primary current |  |  |  |
|  | - rated secondary current |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | Current ratio/Accuracy class/burden/minimum knee point voltage/CT secondary resistance, exciting current at knee point voltage of CT - core 1 |  |  |  |
|  | - do - of core 2 |  |  |  |
|  | - do - of core 3 |  |  |  |
|  | - do - of core 4 |  |  |  |
|  | - do - of core 5 |  |  |  |
| 2.6. | Following details shall be for all CTs |  |  |  |
| 2.6.1. | Rated continuous thermal current | Amp \_ |  |  |
|  | without exceeding temperature rise |  |  |  |
| 2.6.2. | Short time current rating for |  |  |  |
|  | a) One second | KArms \_ |  |  |
|  | b) Three second | KArms \_ |  |  |
| 2.6.3. | Rated dynamic circuit withstand | KAPeak \_ |  |  |
|  | current (peak value) |  |  |  |
| 2.6.4. | Instrument security factor for the | - |  |  |
|  | winding meant for measurement and metering |  |  |  |
| 2.6.5. | One minute power frequency dry | KVrms \_ |  |  |
|  | withstand test voltage between line terminal and ground on primary |  |  |  |
| 2.6.6. | One minute power frequency wet | KVrms \_ |  |  |
|  | withstand test voltage on primary side |  |  |  |
| 2.6.7. | One minute power frequency withstand test voltage on secondary side between line | KVrms \_ |  |  |
|  |  |  |  |
| terminal & ground |
| 2.6.8. | 1.2/50 micro second full wave impulse withstand test voltage |  |  |  |

between line & ground KVPeak

|  |  |  |
| --- | --- | --- |
| 2.6.9. | Maximum radio interference voltage for frequency between 0.5 MHz and 2 MHz at 92 kV rms | Micr- volts |
|  |  |
| 2.6.10. | Partial discharge | pC |
| D) | 132 kV Voltage T ransformer - Electromagnetic Type |  |
|  | (GTPs pertaining to Capacitive type Voltage Transformers are covered under section 18.0) |  |
| 1. | General | - |
| 1.1. | Manufacturer | - |
| 1.2. | Place of manufacture | - |
| 1.3. | Type designation | - |
| 1.4. | Applicable standards | - |
| 2. | Technical data |  |
| 2.1. | Nominal voltage UN | kV |
| 2.2. | Highest voltage for equipment Um | kV |
| 2.3. | Rated frequency | Hz |
| 2.4. | Number of secondary Windings | - |
|  | per PT |  |
| 2.5. | Rated transformation ratio |  |
|  | - for protection | KV/V |
|  | - for metering | KV/V |
| 2.6. | Accuracy class/related burden |  |
|  | - for protection | -/VA |
|  | - for metering | -/VA |
| 2.7. | Rated total thermal burden |  |
| 2.8. | Rated voltage factors for |  |
|  | continuous and 30 seconds at |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  rated frequency & burden | UNITS | VALUE | REMARKS |
| 2.9. | Temp. rise at 1.2 times rated continuous voltage and rated burden and frequency | OC \_ |  |  |
| 2.10. | Temp. rise at 1.5 times rated voltage for 30 seconds after stable operation at 1.2 times rated continuous voltage. | OC \_ |  |  |
| 2.11. | One minute power frequency withstand (dry) voltage on primary winding | KVrms \_ |  |  |
| 2.12. | One minute power frequency withstand (wet) voltage on primary winding | KVrms \_ |  |  |
| 2.13. | 1.2/50 micro second impulse wave withstand test voltage on primary winding | KVrms \_ |  |  |
| 2.14. | One minute power frequency withstand test voltage on secondary windings | KVrms \_ |  |  |
| 2.15. | Variation in ratio and phase angle error for variation in   1. Voltage by 1% 2. Frequency by 1 cycle |  |  |  |
| E) | 132 kV Lightning Arresters |  |  |  |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  2.2. | DESIGNATION  Highest system voltage for | UNITS  kV \_ | VALUE | REMARKS |
|  | equipment Um |  |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Rated arrester voltage | KV \_ |  |  |
| 2.5. | Nominal discharge current | Amps \_ |  |  |
| 2.6. | Maximum discharge current | Amps |  |  |
| 2.7. | Maximum continuous operating | KVrms \_ |  |  |
|  | voltage |  |  |  |
| 2.8. | Reference current of Arrester | KApeak \_ |  |  |
| 2.9. | Reference voltage of the Arrester | KV \_ |  |  |
| 2.10. | Maximum residual voltage for | KVpeak \_ |  |  |
|  | discharge current of (8/20 micro­second wave) |  |  |  |
|  | i) 10,000 Amps |  |  |  |
|  | ii) 20,000 Amps |  |  |  |
| 2.11. | Maximum residual voltage for switching impulse of peak current of 250 A and 1000A (Line discharge class 3) (30/60 micro second wave) | KVpeak \_ |  |  |
|  |  |  |  |
| 2.12. | Maximum value of Residual | KVpeak \_ |  |  |
|  | voltage for steep current impulse of nominal discharge current (1/20 micro second wave) |  |  |  |
| 2.13. | High current (Impulse) 4/10 | KVpeak \_ |  |  |
|  | micro-second wave test value |  |  |  |
| 2.14. | Long duration current tests |  |  |  |
|  | a) Charging Voltage | KV \_ |  |  |
|  | b) Virtual duration | micro- \_ |  |  |
|  | second |  |  |
|  | c) Line discharge class |  |  |  |
|  | d) Energy dissipation capability |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.15. | Insulation withstand of the arrester housing for |  |  |  |
|  | i) Lightning Impulse | Kvp \_ |  |  |
|  | ii) Power frequency voltage | KV \_ |  |  |
| 2.16. | Leakage current at Maximum continuous operating voltage |  |  |  |
|  | i) Resistive | mAp \_ |  |  |
|  | ii) Capacitive | mAp \_ |  |  |
| 2.17. | Pressure relief device class |  |  |  |
| 2.18. | Pressure relief current |  |  |  |
|  | i) High current |  |  |  |
|  | ii) Low current |  |  |  |
| 2.19. | Creepage distance of insulators | mm \_ |  |  |
| 2.20. | Minimum recommended spacing | mm \_ |  |  |
|  | between arresters centre to centre |  |  |  |
| 2.21. | Clearance required from grounded equipment at various heights of arrester unit (sketch to be attached) | mm \_ |  |  |
|  |  |  |  |
| 2.22. | Details of surge monitoring |  |  |  |
|  | equipment |  |  |  |
| 2.23. | Maximum radio interference voltage for frequency between 0.5 MHz and 2 MHz at 92 kV rms | Micro­volts |  |  |
|  |  |  |  |
| 2.24. | Partial discharge at 1.05 | pC \_ |  |  |
|  | continuous operating voltage (COV) |  |  |  |
| **16.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| A) | Circuit Breaker |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM  1. | DESIGNATION  Kilometric fault level | UNITS | VALUE |
| 2. | Maximum no. of breaks in series |  |  |
|  | per pole |  |  |
| 3. | Total length of break per pole |  |  |
| 4. | Type of devices used, if any to |  |  |
|  | obtain uniform voltage |  |  |
|  | distribution during breaks |  |  |
| 5. | Whether the circuit breaker is |  |  |
|  | fixed or trip free |  |  |
| 6. | Method of closing |  |  |
|  | a) Normal |  |  |
|  | b) Emergency |  |  |
| 7. | Type of closing mechanism |  |  |
|  | a) Normal voltage of closing coil |  |  |
|  | b) Pick up range |  |  |
|  | c) Power at normal voltage of |  |  |
|  | closing mechanism |  |  |
|  | d) Power at 85% of normal |  |  |
|  | voltage of closing mechanism |  |  |
| 8. | Type of tripping mechanism |  |  |
|  | a) Normal voltage of tripping coil |  |  |
|  | b) Pick up range |  |  |
|  | c) Power at normal voltage of |  |  |
|  | tripping mechanism |  |  |
|  | d) Power at 70% of normal |  |  |
|  | voltage of tripping mechanism |  |  |
| 9. | Total interrupting time measured |  |  |
|  | a) at 2% rated short circuit |  |  |
|  | current |  |  |
|  | b) at 10% rated short circuit |  |  |
|  | current |  |  |

REMARKS

ITEM DESIGNATION UNITS VALUE

REMARKS

1. at 30% rated short circuit

current

1. at 60% rated short circuit

current

1. at 100% rated short circuit

current

1. Closing time measurement from

the instant of application of power

to closing mechanism up to

contacts touching

1. Power for heating elements in

operating mechanism

1. Number of openings the circuit

breaker is capable of performing

without replacement of contacts

1. at 50% rated current
2. at 100% rated current
3. at current corresponding to

50% rated breaking capacity

1. at current corresponding to

100% rated breaking capacity

1. Seismic acceleration in horizontal and vertical direction for which equipment designed
2. Weight of complete circuit breaker

(three poles)

1. Shipping weight
2. Overall dimensions
3. Number of auxiliary contacts of

circuit breakers

1. Those closed when breaker is

closed

1. Those open when breaker is

closed

1. Those adjustable with respect

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  to the position of main contacts  d) Making, breaking and continuous current ratings of contacts corresponding to 110V D.C. (Inductive & resistive) | UNITS | VALUE | REMARKS |
|  |  |  |  |
| 18. | Support insulator |  |  |  |
|  | a) Name of manufacturer |  |  |  |
|  | b) Manufacturer’s type designation |  |  |  |
|  |  |  |  |
| 1. Type of insulator 2. Dry one minute power frequency test withstand voltage |
|  | KVpeak \_ |  |  |
|  |  |  |  |
|  | 1. Dry flash-over value 2. Wet flash-over value 3. 1.2/50 micro second full wave impulse withstand test voltage | KVpeak \_ |  |  |
|  |  |  |  |
|  |  |  |  |
|  | KVpeak |  |  |
|  | 1. Puncture value of insulators 2. Creepage distance 3. Weight of insulators | KVpeak \_ |  |  |
|  | mm \_ |  |  |
|  |  |  |  |
|  | Kgs |  |  |
| 19. | Type of operating mechanism |  |  |  |
|  | Spring operated mechanism if provided |  |  |  |
|  | a) Particulars of the driving |  |  |  |
|  | motor for spring charging |  |  |  |
|  | b) Type |  |  |  |
|  | c) Horse Power |  |  |  |
|  | d) A.C. voltage |  |  |  |
|  | e) Number of phases |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | | UNITS | VALUE | REMARKS |
| f) | Amperes |
|  | g) | RPM |  |  |  |
|  | h) | Protective devices provided |  |  |  |
|  | i) | for the motor  Time required for charging the |  |  |  |
|  | j) | spring  No. of operations possible |  |  |  |
|  | k) | after failure of auxiliary supply  Whether indication for spring |  |  |  |
| 20. | charged condition provided in central control cabinet  Weight of the operating | | Kg \_ |  |  |
| 21. | mechanism  Additional information for SF6 circuit breakers  a) Rated pressure of SF6 gas in | | Kg/cm2 \_ |  |  |
|  | b) | the circuit breaker  Rated pressure of SF6 gas in | Kg/cm2 \_ |  |  |
|  | c) | the gas cylinders  Quantity of SF6 gas required | Kg \_ |  |  |
|  | d) | for each breaker  Quantity of SF6 gas per | Kg \_ |  |  |
|  | e) | cylinder  Weight of empty cylinder | Kg \_ |  |  |
|  | f) | Quantity of absorbent | Kg \_ |  |  |
|  | g) | required for each breaker  Recommended interval for renewal of absorbent in case of outdoor circuit breakers operating in tropical conditions  Chemical composition of the |  |  |  |
|  | h) |  |  |  |
|  | i) | absorbent  Quantity of absorbent | Kg |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| covered in the scope of | |  |  |  |
|  | supply (including spare quantity) |  |  |  |
| j) | Limit of gas pressure for proper operation of circuit |  |  |  |
|  | breakers |  |  |  |
| k) | Pressure and temperature at which the temperature compensated gas pressure switch will |  |  |  |
|  | i) Sound alarm |  |  |  |
|  | ii) Cut off |  |  |  |
| l) | Name of SF6 gas supplier |  |  |  |
| and country of origin |  |  |  |
| m) | Quantity of SF6 gas supplied for |  |  |  |
|  | i) Actual use in breakers | Kg \_ |  |  |
|  | ii) As spare | Kg \_ |  |  |
| n) | Chemical composition of gas |  |  |  |
|  | i) Qty. of air by weight | ppm \_ |  |  |
|  | ii) Qty. of H20 by weight | ppm \_ |  |  |
|  | iii) Qty. of CF4 by weight | ppm \_ |  |  |
|  | iv) Qty. of free acid by | ppm \_ |  |  |
| weight | |  |  |  |
| o) | Weight of circuit breaker complete with operating mechanism |  |  |  |
| i) With SF6 | | Kg \_ |  |  |
| ii) Without SF6 | | Kg \_ |  |  |
| p) | Voltage and power supply system for which the temperature compensated gas pressure switch and other pressure switches are |  |  |  |
|  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  suitable | UNITS | VALUE | REMARKS |
|  | q) Details of ‘Running hour’ |  |  |  |
|  | meters |  |  |  |
|  | r) Details of ‘Start counter’ |  |  |  |
|  | s) Details of various selector |  |  |  |
|  | switches |  |  |  |
|  | t) SF6 gas density monitor | Yes/No \_ |  |  |
|  | whether provided |  |  |  |
| 22. | Insertion resistor whether provided |  |  |  |
| B) | Isolators and Isolators cum earthing switches | |  |  |
| 1. | Whether individual pole operated / gang operated |  |  |  |
|  | i) Main isolator |  |  |  |
|  | ii) Earthing switch |  |  |  |
| 2. | Whether remote as well as Local operated |  |  |  |
|  | i) Main isolator |  |  |  |
|  | ii) Earthing switch |  |  |  |
| 3. | No. of operations without any |  |  |  |
|  | need for inspection |  |  |  |
| 4. | Type of mounting |  |  |  |
| 5. | Number of break per phase | Watts \_ |  |  |
| 6. | No. of operation which the switch can withstand without deteriorating the contacts |  |  |  |
|  |  |  |  |
| 7. | Power required by each |  |  |  |
|  | interlocking coil at 110 volts and its make |  |  |  |
| 8. | Maximum power required for interlocking circuits |  |  |  |
| 9. | Safety factor taken into account |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  while designing the isolator | UNITS | VALUE | REMARKS |
| 10. | Whether adjustable gap type |  |  |  |
|  | arcing horns provided and if so, |  |  |  |
|  | the material used. |  | — | — |
| 11. | Whether connectors provided, |  |  |  |
|  | and if so, indicate the type and |  |  |  |
|  | material used |  | — | — |
| 12. | Whether 2 nos. earthing terminals |  |  |  |
|  | provided |  |  |  |
| 13. | Whether arcing contacts provided |  |  |  |
|  | and if so, give type and material |  |  |  |
|  | used |  |  |  |
| 14. | Whether separate operating |  |  |  |
|  | mechanism provided for operation |  |  |  |
|  | of main blades and earthing |  |  |  |
|  | blades |  |  |  |
| 15. | Whether suitable for diagonal |  |  |  |
|  | mounting |  |  |  |
| 16. | Location and type and number of |  |  |  |
|  | bearings |  |  |  |
| 17. | Particulars of insulators |  |  |  |
|  | a) Rotating / fixed |  |  |  |
|  | i) Make |  |  |  |
|  | ii) Type |  |  |  |
|  | iii) Size |  |  |  |
|  | iv) Strength |  |  |  |
|  | v) Weight | mm \_ |  |  |
|  | vi) No. of units per stack | mm \_ |  |  |
|  | vii) Diameter of shed | mm \_ |  |  |
|  | viii) Height of stack | mmr \_ |  |  |
|  | ix) Creepage distance | KVrms \_ |  |  |
|  | x) Dry arcing distance | KVrms \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | xi) Dry power frequency | KVrms \_ |  |  |
|  | withstand voltage |  |  |  |
|  | xii) Wet power frequency | KVrms \_ |  |  |
|  | withstand voltage |  |  |  |
|  | xiii) Dry power frequency | KVpeak \_ |  |  |
|  | flashover voltage |  |  |  |
|  | xiv) Wet power frequency | KVpeak \_ |  |  |
|  | flashover voltage |  |  |  |
|  | xv) Impulse flashover voltage | KV \_ |  |  |
|  | xvi) Impulse withstand voltage |  |  |  |
|  | xvii) Hissing voltage (at which |  |  |  |
|  | audible discharge can be |  |  |  |
|  | detected) |  | — | — |
|  | xviii) Cantilever strength |  |  |  |
|  | xix) Bending strength |  |  |  |
|  | xx) Compression strength |  |  |  |
|  | xxi) Tensile strength |  |  |  |
|  | xxii) Torsional strength | Kg \_ |  |  |
| 18. | Weight of one three-pole isolator | Kg \_ |  |  |
|  | switch without earthing blade |  |  |  |
| 19. | Weight of one three-pole-isolator |  |  |  |
|  | with earthing blade |  |  |  |
| 20. | Type of interlocking between |  |  |  |
|  | isolating switch and earthing |  |  |  |
|  | switch |  |  |  |
| 21. | Type of operating mechanism for |  |  |  |
|  | isolator & earthing switch |  |  |  |

1. Operating voltage of operating mechanism motor
2. HP of operating motor
3. Arrangement provided for maintaining synchronism

between poles

1. Shipment dimensions of largest

package

1. Details of marshalling kiosk
2. Degree of protection provided

by the enclosure

1. No. of terminals provided
2. Whether provision for adding

more terminals kept

1. Thickness of the enclosure

sheet

1. Size & weight of marshalling

kiosk

1. Number of auxiliary contacts of isolators and earth switch
2. Those closed when

isolator/earth switch is closed

1. Those open when

isolator/earth switch is closed

1. Those adjustable with respect

to the position of main contacts

1. Making, breaking and

continuous current ratings of contacts corresponding to

110V D.C. (Inductive & resistive)

1. Seismic acceleration in horizontal

and vertical direction for which

equipment designed

1. Any other, particulars not included

above.

C) 132 kV current transformer

(Separate details to be furnished

for each CT)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  1. | DESIGNATION  Creepage distance | UNITS | VALUE | REMARKS |
| 2. | Weight of oil per C.T. | Yes/No \_ |  |  |
| 3. | Class of oil | Kg \_ |  |  |
| 4. | Whether pressure relief device provided |  |  |  |
| 5. | Total weight per C.T. | mm x \_  mm x  mm |  |  |
| 6. | Magnetisation curves of C.T. cores supplied with tender |  |  |  |
| 7. | Overall dimensions | mm x \_  mm x  mm |  |  |
| 8. | Mounting details | kg \_ |  |  |
| 9. | Shipping dimensions of largest packages |  |  |  |
| 10. | Shipping weight of heaviest package |  |  |  |
| 11. | Seismic acceleration in horizontal and vertical direction for which equipment designed |  |  |  |
| 12. | Instrument security factor (as applicable) |  |  |  |
| 13. | Any other, particular(s) not included above |  |  |  |
| D) | 33kV Voltage Transformer |  |  |  |
| 1. | Whether corona shield is provided |  |  |  |
| 2. | Specification of insulating oil |  |  |  |
| 3. | Details of pressure relief device provided | kg \_ |  |  |
| 4. | Weights and dimensions | kg |  |  |
|  | a) Weight of oil | mm \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  b) Total weight | UNITS | VALUE | REMARKS |
|  | c) Overall dimension | mm \_ |  |  |
|  | d) Mounting details | kg \_ |  |  |
|  | e) Shipping dimensions of largest |  |  |  |
|  | package |  |  |  |
|  | f) Shipping weight of heaviest |  |  |  |
|  | package |  |  |  |
| 5. | Seismic acceleration in horizontal |  |  |  |
|  | and vertical direction for which |  |  |  |
|  | equipment designed |  |  |  |
| 6. | Any other information not covered |  |  |  |
|  | above. |  |  |  |
| E) | 132 kV lightning Arrester |  |  |  |
| 1. | Whether capable of discharging | kg \_ |  |  |
|  | energy of two successive |  |  |  |
|  | operations |  |  |  |
| 2. | Details of surge monitoring | mm \_ |  |  |
|  | equipment |  |  |  |
| 3. | Weight of complete unit |  |  |  |
| 4. | Height of complete unit from base |  |  |  |
|  | to the line side |  |  |  |
| 5. | Earthing arrangement provided for |  |  |  |
|  | the arrester |  |  |  |
| 6. | Mounting flange dimensional |  |  |  |
|  | details |  |  |  |
| 7. | Details of insulating base |  |  |  |
| 8. | Shipping dimensions and weight |  |  |  |
| 9. | Seismic acceleration in horizontal |  |  |  |
|  | and vertical direction for which |  |  |  |
|  | equipment designed |  |  |  |
| 10. | Any other information not |  |  |  |
|  | included above. |  |  |  |

**16.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tender may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions.

๏ Dimensional drawings of the proposed switchgear including cross sections showing arrangement of major components including control cabinet details.

๏ Description of the main features of the switchgear

๏ Description and typical illustration of the proposed bay module control cabinet preferably documented by principle diagram.

๏ Proposed erection procedures including supplier’s requirements regarding environmental conditions.

๏ Proposal on dielectric field tests including partial discharge measurements on completely assembled switchgear

๏ Pamphlet with description of the proposed gas processing unit

|  |  |
| --- | --- |
| 16.4 | Switchyard ancillary items |
| 16.4.1 | Guaranteed characteristics |
| ITEM | DESIGNATION UNITS VALUE REMARKS |
| A) | ACSR Panther conductor |
| 1. | General |
| 1.1. | Manufacturer - |
| 1.2. | Place of manufacture - |
| 1.3. | Type designation - |
| 1.4. | Applicable standards - |
| 1.5. | Quality of material and standard to - |
|  | which conforming |
| 2. | Technical data |
| 2.1. | Nominal system voltage UN kV |
| 2.2. | Highest system voltage for kV |
|  | equipment Um |
| 2.3. | Rated frequency Hz |
| 2.4. | Chemical composition |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  a) Aluminium | UNITS | VALUE | REMARKS |
|  | b) Steel |  |  |  |
|  | c) Zinc |  |  |  |
| 2.5. | Composite conductor  a) Nominal aluminium area | Sq.mm |  |  |
|  | b) Stranding and strand diameter | mm \_\_ |  |  |
|  | c) No. of strands  i) Steel layer |  |  |  |
|  | ii) Aluminium layer  1st layer |  |  |  |
|  | 2nd layer |  |  |  |
|  | 3rd layer |  |  |  |
|  | d) Sectional area of aluminium | Sq.mm \_\_ |  |  |
|  | e) Total sectional area | Sq.mm \_\_ |  |  |
|  | f) Approximate overall diameter | mm \_\_ |  |  |
|  | g) Approximate weight | kg/km \_\_ |  |  |
|  | h) Calculated maximum D.C. | Ohm/km \_\_ |  |  |
|  | resistance at 20 deg. C  i) Approximate calculated breaking | kN \_\_ |  |  |
|  | load  j) Co-efficient of linear expansion |  |  |  |
|  | per deg. C.  k) Initial modulus of elasticity | kN/mm2 \_\_ |  |  |
|  | l) Final modulus of elasticity | kN/mm2 \_\_ |  |  |

1. Lay ratio
2. Steel layer
3. Aluminium layer

1st layer

2nd layer

3rd layer

1. Continuous maximum current rating at 75OC corresponding to ambient temp. of 40OC

(calculations may be enclosed).

* 1. Strands

1. Diameter (mm)
2. Nominal
3. Maximum
4. Minimum
5. Cross-sectional area of nominal diameter wire

Sq.mm

c)

Weight

kg/km

d)

Minimum breaking load

kN

e)

2.7.

1. Before stranding
2. ) After stranding

Calculated maximum d.c. resistance at 20OC

1. Co-efficient of linear expansion

(per deg. C)

ohms/km

1. Modulus of elasticity kN/mm2
2. Initial
3. Final

Minimum stress in the steel wire corresponding to 1% elongation

kN/mm2

2.8. No. of twists on steel wire of length equal to 100 times the diameter which it can withstand according to

torsion test

* 1. Zinc coating on steel strand

1. Method of galvanizing
2. No. of 1 minute dips
3. No. of ^ minute dips
4. Minimum weight of zinc coating gm/m2
5. Quality and standard to which

zinc conforming

|  |  |  |
| --- | --- | --- |
| B) | Galvanised steel earth wire (7/3.15mm) | |
| 1. | General |  |
| 1.1. | Manufacturer | - |
| 1.2. | Place of manufacture | - |
| 1.3. | Type designation | - |
| 1.4. | Applicable standards | - |
| 1.5. | Standard to which zinc confirm | - |
| 2. | Technical data |  |
| 2.1. | Nominal system voltage UN | kV |
| 2.2. | Highest system voltage for equipment Um | kV |
| 2.3. | Rated frequency | Hz |
| 2.4. | Chemical composition |  |

1. Steel wire
2. Zinc
   1. Galvanised steel earth wire

a) Stranding, wire size and quality of wire

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | | mm  Sq.mm \_  kg \_ |  |
| b)  c)  d)  e) | Overall diameter  Cross-sectional area  Minimum breaking load  Modulus of elasticity |
|  |  | i) Initial | kN/mm2 \_ |  |
|  |  | ii) Final | kN/mm2 \_ |  |
|  | f) | Co-efficient of linear expansion (per deg. C) |  |  |
|  | g) | Calculated max. d.c. resistance at | ohms/ \_ |  |
|  |  | 20OC | km |  |
|  | h) | Length of lay   1. Maximum 2. Minimum |  |  |
|  | i) | Standard length | km \_ |  |
|  | j) | Random length | km \_ |  |
|  | k) | No. of random lengths |  |  |
| 2.6. | Single wire before stranding | |  |  |
|  | a) | Diameter | mm \_ |  |
|  | b) | Weight | kg/km \_ |  |
|  | c) | Minimum elongation in 1 m length | mm \_ |  |
|  | d) | Minimum breaking strength | kg \_ |  |
|  | e) | Minimum tensile strength | kg/Sq.m \_ m |  |
|  | f) | Calculated max. d.c. resistance at | ohms/ \_ |  |
|  |  | 20OC | km |  |
|  | g) | Normal length without joint or weld | m \_\_ |  |
|  | h) | Minimum complete turns of wrap |  |  |

|  |
| --- |
| on a material with diameter equal to four times the wire diameter |
| 2.7. Minimum elongation in 100 mm long mm |
| steel wire taken from the galvanised |
| steel ground wire |
| 2.8. Zinc coating on steel strand |
| a) Method of galvanizing |
| b) No. of 1 minute dips |
| c) No. of ^ minute dips |
| d) Minimum weight of zinc coating gm/m2 |
| e) Quality of zinc |

C) Conductor and ground wire accessories

|  |  |  |
| --- | --- | --- |
| C.1 | Conductor accessories | |
| I. | T-Connector (For ACSR Panther conductor) | |
| 1. | General |  |
| 1.1. | Manufacturer | - |
| 1.2 | Place of manufacture | - |
| 1.3 | Type designation | - |
| 1.4 | Applicable standards | - |
| 2. | Technical data |  |
| 2.1. | Nominal system voltage UN | kV |
| 2.2. | Highest system voltage for equipment Um | kV |
| 2.3. | Rated frequency | Hz |
| 2.4. | Purity of the material |  |
| 2.5. | Current rating |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  2.6. | DESIGNATION  Short time current rating | UNITS | VALUE | REMARKS |
| 2.7. | Bolt tightening torque (Nm) |  |  |  |
| 2.8. | Resistance in terms of % of equivalent length of Panther conductor |  |  |  |
| II. | PG clamp (For ACSR Panther conductor) | |  |  |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Purity of the material |  |  |  |
| 2.5. | Current rating |  |  |  |
| 2.6. | Short time current rating |  |  |  |
| 2.7. | Bolt tightening torque (Nm) |  |  |  |
| 2.8. | Resistance in terms of % of equivalent length of Panther conductor |  |  |  |

C.2 Ground wire accessories

I. Tension Clamps

1. General
   1. Manufacturer

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  1.2. | DESIGNATION  Place of manufacture | UNITS - | VALUE | REMARKS |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 1.5. | Material and standard to which conforming | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Slip strength of tension clamp as a percentage of breaking load of ground wire |  |  |  |
| 2.5. | Breaking strength of tension clamp as percentage of breaking load of ground wire |  |  |  |
| 2.6. | Resistivity as percentage of equivalent length of ground wire |  |  |  |
| 2.7. | Galvanizing  a) Process for   1. Spring washers 2. Outer ferrous parts |  |  |  |
|  | 1. Weight of zinc 2. No. of dips 3. 1 minutes 4. 1Ẩ minute 5. Quality of zinc and standard to which conforming | gm/m2 \_ |  |  |
| II. | Bonding piece |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | No. of strands and wire diameter |  |  |  |
| 2.5. | Resistance | ohms \_ |  |  |
| 2.6. | Slip strength of lugs provided on either end of earthing bond without any damage to earthing bond | kg \_ |  |  |
| D) | Insulator disc and hardware |  |  |  |
| D.1 | Single Insulator disc for 132 kV tension strings |  |  |  |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM  2.4. | DESIGNATION  Electromechanical strength | UNITS  kN \_ | VALUE |
| 2.5. | Mechanical breaking strength | KN \_ |  |
| 2.6. | Power frequency one-minute withstand voltage |  |  |
|  | a) Dry | kVrms \_ |  |
|  | b) Wet | kVrms \_ |  |
| 2.7. | Impulse 1.2x50 microsecond withstand voltage | kVpeak |  |
| 2.8. | Power frequency flashover voltage |  |  |
|  | a) Dry | kVrms \_ |  |
|  | b) Wet | kVrms \_ |  |
| 2.9. | Impulse 1.2x50 microsecond flashover voltage | KVpeak \_ |  |
| 2.10. | Power frequency puncture voltage | kVrms \_ |  |
| 2.11. | No. of insulator discs in132 kV tension string |  |  |
| D.2 | Insulator strings for 132 kV system |  |  |
| 1. | General |  |  |
| 1.1. | Manufacturer | - |  |
| 1.2. | Place of manufacture | - |  |
| 1.3. | Type designation | - |  |
| 1.4. | Applicable standards | - |  |
| 2. | Technical data |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |
| 2.3. | Rated frequency | Hz \_ |  |
| 2.4. | E.M. Strength |  |  |

REMARKS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  a) Single suspension string | UNITS  kN \_ | VALUE | REMARKS |
|  | b) Double suspension string | kN \_ |  |  |
|  | c) Single tension string | kN \_ |  |  |
|  | d) Double tension string | kN \_ |  |  |
| 2.5. | No. of discs in   1. Single suspension string 2. Double suspension 3. Single tension 4. Double tension |  |  |  |
| 2.6. | Power frequency one minute withstand voltage | kVrms |  |  |
|  | a) Arcing horn   1. Suspension 2. Tension | - |  |  |
| 2.7. | Impulse withstand voltage (dry) kV peak |  |  |  |
|  | a) Arcing horns   1. Suspension 2. Tension | - |  |  |
| 2.8. | Corona extinction voltage - kV rms |  |  |  |
|  | a) Dry / Wet  i) Suspension  ii) Tension | kVrms |  |  |
| 2.9. | Creepage distance of complete string |  |  |  |
|  | a) Suspension | - |  |  |
|  | a) Tension | - |  |  |
| 2.10. | Mechanical strength of complete |  |  |  |

insulator string along with hardware fittings

a) Single suspension insulator

|  |  |  |
| --- | --- | --- |
| strings | | |
|  | b) Double suspension insulator strings | - |
|  | c) Single tension insulator strings | - |
|  | d) Double tension insulator strings | - |
| E.3 | Hardware fittings |  |
| I | Suspension clamp assembly | - |
| 1. | General |  |
| 1.1. | Manufacturer | - |
| 1.2. | Place of manufacture | - |
| 1.3. | Type designation | - |
| 1.4. | Applicable standards | - |
| 2. | Technical data |  |
| 2.1. | Nominal system voltage UN | kV |
| 2.2. | Highest system voltage for equipment Um | kV |
| 2.3. | Rated frequency | Hz |

* 1. Galvanizing and standard to which conforming.

1. Spring washers
2. Other ferrous parts
3. Weight of zinc kg/m2
4. Number of one-minute dips
5. Number of half-minute dips
6. Quality of zinc and standard to which conforming

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE |
| 2.5. | Minimum failing load (No deformation) | kg |  |
| 2.6. | Slip strength at recommended tightening torque | kg |  |
| II | Tension clamp assembly |  |  |
| 1. | General |  |  |
| 1.1. | Manufacturer | - |  |
| 1.2. | Place of manufacture | - |  |
| 1.3. | Type designation | - |  |
| 1.4. | Applicable standards | - |  |
| 2. | Technical data |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |
| 2.3. | Rated frequency | Hz \_ |  |
| 2.4. | Suitable for (Panther conductor) | - |  |
| 2.5. | Material composition and standard to which conforming |  |  |
|  | a) Outer sleeve | - |  |
|  | b) Inner sleeve | - |  |
| 2.6. | Slip strength | kN |  |
| 2.7. | Minimum failing load (No deformation) | kN |  |
| 2.8. | Galvanizing |  |  |
|  | a) Process | - |  |
|  | 1. Weight of zinc 2. No. of dips | G/Sq.m |  |
|  | i) 1 minute | - |  |

REMARKS

1. 1Ẩ minute
   1. Electrical resistances of tension clamp as a % of equivalent length of conductor

|  |  |
| --- | --- |
| III | Other hardware fittings - |
| 1. | General |
| 1.1. | Manufacturer - |
| 1.2. | Place of manufacture - |
| 1.3. | Type designation - |
| 1.4. | Applicable standards - |
| 1.5. | Material, composition mechanical -  strength and standard to which conforming   1. Anchor shackle - 2. Chain link - 3. Yoke plate - 4. Arcing horn - 5. Split pin - 6. Socket clevis - 7. Ball clevis - 8. Clevis-Clevis - 9. Clevis eye - 10. Ball hook - 11. Socket eye horn holder type - 12. Ball eye - 13. Corona control rings - 14. Sag adjustment device - |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION  o) Turn buckle | UNITS - | VALUE | REMARKS |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Galvanizing and standard to which conforming |  |  |  |
|  | a) Spring washers | - |  |  |
|  | b) Other ferrous parts | - |  |  |
|  | c) Weight of zinc (g/ m2) | - |  |  |
|  | d) Number of one minute dips | - |  |  |
|  | e) Number of 1/4 minute dips | - |  |  |
| F | Post Insulators | - |  |  |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for equipment Um | kV \_ |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Material |  |  |  |
| 2.5. | Maximum permissible continuous service voltage | kV \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.6. | Power frequency withstand test voltage for the post insulator |  |  |  |
|  | i) Dry | kV \_ |  |  |
|  | ii) Wet | kV \_ |  |  |
| 2.7. | Lightning impulse withstand test voltage, | kVpeak \_ |  |  |
| 2.8. | Power frequency flashover voltage |  |  |  |
|  | i) Dry | kV \_ |  |  |
|  | ii) Wet | kV \_ |  |  |
| 2.9. | Minimum total creepage distance, | mm \_ |  |  |
| 2.10. | Corona extinction voltage | kV \_ |  |  |
| 2.11. | Mechanical value |  |  |  |
|  | a) Bending strength | N \_ |  |  |
|  | ii) Compression strength | N \_ |  |  |
|  | iii) Tensile strength | N \_ |  |  |
|  | iv) Torsional strength | N \_ |  |  |
|  | v) Cantilever strength | N \_ |  |  |
| 2.12. | Maximum radio interference voltage (in micro volts) for any frequency between 0.5 MHZ to2 MHZ at voltage of 92 kV (rms) between phase to ground. |  |  |  |
| G | Clamp and connectors |  |  |  |
| 1. | General |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 1.5. | Material and standard to which |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION conforming | UNITS | VALUE | REMARKS |
|  | a) Clamp body | - |  |  |
|  | b) Bolts and Nuts | - |  |  |
|  | c) Spring washer | - |  |  |
|  | d) Liner if any. | - |  |  |
| 2. | Technical data |  |  |  |
| 2.1. | Nominal system voltage UN | kV \_ |  |  |
| 2.2. | Highest system voltage for | kV \_ |  |  |
|  | equipment Um |  |  |  |
| 2.3. | Rated frequency | Hz \_ |  |  |
| 2.4. | Rated current | A \_ |  |  |
| 2.5. | Short time current rating | KA \_ |  |  |
|  | a) Rated terminal load | Kg \_ |  |  |
|  | b) Factor of safety |  |  |  |
| 2.6. | Minimum thickness of any part | mm \_ |  |  |
| 2.7. | Corona extinction voltage | KV \_ |  |  |
| 2.8. | Max. radio interference voltage level |  |  |  |
| **16.4.2** | **Informative data** |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| A) | ACSR Panther conductor |  |  |  |
| 1. | Joints in strands |  |  |  |
|  | a) Method of making joint |  |  |  |
|  | i) Steel strand |  |  |  |
|  | ii) Aluminium strand |  |  |  |
| b. | Minimum tensile strength of the finished strand with joint, if any, made in the loose rod or semi- finished wire | kN |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2. | Length |  |  |  |
|  | a) Standard length | km \_ |  |  |
|  | b) Tolerance, if any, on standard |  |  |  |
|  | length |  |  |  |
|  | c) Random length | km \_ |  |  |
|  | d) No. of random lengths |  |  |  |
| 3. | Drum |  |  |  |
|  | a) Dimensions of drum |  |  |  |
|  | b) Constructional details |  |  |  |
|  | i) Type of wood used |  |  |  |
|  | ii) No. and thickness of the piles | mm \_ |  |  |
|  | forming the flange |  |  |  |
|  | iii) No. and diameter of barrel | mm \_ |  |  |
|  | bolts |  |  |  |
|  | iv) Thickness of barrel battons | mm \_ |  |  |
|  | v) Thickness of external leggings | mm \_ |  |  |
|  | vi) Spindle hole diameter | mm \_ |  |  |
|  | vii) Details of protective wrapping |  |  |  |
|  | viii) Weight of the empty drum | kg \_ |  |  |
|  | with protective wrapping and external leggings |  |  |  |
|  | ix) Weight of the conductor on the | kg \_ |  |  |
|  | drum |  |  |  |
|  | x) Gross weight of the drum with | kg \_ |  |  |
|  | conductor and protective leggings |  |  |  |
| 4. | Standard to which the conductor drum |  |  |  |
|  | conforms |  |  |  |
| 5. | Whether the drums are suitable for use with tension stringing equipment | Yes/No. |  |  |
| B) | Galvanised steel earth wire (7/3.15mm) |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE |
| 1. | Joints in the steel strand |  |  |
|  | a) Method of making joint |  |  |
|  | b) Minimum tensile strength of the | kg \_ |  |
|  | finished strand with joint, if any, made in the base rod or semi­finished wire |  |  |
| 2. | Drum |  |  |
|  | a) Dimensions of drum |  |  |
|  | b) Constructional details |  |  |
|  | i) Type of wood used |  |  |
|  | ii) No. and thickness of the piles | mm \_ |  |
|  | forming the flange |  |  |
|  | iii) No. and diameter of barrel | mm \_ |  |
|  | bolts |  |  |
|  | iv) Thickness of barrel battons | mm \_ |  |
|  | v) Thickness of external leggings | mm \_ |  |
|  | vi) Spindle hole diameter | mm \_ |  |
|  | c) Details of protective wrapping |  |  |
|  | d) Weight of the empty drum with | kg \_ |  |
|  | protective wrapping and external leggings |  |  |
|  | e) Gross weight of the drum with | kg \_ |  |
|  | conductor and protective leggings |  |  |
| 3. | Whether the drums are suitable for use | Yes/No \_ |  |
|  | with tension stinging equipment |  |  |
| 4. | Any other information |  |  |
| C) | Conductor and ground wire accessories |  |  |
| C.1 | Conductor accessories |  |  |

I. Vibration dampers (suitable for ACSR Panther Conductor)

REMARKS

1. Total weight of each damper Kg

2. Dimension of balancing weights mm

|  |  |  |
| --- | --- | --- |
| 3. | Weight of each balancing weight | Kg |
| 4. | Quality, length and size of messenger cable |  |
| II. | T-Conductor (For ACSR Panther Conductor) |  |
| 1. | Weight | kg. |
| C.2 | Ground wire accessories |  |
| I. | Tension clamps |  |
| 1. | Weight | kG |
| 2. | Dimensions of sleeve   1. Before compression 2. After compression | mm |
| 3. | Length of sleeve   1. Before compression 2. After compression | mm |
| 4. | Angle of jumper terminal with the vertical plane | Degree |
| II. | Bonding piece |  |
| 1. | Length | mm |
| 2. | Weight | Kg |
| D) | Insulator disc and hardware |  |
| D.1 | Single Insulator disc |  |
| 1. | Dimensions |  |
|  | a) Diameter | mm |
|  | b) Spacing | mm |
|  | c) Creepage distance | mm |
| 2. | Pin-ball-shank diameter | mm |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  3. | DESIGNATION  Weight of the insulator disc | UNITS  kg \_ | VALUE | REMARKS |
| 4. | Locking device   1. Type 2. Material 3. Standard to which conforming |  |  |  |
| 5. | Socket and ball ended component   1. Standard to which conforming 2. Material and standard to which conforming 3. Process of galvanizing 4. Quality of zinc and standard to which conforming |  |  |  |
|  | 1. Weight of zinc 2. Number of one-minute dips | gm/ m2 \_ |  |  |
| D.2 | Insulator strings |  |  |  |
| 1. | Number of insulator discs   1. Single suspension 2. Double suspension 3. Single tension 4. Double tension |  |  |  |
| D.3 | Hardware fittings |  |  |  |
| I. | Suspension clamp |  |  |  |
| 1. | Weight of suspension clamp   1. Body 2. Supporting and clamping components 3. Total | Kg \_ |  |  |
| II | Tension clamp assembly |  |  |  |

1. Shape of cross section
2. Before compression
3. Aluminium
4. Steel
5. After compression
6. Aluminium
7. ) Steel
8. Dimensions of sleeve

a)Before compression

1. Aluminium
2. Sheets

b)After compression

1. Aluminium
2. Steel
3. Length of sleeve
4. Before compression
5. Aluminium
6. Steel
7. After compression
8. Aluminium
9. Steel
10. Details of dies and hydraulic compressor required for compressing sleeves of tension clamp

III Other hardware fittings

1. Whether components are inter

changeable

mm

mm

Yes/No

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| E) | Post Insulators |  |  |  |
| 1. | Height of insulator | mm \_ |  |  |
| 2. | Net weight (approx.) | mm \_ |  |  |
| 3. | Outside diameter | mm \_ |  |  |
| 4. | Type of mounting |  |  |  |
| 5. | Dimensions of the post insulator |  |  |  |
|  | i) Weight | Kg \_ |  |  |
|  | ii) Height | mm \_ |  |  |
|  | iii) Insulating part diameter | mm \_ |  |  |
|  | iv) Top pitch circle diameter | mm \_ |  |  |
|  | v) Bottom pitch circle diameter | mm \_ |  |  |
| 6. | Fixing arrangements for outdoor cylindrical post insulator   1. No. of bolts per insulator 2. Top 3. Bottom 4. Diameter of bolt holes 5. Top 6. Bottom |  |  |  |
| 7. | Any, others particulars not included above |  |  |  |
| F) | Clamp and connectors |  |  |  |
| 1. | Bolt tightening torque | Nm \_ |  |  |

**16.4.3 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Initial and final sag & tension charts for ACSR conductor & ground wires.

๏ Stress / strain data corresponding to different tensions, temperatures and time of the conductor.

๏ Curves / tables for creep compensation corresponding to different tensions, temperatures for conductors.

๏ Supporting calculations for recommending number of dampers and point of their fixation for effectively damping out the conductor vibration.

๏ Dynamic characteristics curves showing force Vs. frequency, phase angle Vs frequency and power dissipation per mm displacement per cycle Vs frequency in support of resonance frequencies in case of Vibration Dampers.

๏ Graph showing relation between power losses in watts against currents in amperes for different clamps, connectors etc.

๏ Dimensional drawings for all the items offered.

# **Switchyard structures**

**17.1 Guaranteed characteristics**

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| 1.  1.1. | General | |
| Manufacturer | - |
| 1.2. | Place of manufacture | - |
| 1.3. | Type designation | - |
| 1.4. | Applicable standards | - |
| 1.5. | Ceiling weights of structures in tonnes | - |
|  | i) Switchyard Structures as per drawings volume . | - |
|  | a) Columns designated | - |
|  | b) Beams designated | - |
|  | ii) Lighting masts | - |
|  | iii) Support Structures for 33kV | - |

switchyard equipment.

1. Circuit breakers

* Weight
* Height

1. Isolators

* Weight
* Height

1. Current transformers

* Weight
* Height

1. Potential transformers

* Weight
* Height

1. Capacitive voltage transformers

* Weight
* Height

1. Lightning arresters

* Weight
* Height

1. Post Insulators

* Weight
* Height
* v) Cable support structures
* Weight
* Height
  1. Maximum working stress employed in design.

1. Tension on net sectional area.
2. Compression on gross sectional

area at maximum slenderness ratio.

1. Shearing stress on steel bolts.
2. Bearing stress on steel bolts.
   1. Other particulars :
3. Maximum slenderness ratio used in design
4. Main leg members of columns
5. Main members of beams

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | c) Lattice member having |  |  |  |
|  | calculated stress |  |  |  |
|  | d) Members under tension only |  |  |  |
|  | e) Strut formula used |  |  |  |
|  | ii) Standards according to which |  |  |  |

properties of sections have been

adopted in design.

1. Standard specification to which the

quality of steel for the sections would conform to the mechanical properties of the type of steel offered.

1. Standard to which galvanizing shall

conform

1. Minimum sheared edge distances
2. Minimum rolled edge distances
3. Quality of zinc used for galvanizing

viii)Weight of zinc coating per ton of

structure weight and minimum thickness of zinc coating

1. Sizes of bolts and bolt holes
2. Standard to which bolts and nuts

shall conform

* 1. Factor of safety

1. Normal condition
2. Abnormal condition of broken wire

condition

**17.2 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

* Layout of structures in the switchyard
* Installation arrangement of the switchgears on the structures

Termination details etc.

Earthing arrangement of the towers with the main ground mat.

# **OLTE Equipment**

**18.1** **Guaranteed and General Technical Particulars**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  |  |  |  |  |
| 1. | Years of Manufacturing Experience | years |  |  |
| 2. | \_ General |  |  |  |
| 3. | Manufacturer of Nx2 Mbit multiplexer equipment Terminal Equipment |  |  |  |
| 4. | Type of Nx2 Mbit multiplexer equipment  Terminal Equipment |  |  |  |
| 5. | Maximum extension of transmission capacity of individual terminal by adding plug in cards. |  |  |  |
| 6. | Ditto, for multiplexer based on 2 Mbit- hierachy | ^- |  |  |
| 7. | Maximum extension of multiplexer and terminal equipment racks. |  |  |  |
| 8. | Protection class(es) of terminal equipment racks. |  |  |  |
| 9. | Construction requirement. |  |  |  |
| 10. | Operating principle of amplifiers: Optical-optical(bit rate incentive). |  |  |  |
| 11. | Operating range of fiber of fiber optic terminals. | Mbit/s |  |  |
| 12. | Operating principle of optical transmitter. |  |  |  |
| 13. | Operating parameters. |  |  |  |
| 14. | Nominal operating wave length. |  |  |  |
| 15. | Remaining overall system margin at start of life/end of life |  |  |  |
| 16. | Receiver sensitivity (at BER of 10-10) at start of life/end of life |  |  |  |
| 17. | Transmitter 1 Parameters. |  |  |  |
| 18. | Bit error rate (path including terminals) at: - n x 2 Mbit/s. |  |  |  |
| 19. | Jitter performance - n x 2 Mbit/s. |  |  |  |
| 20. | Accuracy of internal clock | ppm |  |  |
| 21. | Line code (optical) |  |  |  |
| 22. | Line code (electrical). |  |  |  |
| 23. | ITU/CCITT standards |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  |  |  |  |  |
|  | (PCM equipment). |  |  |  |
| 24. | 3. Teleportation Interface. |  |  |  |
| 25. | Electromagnetic compatibility. |  |  |  |
| 26. | - Isolation (0.5 J, 1 min.). | KV/DC |  |  |
| 27. | - Pulse 1.2/50 micro-sec | kV |  |  |
| 28. | No. of simultaneous commands |  |  |  |
| 29. | No. of analogue signals |  |  |  |
| 30. | 4. Optical Approach Cable |  |  |  |
| 31. | Manufacturer’s name |  |  |  |
|  | Type of fibers |  |  |  |
|  | Number of Optical Fibers |  |  |  |
| 32. | Overall diameter | mm |  |  |
| 33. | Weight | Kg/km |  |  |
| 1. | Core diameters | Micro-m |  |  |
| 2. | Cladding design either matched or | ^- |  |  |
|  | depressed. |  |  |  |
| 3. | Clad diameter | Micro-m |  |  |
| 4. | Core-clad concentricity. |  |  |  |
| 5. | Coating diameter. | Micro-m |  |  |
| 6. | Coating concentricity | >= |  |  |
| *-า.* | Attenuation: 1310 nm | dB/km |  |  |
| *~8.* | 1550 nm | dB/km |  |  |
| 9. | Bending attenuation: 1310 nm. | dB/km |  |  |
| 10. | 1550 nm. | dB/km |  |  |
| 11. | Temperature dependence Cut-off wave length | dB/km nm |  |  |
| 12. | Chromatic Dispersion:  Zero dispersion at  Zero dispersion slop (max) | nm Ps/nmA2 (km) |  |  |
|  | Mode filed diameter: | KA |  |  |
| 13. | 1310 nm | nm |  |  |
|  | 1550 nm | nm |  |  |
|  | Splice attenuation | dB/splice |  |  |
|  | Connector loss | dB/conne ctor |  |  |

Equipment for line protection

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  |  |  |  |  |
| 1. | Signalling system. | ^- i i | | |
| 2. | Signalling frequency band-width | ^- | | |
| 3. | Frequency spacing | ^- | |  |
| 4. | Frequency shift band width | ^- | |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  |  |  |  |  |
| 5. | Supervising pilot for protection signaling path | ^- |  |  |
|  |  |
| 6. | Nominal input / output impedance | ^- |  |  |
| 7. | Operation time - | |  | |
| 8. | Interface condition between protection relay set and this equipment | ^- |  |  |
|  | - Transmission control of the trip signal | ^- |  |  |
|  |  |
|  | - Reception output |  |  |  |
| 9. | Test facilities | ^- |  |  |
| 10. | Alarm circuit | ^- |  |  |
| 11. | Details for the code signals used for operation if any | ^- |  |  |
|  |  |
| 12. | Details of voltage level, impedance and type of connections at the input and output terminals, command relay output  T voltage rating | -  ^- |  |  |
| ] T current rating; alarm relay output 1 - | | |  | |
|  | T voltage rating - | |  |  |
|  | T current rating. Nominal output impedance | ^- |  |  |
|  |  |
| 13. | Type & current rating of the circuit breaker tripping contacts Receiver relay output | ^- |  |  |
|  |  |

14. Details of the transistors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 15. | Details of protection provided for preventing unwanted trippings | ^- |  | |
|  |  |
| 16. | Type of modulation | ^- |  |  |
| 17. | Frequency allocation | ^- |  |  |
| 18. | Operating temperature | ^- |  |  |
| 19. | Performance under Noise conditions | ^- |  |  |
|  | (while noise measured in -4Khz band width) |  |  |  |
| 20. | Transmitter | ^- |  |  |
|  | " Trip input | ^- |  |  |
|  | " Starting relay input | ^- |  |  |
|  | “ Transmission level | ^- |  |  |
| 21. | Receiver | ^- |  |  |
|  | - A.F. input | ^- |  |  |
|  | - Trip outputs | ^- |  |  |
|  | - Auxiliary outputs | ^- |  |  |
| 22. | Power supply | ^- |  |  |
| 23. | Type and voltage requirement of the relays used | ^- |  |  |
|  | - Voltage rating | ^- | — | — |

- Current rating

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  |  |  |  |  |
| 24. | Isolation voltage | ^— |  |  |
| 25. | Housing | ^— |  |  |
| 26. | Reliability in terms of fail to trip rate | ^— |  |  |
| 27. | Security in terms of false trip rate | ^— |  |  |

Electronic private automatic exchange

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| 1. | Name of manufacturer and country. — | |
| 2. | Type | — |
| 3. | Power supply — Voltage | — |
|  | — Consumption | — |
|  |  |
| 4. | Priority facilities. | — |
| 5. | Alarm or indications for failure. | — |
| 6. | Protection. | — |
| 7. | Nos. of tie lines. | — |
| 8. | Nos. of subscriber lines. | — |
| 9. | Busy key to busy links. | — |
| 10. | Nos. of connection links. | — |

**17.2 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions.

1. Public Address System

* Complete functional description of proposed system and equipments.
* Block diagrams for wall/columns/desk mounting handset stations
* Schematic wiring diagram for Public Address System.
* Power supply distribution single line diagram.
* A coustic hood diagram

1. Details of remote and four wire ‘E/M’ Interference & Subscriber unit.

Details of network protection equipment (Protection Coupler)

# **Firefighting system**

**19.1 Guaranteed Characteristics**

Water Based System-

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| A. | Centrifugal pumping set for water system : |  |  |  |
| a) | Pump particulars |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Total weight of pump | kg \_ |  |  |
| 3. | Rated dynamic head and head range | m \_ |  |  |
| 4. | Full load speed | RPM \_ |  |  |
| 5. | Size of suction inlet | mm \_ |  |  |
| 6. | Size of discharge outlet | mm \_ |  |  |
| 7. | Size of base plate, foundation bolts etc. | mm \_ |  |  |
| 8. | Shut-off head | m \_ |  |  |
| 9. | Capacity at specified total dynamic head | Litre/M \_ |  |  |
| 10. | Efficiency at above capacity at specified head | % \_ |  |  |
| 11. | Power required at above capacity | Kw \_ |  |  |
| 12. | Max. power consumption at closed discharge | Kw \_ |  |  |
| 13. | Total loss in suction | m \_ |  |  |
| 14. | Pump casing material | - |  |  |
| 15. | Impeller material | - |  |  |
| 16. | Shaft material | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 17. | Base plate material | - |  |  |
| 18. | Bearing type | - |  |  |
| 19. | Lubrication arrangement | - |  |  |
| 20. | Standards to which it conforms | - |  |  |
| b) | Motor particulars : |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Type | - |  |  |
| 3. | Rating | KW \_ |  |  |
| 4. | Rated voltage | V \_ |  |  |
| 5. | Frequency | HZ \_ |  |  |
| 6. | No. of phases | - |  |  |
| 7. | Type of enclosure and cooling | - |  |  |
| 8. | Class of insulation | - |  |  |
| 9. | Type of starting | - |  |  |
| 10. | Full load speed | RPM \_ |  |  |
| 11. | Full load current | A \_ |  |  |
| 12. | Temp. rise of rotor; stator above the ambient temp. of 400C. | OC \_ |  |  |
| 13. | Starting current as a percentage of full load current | % \_ |  |  |
| 14. | Locked rotor current | Amp \_ |  |  |
| 15. | Permissible limits of variation for satisfactory operation |  |  |  |
|  | - Variation in frequency | % \_ |  |  |
|  | - Variation in voltage | % |  |  |
| 16. | Type of terminal box | - |  |  |
| 17. | Type of bearings | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 18. | Lubrication arrangement of bearing | - |  |  |
| 19. | Overall dimensions | mm \_\_\_ |  |  |
| 20. | Standards to which it conform | - |  |  |
| c)  1. | Complete pumping unit  Overall efficiency at dynamic head | % \_\_\_ |  |  |
| 2. | Total weight of Pump and motor | Kg \_\_\_ |  |  |
| 3. | Over all dimensions | mmxmm \_\_\_ |  |  |
| 4. | Base plate dimensions | xmm  - |  |  |
| 5. | Size of base plate, foundation etc. | - |  |  |
| d)  1. | Electrical control panel  Manufacturer | - |  |  |
| 2. | Overall dimensions | mm \_\_\_ |  |  |
| 3. | Details of protection & control | - |  |  |
| 4. | provided  Make, type and rating of starter | - |  |  |
| B.  a)  1. | HV water spray protection for generator transformers  Temperature sensing elements  Manufacturer - | |  |  |
| 2. | Type of element used and material | - |  |  |
| 3. | used for sensing.  No of sensing elements used for each | Pcs \_\_\_ |  |  |
| 4. | Generator Transformer.  Operating temperature of sensing | 0C \_\_\_ |  |  |
| 5. | elements  Range of sensing | 0C \_\_\_ |  |  |
| 6. | Life of element | Years \_\_\_ |  |  |
| 7. | Maximum mechanical force | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | withstanding capacity |  |  |  |
| 8. | Duration of sensing at rated temperature for actuation of the element | - |  |  |
| b) | Spray projectors / nozzles |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Type and material used | - |  |  |
| 3. | Dimensional details of nozzles | mm \_ |  |  |
| 4. | Discharge capacity at various pressures | Lit/ \_  Minute |  |  |
| 5. | Number of projectors/Nozzles required for each Generator Transformer. | Pcs \_ |  |  |
| 6. | Details regarding anti-corrosiveness | - |  |  |
| 7. | . Whether any fine Strainer required | - |  |  |
| c) | Deluge valve |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Type and material of body | - |  |  |
| 3. | Size of the deluge valve for each Generator Transformer | - |  |  |
| 4. | Valve operating mechanism i.e. whether compressed air operated | NB |  |  |
|  | Water operated | - |  |  |
|  | Solenoid operated | - |  |  |
| 5. | Number, type and rating of auxiliary contacts | - |  |  |
| 6. | Type and particulars of auxiliary valves | - |  |  |
| 7. | Type and particulars of pressure groups | - |  |  |
| 8. | Details of Gong Siren | - |  |  |
| D | Fire Hose cabinets/RAW water hose cabinet | |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Manufacturer | - |  |  |
| 2. | Dimensional data of cabinet | - |  |  |
| 3. | Details of hose-material, dia., length | - |  |  |
| 4. | Type of nozzle provided | - |  |  |
| 5. | Details of Hose Coupling | - |  |  |
| 6. | Safe working pressure | N/m2 \_ |  |  |
| 7. | Bursting pressure | N/m2 \_ |  |  |
| 8. | . Standard to which it conforms | - |  |  |
| E. | Fire hose reel-wheeled type |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Overall size | mm \_ |  |  |
| 3. | Details of hose-material, diameter, length etc. | mm, m \_ |  |  |
| 4. | Type of nozzle provided. | - |  |  |
| 5. | Details of Fire Hose Coupling. | - |  |  |
| 6. | Safe working Pressure | N/m2 \_ |  |  |
| 7. | Bursting pressure | N/m2 \_ |  |  |
| 8. | Standard to which it conforms. | - |  |  |
| 9. | Details of Wheeled Unit. | - |  |  |
| F. | Fire hydrants |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Overall dimensional data | - |  |  |
| 3. | No. of outlets | - |  |  |
| 4. | Dia of each outlet | mm \_ |  |  |
| 5. | Dia of inlet | mm \_ |  |  |
| 6. | Details of couplings for the hose | - |  |  |

|  |  |  |
| --- | --- | --- |
| 7. | Nominal discharge capacity of each | Lit/ |
|  | outlet. | Minute |
| 8. | Standard to which it conforms. | - |
| G. | Pipes |  |
|  | (Details to be furnished for each size) |  |
| 1. | Manufacturer | - |
| 2. | Type of pipe | - |
| 3. | Material used | - |
| 4. | Inner and outer diameter | mm |
| 5. | Standard to which it conforms | - |
| H. | Gate valves |  |
|  | (Details to be furnished for each size) |  |
| 1. | Manufacturer | - |
| 2. | Type | - |
| 3. | Details of operation | - |
| 4. | Material used | - |
| 5. | Dimensional data | - |
| 6. | Inlet and outlet details | - |
| 7. | Safe working pressure | N/m2 |
| 8. | Hydraulic testing pressure | N/m2 |
| 9. | Details of stem | - |
| 10. | Standards to which it conforms | - |
| I. | Non return valve |  |
|  | (Details to be furnished for each size) |  |
| 1. | Manufacturer | - |
| 2. | Type | - |
| 3. | Details of operation | - |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 4. | Material used | - |  |  |
| 5. | Dimensional data | - |  |  |
| 6. | Inlet and outlet details | - |  |  |
| 7. | Standards to which it conforms | - |  |  |
| 8. | Safe working pressure | N/m2 \_ |  |  |
| 9. | Hydraulic testing pressure | N/m2 \_ |  |  |
| J | Tees, elbows, reducer sockets etc :  (Separate details for different sizes as per drg. |  |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Type | - |  |  |
| 3. | Material used | - |  |  |
| 4. | Size | mm \_ |  |  |
| 5. | Inlet & outlet dia. And thickness | mm \_ |  |  |
| 6. | Standard to which it conforms | - |  |  |
| K. | Pipe & valve flanges  (Separate details for different sizes as per drg.) | |  |  |
| 1. | Manufacturer | - |  |  |
| 2. | Type | - |  |  |
| 3. | Material | - |  |  |
| 4. | Inner/outer dia. & flange thickness | mm \_ |  |  |
| 5. | Details of Gaskets | - |  |  |
| 6. | No. of dia of bolts and PCD | Pcs, mm \_ |  |  |
| 7. | Standard to which it conforms | - |  |  |
| L. | Sand buckets with stand |  |  |  |
| 1. | Capacity of each bucket | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2. | No. of buckets per stand | Litres \_ |  |  |
| 3. | Material of bucket | - |  |  |
| 4. | Standard to which it conforms | - |  |  |
| M  1. | Instrumentation  Flow metres | - |  |  |
| 2. | Pressure gauges | - |  |  |
| 3. | Flow traducers | - |  |  |
| 4. | Flow indicator | - |  |  |
| **19.2 Chemical fire Extinguishers**  A. Carbon dioxide extinguishers  (Separate for hand portable & wheeled portable) | |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Manufacturer | - |  |  |
| 2. | Capacity | Kg \_ |  |  |
| 3. | Dimensional details | - |  |  |
| 4. | Fixing/mounting details | - |  |  |
| 5. | Details of operation | - |  |  |
| 6. | Details of maintenance schedule | - |  |  |
| 7. | Standard to which it conforms | - |  |  |
| 8. | . Safety measures to be adopted for | - |  |  |
| 9. | operation  Applicable standards | - |  |  |
| B. Foam type extinguishers  (Separate for hand portable & wheeled portable) | |  |  |  |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Manufacturer | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2. | Capacity | Litres \_ |  |  |
| 3. | Dimensional details | - |  |  |
| 4. | Fixing/mounting details | - |  |  |
| 5. | Details of operation | - |  |  |
| 6. | Details of maintenance schedule | - |  |  |
| 7. | Standard to which it conforms | - |  |  |
| 8. | Safety measures to be adopted for | - |  |  |

operation

# **Illumination**

**20.1** **Guaranteed & General characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | General  (Applicable to all distribution boards  (MLB, LDC) and sub distribution boards (SDBs), emergency board to be given separately for each type) |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Place of manufacture | - |  |  |
| 1.3. | Type/designation | - |  |  |
| 1.4. | Applicable standards | - |  |  |
| 2. | Main data  (details to be furnished for each type of board) |  |  |  |
| 2.1. | Dimensions (H x W x L) | mm \_ |  |  |
| 2.2. | Weight | kg \_ |  |  |
| 2.3. | Short circuit rating bus bars |  |  |  |
|  | * peak short circuit current (Is) * initial symmetrical short circuit | kApeak \_ |  |  |
|  | current (Ik“) | kArms \_ |  |  |
| 2.4. | Conductor cross sections | mm \_ |  |  |
| 2.5. | Continuous current rating | A |  |  |
| 3. | MCCB /MCB/ fuse  (to be given separately for each type) |  |  |  |
| 3.1. | Manufacturer | - |  |  |
| 3.2. | Type designation | - |  |  |
| 3.3. | Applicable standards | - |  |  |
| 3.4. | Design voltage | V \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 3.5. | Protection class (IP) | - |  |  |
| 3.6. | Rated short circuit making current | kApeak \_ |  |  |
| 3.7. | Rated symmetrical short circuit breaking | kArms \_ |  |  |
|  | current |  |  |
| 3.8. | Continuous current rating | A \_ |  |  |
| 3.9. | Whether thermal & instantaneous relays provided in MCCBs (yes/no) | - |  |  |
| 4. | Illumination of Powerhouse Complex |  |  |  |
| 4.1. | Luminaries  (To be given separately for each type) | - |  |  |
| 4.2. | Manufacturer | - |  |  |
| 4.3. | Type of luminaires | - |  |  |
| 4.4. | Applicable standard | - |  |  |
| 4.5. | Number and type of luminaires to be installed in each indoor and outdoor premises (depending on specified lux level as per specification) | nos. \_ |  |  |
| 4.6. | Lumen output for each type | - |  |  |
| 4.7. | Documentation for each type of |  |  |  |
|  | luminaires to be attached | - |  |  |
| 4.8. | Design Factors listed below considered for design of illumination system of each premises |  |  |  |
| (i) | Room index | - |  |  |
| (ii) | Maintenance factor | - |  |  |
| (iii) | Reflection factors for floor walls and ceiling | - |  |  |
| (iv) | Coefficient of utilization | - |  |  |
| 4.9. | Calculations for each indoor / outdoor premises based on specified lux level, premises size, design factors, no. of calculated luminaires, average lux level, | - |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION  ratio of max to average lux level etc to be furnished along with summarized table | UNITS | VALUE |
| 4.10. | Schematic electric distribution scheme to be furnished | - |  |
| 4.11. | Other details | - |  |
| 5. | Convenience outlets with controlling Switches |  |  |
| 5.1. | Manufacturer | - |  |
| 5.2. | Type / designation | - |  |
| 5.3. | Rated voltage | V \_ |  |
| 5.4. | Details premises wise | - |  |
| 5.5. | Schematic electric distribution scheme to be furnished | - |  |
| 6. | Illumination of Switchyard Complex |  |  |
| 6.1. | Lux level | - |  |
| 6.2. | Luminaire type | - |  |
| 6.3. | Maintenance factor | - |  |
| 6.4. | No. of fittings required | - |  |
| 6.5. | No. of fittings provided on each lighting mast at 15.0 m height | - |  |
| 6.6. | No. of fittings provided on each lighting mast at 11.5 m height | - |  |
| 7. | Ceiling fan |  |  |
| 7.1. | Manufacturer | - |  |
| 7.2. | Type / designation | - |  |
| 7.3. | Rated voltage | V \_ |  |
| 7.4. | Rated current | A \_ |  |
| 7.5. | Size | mm \_ |  |

REMARKS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM  7.6. | DESIGNATION  Duty | UNITS - | VALUE | REMARKS |
| 7.7. | Speed | rpm \_ |  |  |
| 8.  8.1. | Ballasts  Manufacturer | - |  |  |
| 8.2. | Type / designation | - |  |  |
| 8.3. | Material used | - |  |  |
| 8.4. | Normal current rating | V \_ |  |  |
| 8.5. | Voltage | A \_ |  |  |
| 8.6. | Starting current | A \_ |  |  |
| 8.7. | Power factor | - |  |  |
| 9.  9.1. | Lighting transformer  Manufacturer |  |  |  |
| 9.2. | Rating | KVA \_ |  |  |
| 9.3. | Primary voltage | V \_ |  |  |
| 9.4. | secondary voltage | V \_ |  |  |
| 9.5. | Type |  |  |  |
| 9.6. | Percentage impedance voltage | % \_ |  |  |
| 9.7. | 1 minute P.F. withstand voltage | KV \_ |  |  |
| 9.8. | Class of insulation |  |  |  |
| 9.9. | Temperature rise over ambient | K \_ |  |  |
| 9.10. | Neutral earthing arrangement |  |  |  |
| 9.11. | Vector group |  |  |  |
| 9.12. | No. & range of tap provided in tap | No \_ |  |  |
| 9.13. | changer  Short circuit withstand capacity | KA \_ |  |  |
| 9.14. | Applicable standard |  |  |  |

REMARKS

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | DESIGNATION | UnNITS | VALUE |
| 9.15. | Total weight | Kg \_ |  |
| 9.16. | Dimension (L x W x H) | mxmxm \_ |  |
| 9.17. | Material of insulation |  |  |
| 9.18. | Degree of protection | IP \_ |  |

|  |  |  |
| --- | --- | --- |
| 9.19. | Sheet metal enclosure thickness | mm |
| 10. | Lighting poles / Brackets |  |
| 10.1. | Type & manufacturer |  |
| 10.2. | Breaking strength | Kg |
| 10.3. | Whether galvanised (yes/no) |  |
| 10.4. | Height above ground | m |
| 10.5. | Height below ground | m |
| 10.6. | Inside/outside diameter | mm |
| 10.7. | Whether provision of mounting lighting fixtures provided on top (yes/no) |  |
| 10.8. | Steps | h1x h2 |
| 10.9. | Applicable standard |  |
| 11. | Cables & Wires |  |
| 11.1. | Name of manufactures |  |
|  | Type/designation |  |
| 11.2. | Voltage grade | KV |
| 11.3. | Current rating | A |
| 11.4. | Insulation |  |
| 11.5. | Conductor material |  |
| 11.6. | Sizes of conductor | mm2 |
| 11.7. | Strands per conductor | no |
| 11.8. | Whether cables/wires bear ISI marks | - |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 11.9. | Detailed literature furnished | - |  |  |
| 11.10. | IS applicable | - |  |  |
| 12. | Conduit/conduit accessories & fittings |  |  |  |
| 12.1. | Manufacture | - |  |  |
| 12.2. | Material | - |  |  |
| 12.3. | Sizes | - |  |  |
| 12.4. | Thickness | - |  |  |
| 12.5. | Detailed literature furnished | - |  |  |
| 12.6. | IS applicable | - |  |  |

# **LP Compressed Air System**

**21.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| I | HP Compressed Air System |  |  |  |
| 1. | Compressor units |  |  |  |
| 1.1. | Manufacturer | - |  |  |
| 1.2. | Type designation | - |  |  |
| 1.3. | Applicable standards | - |  |  |
| 1.4. | Number of units | nos. \_ |  |  |
| 1.5. | Capacity FAD / pressure |  |  |  |
| 1.6. | Nominal discharge pressure | bar \_ |  |  |
| 1.7. | Power consumed | kW \_ |  |  |

1.8. Outline dimensions (L x B x H)

1. Air Receivers
   1. No. and volume
   2. Dimensions (Dia. X Length)
   3. Design pressure
2. Motor
   1. Type / rating (kW) and make
   2. Voltages, phase, frequency
   3. Speed, direction of rotation
   4. Insulation, Temperature rise
   5. Torque
   6. Efficiency at full, % load
   7. Outline dimensions

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ITEM | | DESIGNATION | UNITS | | | VALUE | | REMARKS | |
| 3.8. | | Compressor Operation - (continuous / intermittent) |  | | |  | |  | |
| 4. | | Provision for auto start / stop |  | | |  | |  | |
| 5. | | After cooler details |  | | |  | |  | |
| 6. | | Maximum sound pressure level at 1 m |  | | |  | |  | |
|  | | distance | dB(A) \_ | | |  | |  | |
| II | | Details of N2 accumulator System if offered in lieu of HP Compressed Air System |  | | |  | |  | |
| III | | LP Compressed Air System for Station Services |  | | |  | |  | |
| 1. | | Compressor units |  | | |  | |  | |
| 1.1. | | Manufacturer | - | | |  | |  | |
| 1.2. | | Type designation | - | | |  | |  | |
| 1.3. | | Applicable standards | - | | |  | |  | |
| 1.4. | | Number of units | nos. \_ | | |  | |  | |
| 1.5. | | Capacity FAD / pressure |  | | |  | |  | |
| 1.6. | | Nominal discharge pressure | bar \_ | | |  | |  | |
| 1.7. | | Power consumed | kW \_ | | |  | |  | |
| 1.8. | | Outline dimensions (L x B x H) |  | | |  | |  | |
| 2. | | Air Receivers |  | | |  | |  | |
| 2.1. | | No. and volume |  | | |  | |  | |
| 2.2. | | Dimensions (Dia. X Length) |  | | |  | |  | |
| 2.3. | | Design pressure |  | | |  | |  | |
| 3. | | Motor |  | | |  | |  | |
| 3.1. | | Type / rating (kW) and make |  | | |  | |  | |
| 3.2. | | Voltages, phase, frequency |  | | |  | |  | |
| 3.1 | | Speed, direction of rotation |  | | |  | |  | |
|  | |  |  | | |  | |  | |
| ITEM | DESIGNATION | | | UNITS | VALUE | | REMARKS | |
| 3.2 | Insulation, Temperature rise | | |  |  | |  | |
| 3.3 | Torque | | |  |  | |  | |
| 3.3. | Efficiency at full, % load | | |  |  | |  | |
| 3.4. | Outline dimensions | | |  |  | |  | |
| 3.5. | Compressor Operation - (continuous / | | |  |  | |  | |
|  | intermittent) | | |  |  | |  | |
| 4. | Provision for auto start / stop | | |  |  | |  | |
| 5. | After cooler details | | |  |  | |  | |
| 6. | Maximum sound pressure level at 1 m | | |  |  | |  | |

distance

III LP Compressed Air System for Brakes

1. Air Receivers
   1. No. and volume
   2. Dimensions (Dia. X Length)
   3. Design pressure

**21.2 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Pamphlets of the proposed compressor units describing type of compressor (rotor) as well as the control and supervisory equipment and showing schematic with all accessories (e.g. oil absorber, air cooler, condensate extraction etc.)

® Details of N2 accumulator system, if offered in lieu of HP compressed air system

# **Power, control & instrumentation cable including cable trays**

(Separate particulars shall be furnished for each size of cable and cable tray)

**22.1 Guaranteed characteristics**

ITEM DESIGNATION UNITS VALUE REMARKS

|  |  |  |
| --- | --- | --- |
| 1. | 11 kV XLPE Power cables | |
| 1.1. | Manufacturer | - |
| 1.2. | Type designation | - |
| 1.3. | Applicable standards | - |
| 1.4. | Rated voltage | kV |
| 1.5. | Max. continuous rated current |  |
| A |
| 1.6. | Max. Short circuit current and duration |
|  |
| 1.7. | Whether type tests shall be carried out |  |
|  | on test sample |  |
| 1.8. | Whether routine tests shall be carried |  |
|  | out on test sample |  |
| 1.9. | Whether acceptance tests shall be |  |
|  | carried out on test sample |  |
| 1.10. | Whether flammability test shall be |  |
|  | carried out |  |
| 1.11. | Impulse withstand test voltage | kVpeak |
| 1.12. | High voltage withstand test voltage as | kVrms |
|  | type test |  |
| 1.13. | Duration of high voltage test as type | Hours |
|  | test |  |
| 1.14. | High voltage withstand test voltage as |  |
|  | routine test |  |
| 1.15. | Duration of high voltage test as routine | minutes |

test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1.16. | Test voltage at site after laying | kV \_ |  |  |
| 1.17. | Oxygen Index |  |  |  |
| 1.18. | Smoke density |  |  |  |
| 1.19. | Acid Gas |  |  |  |
| 1.20. | Flame propagation |  |  |  |
| 1.21. | Material of conductor |  |  |  |
| 1.22. | Material of insulation |  |  |  |
| 1.23. | Minimum thickness of insulation | mm \_ |  |  |
| 1.24. | Type of screen | - |  |  |
| 1.25. | Material of screen | - |  |  |
| 1.26. | Max. conductor temperature at |  |  |  |
|  |  |  |
|  | - service conditions | °C \_ |  |  |
|  | - fault conditions | °C \_ |  |  |
| 2. | Low voltage power cables  (to be filled in for every type and size of cable- 500, 240, 120, 95, 70, 50, 25, 16, 10, 6, 4 sq. mm) |  |  |  |
| 2.1. | Manufacturer | - |  |  |
| 2.2. | Type designation | - |  |  |
| 2.3. | Applicable standards | - |  |  |
| 2.4. | Rated voltage | kV \_ |  |  |
| 2.5. | Whether type tests shall be carried out on test sample |  |  |  |
| 2.6. | Whether routine tests shall be carried out on test sample |  |  |  |
| 2.7. | Whether acceptance tests shall be carried out on test sample |  |  |  |
| 2.8. | Whether flammability test shall be carried out |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.9. | High voltage withstand test voltage (at | kVrms \_ |  |  |
|  | room temperature) as type test |  |  |  |
| 2.10. | Duration of high voltage test at room temperature | minutes |  |  |
| 2.11. | High voltage AC withstand test voltage | kVrms \_ |  |  |
|  | (water immersion test) as type test |  |  |  |
| 2.12. | Duration of AC high voltage test for water immersion test | minutes \_ |  |  |
|  |  |  |  |
| 2.13. | High voltage DC withstand test voltage |  |  |  |
|  | for water immersion test |  |  |  |
| 2.14. | Duration of DC high voltage test for | Hours |  |  |
|  | immersion test |  |  |  |
| 2.15. | High voltage withstand test voltage (at |  |  |  |
|  | room temperature) as routine test |  |  |  |
| 2.16. | Duration of high voltage at room | minutes |  |  |
|  | temperature (routine test) |  |  |  |
| 2.17. | Material of conductor | - |  |  |
| 2.18. | Material of insulation | - |  |  |
| 2.19. | Minimum thickness of insulation | mm \_ |  |  |
| 2.20. | Max. conductor temperature at |  |  |  |
|  | - service conditions | °C \_ |  |  |
|  | - fault conditions | °C \_ |  |  |
| 3. | Control cables  (to be filled in for every type and size - 2C , 4C, 7C,10C,12C, 16C, 5C x 2.5 sq.  mm cables) |  |  |  |
| 3.1. | Manufacturer | - |  |  |
| 3.2. | Type designation | - |  |  |
| 3.3. | Applicable standards | - |  |  |
| 3.4. | Rated voltage | kV \_ |  |  |
| 3.5. | Whether type tests shall be carried out |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | on test sample |  |  |  |
| 3.6. | Whether routine tests shall be carried |  |  |  |
|  | out on test sample |  |  |  |
| 3.7. | Whether acceptance tests shall be |  |  |  |
|  | carried out on test sample |  |  |  |
| 3.8. | Whether flammability test shall be |  |  |  |
|  | carried out |  |  |  |
| 3.9. | High voltage withstand test voltage (at | kVrms \_ |  |  |
|  | room temperature) as type test |  |  |  |
| 3.10. | Duration of high voltage at room | minutes |  |  |
|  | temperature |  |  |  |
| 3.11. | High voltage AC withstand test voltage | kVrms \_ |  |  |
|  | (water immersion test) as type test |  |  |  |
| 3.12. | Duration of AC high voltage test for | minutes \_ |  |  |
|  | water immersion test |  |  |  |
| 3.13. | High voltage DC withstand test voltage |  |  |  |
|  | for water immersion test |  |  |  |
| 3.14. | Duration of DC high voltage test for | Hours |  |  |
|  | immersion test |  |  |  |
| 3.15. | High voltage withstand test voltage (at |  |  |  |
|  | room temperature) as routine test |  |  |  |
| 3.16. | Duration of high voltage at room | minutes |  |  |
|  | temperature (routine test) |  |  |  |
| 3.17. | Material of conductor | - |  |  |
| 3.18. | Material of insulation | - |  |  |
| 3.19. | Minimum thickness of insulation | mm \_ |  |  |
| 3.20. | Max. conductor temperature at |  |  |  |
|  | - service conditions | °C \_ |  |  |
|  | - fault conditions | °C \_ |  |  |
| 4. | Instrumentation Cables |  |  |  |
|  | (to be filled in for every type and size - |  |  |  |
|  | 16C, 24C, 12C, 8C x 0.5 sq.mm cables) |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

* 1. Manufacturer
  2. Type
  3. Standards
  4. Voltage rating
  5. Test voltage
  6. Conductor material
  7. Conductor insulation material
  8. Screening/armouring

5. Cable tray and accessories

* 1. General
     1. Manufacturer -
     2. Place of manufacture -
     3. Type designation -
  2. Applicable standards -

1. Structural steel -
2. Metal arc welding -
3. Cold rolled low carbon steel sheets -

& strips conforms

1. Hot rolled mild steel plate -
2. Hot rolled carbon steel sheets & -

strips

1. Mild steel tubes -
2. Bolts, nuts, locknuts & screws -
3. Electroplated coating of cadmium -

on steel

1. Plain washer -
2. Hot dip galvanising of steel -
3. Hot dip zinc coating
   1. Technical data for each width of Cable tray 150

mm/300mm/450mm/600mm/750mm and accessories

5.3.1. Width of cable

|  |  |  |
| --- | --- | --- |
| 5.3.2. | Height of side rails | kV |
| 5.3.3. | Spacing between ladders | Hz |
| 5.3.4. | Material | - |
| 5.3.5. | Minimum thickness |  |
|  | i) Side rail | - |
|  | ii) Range | - |
| 5.3.6. | Minimum thickness of zinc deposit | - |

**22.2 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

๏ Documentation on each of the following categories of cables and accessories:

o 11 kV power cables

o low voltage power cables

o control cables

o instrumentation cables

o cable trays

# **Public address system**

**23.1 Guaranteed Characteristics**

1. Handsets Wall / Column / Desk

mounted

|  |  |  |
| --- | --- | --- |
| a. | Manufacturer | - |
| b. | Model Number | - |
| c. | No. of handset stations |  |
| d. | Applicable standards | - |

1. Preamplifier / Line amplifier (for each - type)
2. Make / Model No. -
3. Type of system
4. Number of power amplifier
5. Re-entrant Horn type speaker (for each - type)
6. Make / Model No. -
7. Type / Mounting
8. Applicable Standards
9. Capacity
10. Cone Type Speaker (for each type)
11. Make/Model No.
12. Type. Catalogue No. and Standard
13. Applicable Standard
14. Capacity
15. Audio conference System
    1. Main console with computer
16. Make/Model No.
17. Type. Catalogue No. and Standard
18. Applicable Standard
19. Capacity
20. Video Conference System
    1. Cameras
21. Make/Model No.
22. Type. Catalogue No. and Standard
23. Applicable Standard
24. Capacity
    1. Monitors
25. Make/Model No.
26. Type. Catalogue No. and Standard
27. Applicable Standard
28. Screen size
29. Configuration
30. Display
    1. Microphones and Speakers
31. Make/Model No.
32. Type. Catalogue No. and Standard
33. Applicable Standard
34. Output Capacity
    1. Central control Cabinet
35. Make/Model No.
36. Type. Catalogue No. and Standard
37. Applicable Standard
38. Output Capacity
39. Configuration
40. General -
41. Weather proofing arrangement -

(degree of protection)

1. outdoor handsets
2. indoor handsets
3. outdoor speakers
4. indoor speakers
5. amplifier enclosures
6. Central switching system
7. Audio conference control console
8. Video conference control cabinet
9. Confirm that all required cables, Yes/No junction boxes, earth, wire and accessories like standard brackets, nut­bolts, glands, lugs, conduit sleeves etc., required to complete the system shall be provided.

# **Oil Filtration System**

**24.1 Guaranteed characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Lubricating (Bearing oil and hydraulic oil) Oil Purifying System |  |  |  |
| 1.1 | Manufacturer | - |  |  |
| 1.2 | Type designation | - |  |  |
| 1.3 | Applicable standards | - |  |  |
| 1.4 | Number supplied | pcs \_ |  |  |
| 1.5 | Rate of oil flow | l/h \_ |  |  |
| 1.6 | Capacity of purifier | m3/h \_ |  |  |
| 1.7 | Total heating capacity | kW \_ |  |  |
| 1.8 | Purifier cleaning effectiveness, |  |  |  |
|  | particulate matter down to | Om \_ |  |  |
| 2. | Trolley mounted lubricating oil tanks |  |  |  |
| 2.1 | Applicable standards | - |  |  |
| 2.2 | Number | pcs \_ |  |  |
| 2.3 | Capacity of tank | l \_ |  |  |
| 3 | Insulating Oil Purifier System |  |  |  |
|  | Manufacturer | - |  |  |
|  | Type designation | - |  |  |
|  | Applicable standards | - |  |  |
|  | Number supplied | pcs |  |  |
|  | Rate of oil flow | l/h |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | Capacity of purifier | m3/h |  |  |
|  | Total heating capacity | kW |  |  |
|  | Purifier cleaning effectiveness, particulate matter down to | Om |  |  |
| 4 | Trolley mounted insulating oil tanks |  |  |  |
|  | Applicable standards | - |  |  |
|  | Number | pcs |  |  |
|  | Capacity of tank | l |  |  |
| 5. | Instrumentation |  |  |  |
| o | **Informative Data** |  |  |  |
| 1. | Lubricating (Bearing oil and hydraulic oil) Oil Purifying System |  |  |  |
| 1.1 | Total power requirement | kW \_ |  |  |
| 1.2 | Weight of complete system | kg \_ |  |  |
| 1.3 | Overall dimensions of complete system |  |  |  |
|  | - length | mm \_ |  |  |
|  | - height | mm \_ |  |  |
|  | - width | mm \_ |  |  |

1. Trolley mounted lubricating oil tanks
   1. Overall dimensions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | - length | mm \_ |  |  |
|  | - height | mm \_ |  |  |
|  | - width | mm \_ |  |  |
| 3 | Insulating oil Purifier System |  |  |  |
|  | Total power requirement | kW |  |  |
|  | Weight of complete system | kg |  |  |

Overall dimensions of complete system

* length mm
* height mm
* width mm

Trolley mounted insulating oil tanks

Overall dimensions

* length mm
* height mm
* width mm

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 25.1 | **Ventilation System** Guaranteed Characteristics | | | |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
|  | Technical particulars |  |  |  |
| 1. | Fans (Supply / Exhaust) |  |  |  |
| 1.1. | Type of fan (centrifugal / axial flow / propeller). | - |  |  |
| 1.2. | No. of each type. | - |  |  |
| 1.3. | Purpose (supply / exhaust) | - |  |  |
| 1.4. | Location (Switchgear room / Battery room / machine hall & service bay /cable spreading room/ W.C.). | - |  |  |
| 1.5. | Capacity. | m3/hr. \_\_ |  |  |
| 1.6. | Size. | mm \_\_ |  |  |
| 1.7. | RPM | RPM \_\_ |  |  |
| 1.8. | Net power requirement of the fan and fan bearings. | KW \_\_ |  |  |
| 1.9. | Outlet velocity. | m/sec \_\_ |  |  |
| 1.10. | Static pressure. | mm of wg \_\_ |  |  |
| 1.11. | Whether Acid resistant coating provided for battery room fans. |  |  |  |
| 1.12. | Direction of rotation as viewed from drive-end. |  |  |  |
| 1.13. | Blades : |  |  |  |
|  | - No. of Blades | - |  |  |
|  | - Type of Blades (forward curved / backward curved / radial). | - |  |  |
| 1.14. | Tip speed. | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 1.15. | Type of fan shaft bearing. | - |  |  |
| 1.16. | Diameter of fan impeller. | - |  |  |
| 1.17. | Diameter of fan casing. | mm \_\_ |  |  |
| 1.18. | Type of drive with details. | mm \_\_ |  |  |
| 1.19. | Overall dimensions. | - |  |  |
| 1.20. | Type of guards with location. | mm x \_\_  mm x mm |  |  |
| 1.21. | Mounting details. | - |  |  |
| 1.22. | Fan efficiency. |  |  |  |
| 1.23. | Weight. | Kg \_\_ |  |  |
| 1.24. | Material of construction of : |  |  |  |
|  | - Fan casing | - |  |  |
|  | - Fan blades | - |  |  |
|  | - Structural base | - |  |  |
|  | - Shaft | - |  |  |
|  | - Dampers | - |  |  |
|  | - Resilient mounting | - |  |  |
| 2. | Dampers if provided |  |  |  |
| 2.1. | Manufacturer | - |  |  |
| 2.2. | Capacity | m3/hr. \_\_ |  |  |
| 2.3. | Friction drip | - |  |  |
| 2.4. | Material of construction | - |  |  |
| 2.5. | Type of control (manual / automatic) | - |  |  |
| 2.6. | Locations | - |  |  |
| 2.7. | Overall dimensions and weight | mm x \_\_ |  |  |

mm x mm

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 2.8. | No. and gauge of leaves | mm \_\_ |  |  |
| 3. | Motors |  |  |  |
| 3.1. | Manufacturer | - |  |  |
| 3.2. | Three phase / single phase | - |  |  |
| 3.3. | Location | - |  |  |
| 3.4. | Type / Designation | - |  |  |
| 3.5. | RPM at rated output | RPM \_\_ |  |  |
| 3.6. | Rating | kW/HP \_\_ |  |  |
| 3.7. | Type of enclosure | - |  |  |
| 3.8. | Starting current | A \_\_ |  |  |
| 3.9. | Full load current | A \_\_ |  |  |
| 3.10. | Winding insulation | - |  |  |
| 3.11. | Temperature rise | OC \_\_ |  |  |
| 3.12. | Duty Class |  |  |  |
| 3.13. | Minimum voltage required at the motor terminal during starting period | V \_\_ |  |  |
| 3.14. | Details of starters and control gear | - |  |  |
| 3.15. | Overall and mounting dimensions | M x M \_\_ |  |  |
| 3.16. | Net weight of motor including weight of pulley & belts | Kg \_\_ |  |  |
| 4. | Ducts if applicable |  |  |  |
| 4.1. | Materials of construction | - |  |  |
| 4.2. | Thickness of sheet metal used for various sizes of ducts. | Gauge \_\_ |  |  |
| 4.3. | Type of seams. | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 4.4. | Friction resistance of straight duct. |  |  |  |
| 4.5. | Each duct section with following details. |  |  |  |
|  | - Air flow | m3/hr |  |  |
|  | - Dimensions | mxm (LxB) |  |  |
|  | - Velocity | m/sec. |  |  |
|  | - Location | - |  |  |
|  | - Gauge of sheet metal | SWG |  |  |
| 4.6. | No. and type of bends and other fittings with friction drops in each | - |  |  |
| 4.7. | Dampers-Location, size & type. | - |  |  |
| 4.8. | Details of bracing, hangers and supports | - |  |  |
| 4.9. | Total weight of duct work | Kg \_\_ |  |  |
| 5. | Grills / Registers if applicable |  |  |  |
| 5.1. | Type and size of the various grills / registers provided | - |  |  |
| 5.2. | Air flow | m3/hr \_\_ |  |  |
| 5.3. | Outlet velocity | m/ \_\_  minute |  |  |
| 5.4. | Mounting height | m \_\_ |  |  |
| 5.5. | Angle of projection | Degree \_\_ |  |  |
| 5.6. | Air throw |  |  |  |
| 5.7. | Air drop |  |  |  |
| 5.8. | Vane ratio |  |  |  |
| 5.9. | Friction drop in grill / register |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 5.10. | Deflecting arrangement |  |  |  |
| 5.11. | Air regulating arrangement |  |  |  |
| 5.12. | Total nos. provided |  |  |  |
| 6. | Air Filters if applicable |  |  |  |
| 6.1. | Location |  |  |  |
| 6.2. | Nos. provided | Pcs. \_\_ |  |  |
| 6.3. | Overall dimensions & weight | mmxmmx \_\_ mm/kG |  |  |
| 6.4. | Type (washable/throwaway) |  |  |  |
| 6.5. | Capacity | m3/hr \_\_ |  |  |
| 6.6. | Friction drop at rated capacity | mm of \_\_  WG |  |  |
| 6.7. | Normal period when cleaning is done & method of cleaning | - |  |  |
| 7. | Any other information not included above. |  |  |  |

**25.2 Information to be supplied together with the bid**

At least the information listed hereunder shall be given by the Tenderer. The Tenderer may support advantages in his design of the delivery or of special technical features of his offer by additional documents / descriptions

1. Dimensional drawing with cross section showing provisional main dimensions of ventilation equipment
2. Description of main features of proposed ventilation system

# **Ventilation and Air conditioning system**

**26.1 Guaranteed Characteristics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | 1 DESIGNATION | UNITS | VALUE | REMARKS |
| 1. | Split Air Conditioner |  |  |  |
| a) | Make | - |  |  |
| b) | Nominal capacity | K Cal/hr. \_ |  |  |
| c) | Capacity at given ambient conditions | K Cal/hr. \_ |  |  |
| d) | Material and thickness of refrigerant | - |  |  |
|  | piping |  |  |  |
| e) | 3 phase 415V 4 wire power required | kW \_ |  |  |
| f) | Whether technical literature attached | Yes/No \_ |  |  |
| 1.1 | Condensing (outdoor) unit |  |  |  |
| i) | General | - |  |  |
|  | a) Overall dimensions Lx B x H | mm x \_ |  |  |
|  |  | mm x |  |  |
|  |  | mm |  |  |
|  | b) Weight | kg. \_ |  |  |
|  | c) 3 phase 415V wire power required | kW \_ |  |  |

ii) Compressor

|  |  |
| --- | --- |
| a) | Make of compressor |
| b) | Model |
| c) | Type of compressors |
| d) | Capacity of each compressor TR |
| e) | Compressor motor rating kW |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| iii) | Condenser |  |  |  |
| a) | Quality |  |  |  |
| b) | Face (area) |  |  |  |
| c) | No. of rows | m2 \_\_ |  |  |
| d) | Fins / CM. |  |  |  |
| e) | Tube material |  |  |  |
| f) | Fin material |  |  |  |
| g) | No. and type of fans |  |  |  |
| h) | Impeller diameter | mm \_\_ |  |  |
| i) | Speed | RPM \_\_ |  |  |
| j) | Total air quantity | m3/hr \_\_ |  |  |
| k) | Fan motor rating | (whether \_\_ |  |  |
|  |  | 1 ph./3 |  |  |
|  |  | ph. |  |  |
| 1.2 | Evaporator unit |  |  |  |
| i) | General | - |  |  |
| a) | Overall dimensions L x B x H | mm x \_\_ |  |  |
|  |  | mm x |  |  |
|  |  | mm |  |  |
| b) | Weight | Kg. \_\_ |  |  |
| ii) | Evaporator Fan |  |  |  |
| a) | No. and type of fans | - |  |  |
| b) | Impeller diameter | mm \_\_ |  |  |
| c) | Speed | RPM \_\_ |  |  |
| d) | Total air quantity | m3/hr. \_\_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| e) | Fan motor rating | kW \_ |  |  |
| iii) | Evaporator coil |  |  |  |
| a) | Face area | - |  |  |
| b) | No. of rows | - |  |  |
| c) | Fins / CM | - |  |  |
| d) | Tube material | - |  |  |
| e) | Fin material | - |  |  |
| iv) | Filter |  |  |  |
| a) | Type | - |  |  |
| b) | Size and thickness of each filter | - |  |  |
| c) | No. of filters | - |  |  |
| 2. | Drain Piping |  |  |  |
| a) | Material | - |  |  |
| b) | Size-m | mm \_ |  |  |
| c) | Total length included (including | M \_ |  |  |
|  | fittings) |  |  |  |
| 3. | Room Fan Unit |  |  |  |
| i) | Fan |  |  |  |
| a) | Make | - |  |  |
| b) | Model | - |  |  |
| c) | Impeller diameter | mm \_ |  |  |
| d) | Speed | RPM \_ |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| e) | Capacity | m3/hr. \_ |  |  |
| ii) | Motor |  |  |  |
| a) | Make | - |  |  |
| b) | Motor rating | - |  |  |
| c) | Type of enclosure | KW \_ |  |  |
| d) | Class of insulation | - |  |  |
| iii) | Filter |  |  |  |
| a) | Number of cleanable metallic viscous | - |  |  |
|  | filters provided. |  |  |  |
| b) | Size of each filter provided. | - |  |  |
| c) | Number of dry fabric filter provided. | - |  |  |
| d) | Size of each fabric filter provided. | - |  |  |
| 4. | Ducts, diffusers and accessories |  |  |  |
| i) | Ducting if necessary |  |  |  |
| a) | Material | - |  |  |
| b) | Whether all the accessories as | Yes/No \_ |  |  |
|  | specified shall be provided. If No. |  |  |  |
|  | indicate deviations |  |  |  |
| ii) | Thermal insulation |  |  |  |
| a) | Material | - |  |  |
| b) | Thickness | - |  |  |
| c) | Mode | - |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| d) | Make | - |  |  |
| iii) | Acoustic lining |  |  |  |
| a) | Material | - |  |  |
| b) | Thickness | - |  |  |
| c) | Mode | - |  |  |
| d) | Make | - |  |  |
| iv) | Diffusers |  |  |  |
| a) | Material | - |  |  |
| b) | Thickness | - |  |  |
| c) | Whether duct layout drawing attached | Yes/No \_ |  |  |
| 5. | Electrical |  |  |  |
| 5.1 | Electrical protection provided for each | Yes/No \_ |  |  |
|  | motor. |  |  |  |
| 5.2 | Type and material of wiring in the | - |  |  |
|  | scope of the bidder. |  |  |  |
| 5.3 | Details of material point on the | Yes/No \_ |  |  |
|  | condensing unit to which the |  |  |  |
|  | purchaser’s 3 P. 4 wire 415V feeder |  |  |  |
|  | could be connected. |  |  |  |
| 6. | Controls |  |  |  |
| 6.1 | Write up on control system furnished | Yes/No \_ |  |  |
| 6.2 | Protection provided for loss of | Yes/No \_ |  |  |
|  | refrigerant and over pressure due to |  |  |  |
|  | condenser trouble. |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ITEM | DESIGNATION | UNITS | VALUE | REMARKS |
| 6.3 | List of LED’s provided. | Yes/No \_ |  |  |
| 6.4 | Size of control module. | Yes/No \_ |  |  |
| 6.5 | Technical literature of control module attached. | Yes/No \_ |  |  |
| 6.6 | List of local Instruments/Gauge to be provided. | Yes/No \_ |  |  |
| 6.7 | Whether wiring diagram shall be furnished with the equipment. | Yes/No \_ |  |  |

Guaranteed Performance

We hereby declare that :

1. The Air Conditioning System shall maintain inside conditions as specified in the rooms.
2. Rating and performance figures of the equipment furnished by us are guaranteed.
3. Any defect/failure in our system shall be rectified /replaced by us free of cost up to the

period of 36 months from the date of taking over at site.