SECTION 5

Scope of Work and Technical Specifications

Bidding Document
for
Construction of 6KM Smart Roads in Shillong under the Smart Cities Mission

Tender No.: PW/CE/NH/SSCL/2020/MEG-SHI-001

Office of the Chief Engineer (NH), PWD(Roads)
Lower Lachumiere, Shillong-793001, Meghalaya.

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1 Scope of Work

1.1 General

- About 6KM of roads (exactly 5.695KM) within the limit of Area Based Development (ABD) have been identified for development as "Smart Roads" under the Shillong Smart City project.
- Geographic details of the Area Based Development and the roads identified under 6KM "Smart Roads" within ABD limit are given at para 1.2 and 1.3 below. For details of proposed design, please refer "Drawings" section of this Bidding Document. Details and drawings given in the Bidding Document for information purpose only and are relevant at Tendering Stage. Actual design for construction may vary.
- These roads are proposed to be developed as "complete streets", i.e. with proper pedestrian facilities, underground utility ducts (as far as possible and practicable), road signage, landscaping works, etc. through retrofitting.

1.2 Location of the roads in Shillong

The roads identified are within the areas/ localities of Police Bazar/ Khyndailad (commercial/ retail hub), Ward's Lake (recreational area) and Lower Lachimiere (institutional/ office area).

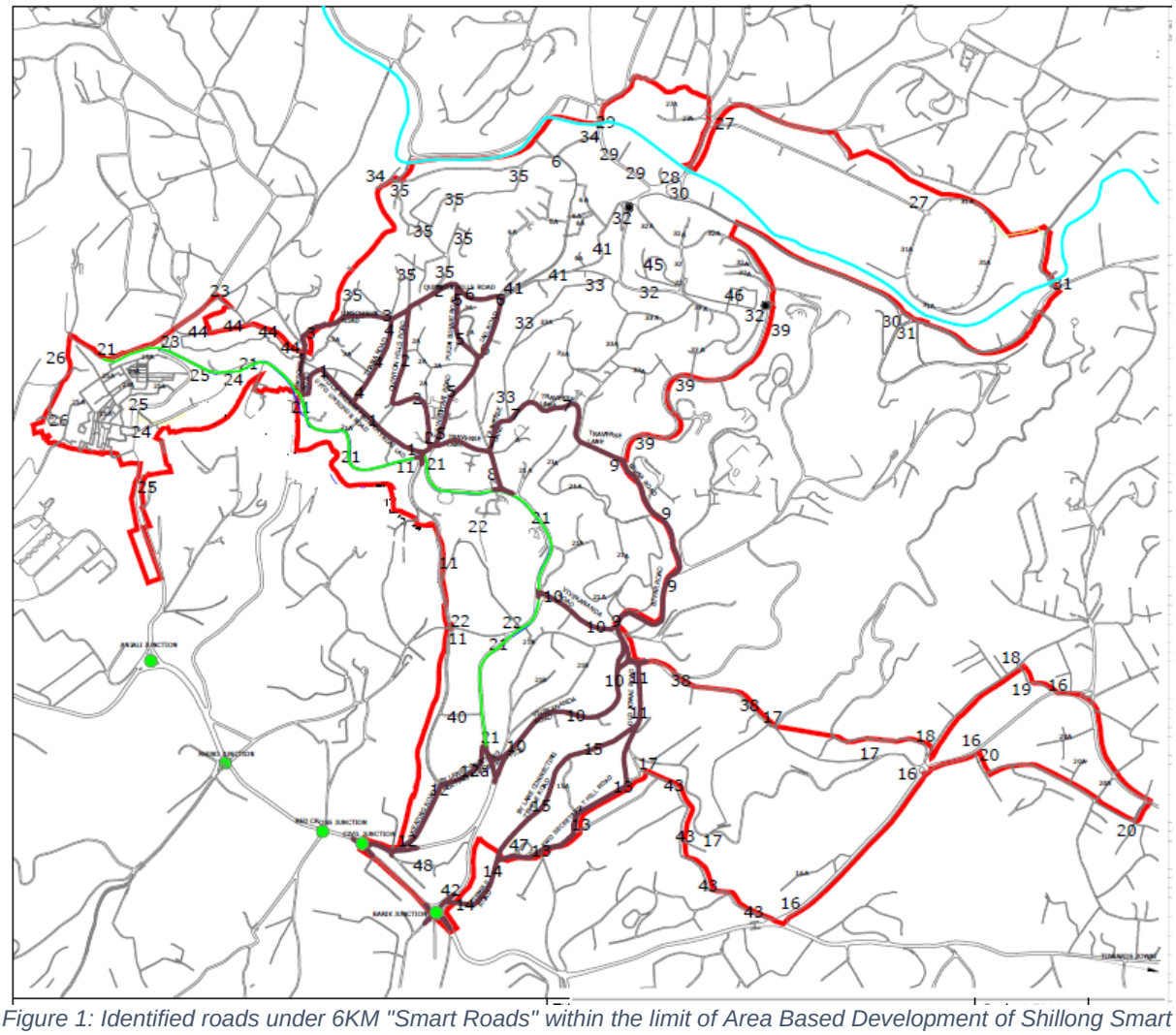

Figure 1: Identified roads under 6KM "Smart Roads" within the limit of Area Based Development of Shillong Smart City

1.3 Identified roads as part of 6KM "Smart Roads"

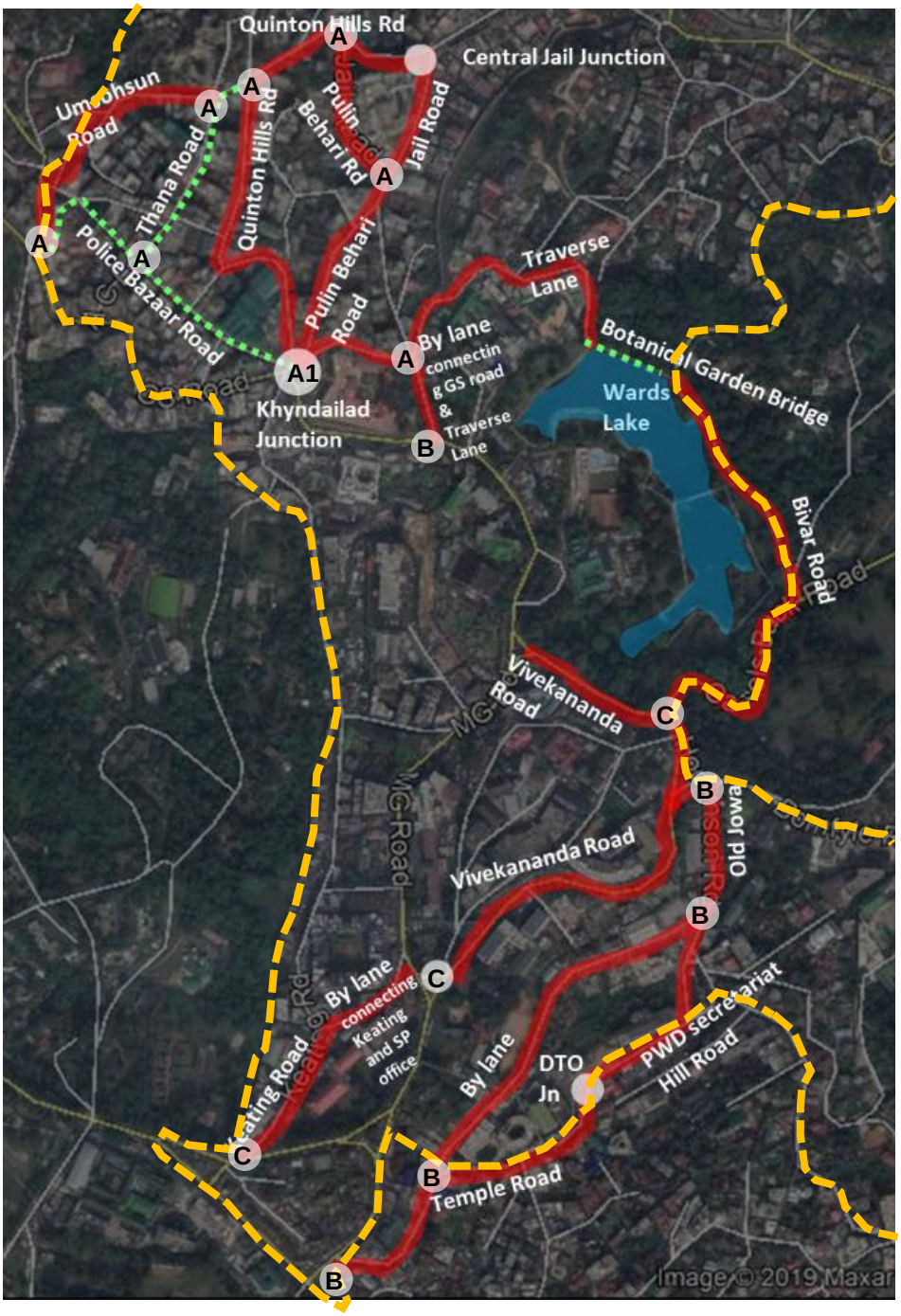

Figure 1-2:The figure showing identified smart road names

Table 1: List of roads and chainage-wise various Cross Sections

Sl. No.	Name of the Road and Chainage	Length (m)
1	Quinton Hill Road (Ch. 0+000 to Ch. 0+160)	160
2	Quinton Hill Road (Ch. 0+160 to Ch. 0+400)	240
3	Quinton Hill Road (Ch. 0+400 to Ch. 0+560)	160
4	Quinton Hill Road (Ch. 0+560 to Ch. 0+650)	90
5	Jail Road (Ch. 0+000 to Ch. 0+144)	144

Sl. No.	Name of the Road and Chainage	Length (m)
6	Pulin Bihari Road (Ch. 0+000 to Ch. 0+240)	240
7	Pulin Bihari Road (Ch. 0+240 to Ch. 0+413)	173
8	Bylane connecting Traverse Lane to G.S. Road (Ch. 0+000 to Ch. 0+100m)	100
9	Traverse lane (Ch. 0+000 to Ch. 0+450)	450
10	Police Bazaar Road (Ch. 0+000 to Ch. 0+200)	200
11	Police Bazaar Road (Ch. 0+200 to Ch. 0+419)	219
12	Thana Road (Ch. 0+000 to Ch. 0+247)	247
13	Umsohsun Road (Ch. 0+000 to Ch. 0+120)	120
14	Umsohsun Road (Ch. 0+120 to Ch. 0+340)	220
15	Bivar Road (Ch. 0+000 to Ch. 0+260)	260
16	Bivar Road (Ch. 0+260 to Ch. 0+520)	260
17	Vivekananda Road (Ch. 0+000 to Ch. 0+787)	787
18	Keating Road (Ch. 0+000 to Ch. 0+220)	220
19	By Lane connecting Keating Road to SP Office (Ch. 0+000 to Ch. 0+130)	130
20	Temple Road (Ch. 0+000 to Ch. 0+200)	200
21	Temple Road (Ch. 0+200 to Ch. 0+420)	220
22	PWD Secreatriat Hill Road (Ch. 0+000 to Ch. 0+220)	220
23	By Lane Connecting Old Jowai Road to Temple Road (Ch. 0+000 to Ch. 0+430)	430
24	Old Jowai Road (Ch. 0+000 to Ch. 0+205)	205
	TOTAL (m)	**5,695**

1.4 Detailed Scope of Work

1.4.1 Introductory note / General scope of work

- Scope of work contained in the paragraphs mentioned below is only indicative and not exhaustive. In addition, the contractor shall be responsible for executing all items required for completing the work as per direction of the Engineer-in-Charge. The price quoted shall include all the items and covers all details as may be required to meet the purpose and intents of the contract.
- The design/drawings and cost estimate are for reference only. If required and directed by the Engineer-in-Charge, the contractor will undertake necessary confirmatory Surveys/ Investigations at his own cost, including but not limited to the following:
    - Underground Utility Mapping (Ground Penetrating Radar);
    - Topographic Survey;
    - Geo-technical Investigation, etc.
- Construction related approvals from concerned Authorities will be obtained by the Contractor at his own cost.
- The Contractor shall have to prepare and submit 'As Built Drawings' depicting the exact construction

carried out on site, in editable soft (Autocad format) and hard copy (A1 size, coloured in 5 copies) format.

- The Contractor shall also prepare an Operation & Maintenance (O&M) Manual.
- The scope of work is not limited only as mentioned in above paras, but also include to address any exigency generated during tendered work execution and no extra cost shall be paid for the same.

1.4.2 Broad type of works

- The overall scope of work is divided into two parts, namely "civil works" and "electrical works".
- "Civil works" include retrofitting of the identified existing roads to develop them into "Smart Roads", such as road pavement (carriageway works); Bus Bays; junction improvement works; protected footpaths/ pedestrian walkways; pedestrian plazas; street furniture; road markings; road signages; utility ducts for various utilities such as water supply, power distribution system; communication (telephone and Optical Fiber Cables); landscaping works; storm water drainage including culverts, etc.
- "Electrical works" include all works related to Compact Sub-Stations (CSS) or other type of transformers; Ring Main Units (RMU); Compact Feeder Pillars; HT, LT (overhead or underground), etc.

1.4.3 Detailed scope under "civil works"

- Dismantling of part/whole of existing road carriageway surface, footpaths, storm water drains, etc. to house the proposed components;
- Excavation for underground utility ducts (such as Water Supply Pipeline Duct and Electrical cum Communication Duct) and Storm Water Drains;
- Plain Cement Concrete (PCC) works as base of utility ducts and storm water drains;
- Formwork;
- Reinforced Cement Concrete (RCC) works as per IS 456:2000 for foundation, side walls and covers (wherever precast covers are not used) of utility ducts and storm water drains. The size and the shape will be as per the respective drawing for different section of roads as shown in drawing. **It is important to mention that specific requirements of concerned Utility Departments/ Agencies will have to be complied with during construction. For example, for Water Supply Pipeline Ducts, the relatively bigger diameter pipelines belonging to PHED will be laid by PHED in the duct first – implying that the 'U' portion of the ducts will have to construct first. The top cover will be closed after laying of pipelines by PHED.**
- Storm Water Drains: Scope of work also includes collecting storm water from adjacent properties through pipes of appropriate material and diameter and then discharging that storm water into the proposed storm water drains, as per drawing and direction of the Engineer-in-Charge. It is the responsible of the contractor to interconnect existing drain (inlet or outlet) with the new system as applicable.
- Precast pre-moulded utility ducts/ cable tray (for electrical, communication etc.) including all associated works such as excavation, sand bed, geosynthetics, etc. complete in all respect;
- Structural Steel work within utility ducts to house cables, pipelines etc. (e.g. embedding M.S. angles within the RCC walls);
- Backfilling – with earth and sand (wherever desired compaction is required);
- Construction of footpaths/ pedestrian walkways, pedestrian plazas etc. on top of Storm Water Drains or Utility Ducts or at other locations by means of precast concrete paver blocks / concrete tiles,

including lining of ductile tiles for visually impaired persons, as per drawings and direction of the Engineer-in-Charge.

- Guard Rail;
- Embankment – wherever filling is required to maintain proper gradient, as per design and direction of the Engineer-in-Charge.
- Base layers (GSB, WMM) and Bituminous Layers (e.g. Bituminous Macadam, Bituminous Concrete, etc.) for road surface.
- Precast covers and gratings for inspection chambers/ manholes of ducts, Valve chambers, etc.
- Road markings;
- Road signage;
- Landscaping works – both soft-scaping (plantation, lawn, etc.) and hard-scaping (pedestrian plaza, street furniture such as benches, decorative lamps, etc.).

1.4.4 Detailed scope under "electrical works"

Supply, installation, testing and commissioning of the following (including Factory Acceptance Test, wherever required and/or directed by the Engineer-in-Charge):

- Compact Sub-station (CSS);
- Ring Main Units (RMUs);
- LV Feeder Pillars;
- SCADA integration;
- Field Remote Terminal Unit (FRTU);
- RTU and associated hardware;
- Moulded Case Circuit Breakers (MCCB);
- Air Circuit Breakers (ACB);
- HT Cabling;
- LT Cabling, etc.

1.5 Utility shifting and provision of temporary service connections during construction - to be done by concerned Departments/ Agencies

For removal of doubt, it is clarified that the scope of wok for shifting of utilities, wherever required, and providing temporary service connections during construction stage (if required due to shifting of utilities) is not included in the scope of work of the Contractor for 6KM "Smart Roads". These are to be done by the concerned Departments/ Agencies. However, the Contractor will extend full cooperation with the other Contractors who may be engaged by the concerned Departments/ Agencies for the utility shifting and temporary connection job. In any case, the Contractor for 6KM "Smart Roads" will be overall responsible for timely completion and accordingly, it will be required on his part that he coordinates with all concerned Departments/ Agencies for speedy utility shifting and provision of temporary connections, so that sufficient work front can be ensured on the ground.

For easy reference, the utilities vis-à-vis concerned Departments/ Agencies are mentioned below:

- Water Supply (transmission lines/ main supply lines): Public Health and Engineering Department (PHED);

- Water Supply (distribution pipelines): Shillong Municipal Board (SMB);
- Power Distribution Lines: Meghalaya Power Distribution Corporation Limited (MePDCL);
- Copper Telephone Lines: BSNL;
- Communication Cables (OFC): BSNL and respective internet or cable TV service providers (e.g. Reliance Jio, Airtel, Vodafone Idea, Express Wi-Fi, NeLine, etc.).

TECHNICAL SPECIFICATIONS FOR "CIVIL WORKS"

1.6 General Technical Specifications and Work Requirements and order of applicability of various Specifications/ Codes/ Standards/ Guidelines for civil works

The Technical Specifications mentioned below are the minimum required specifications and the Employer/Client reserves the right to select products/material that exceed the specifications. Contractors are required to submit the manufacturer datasheets, wherever applicable.

In order of applicability, the following technical specifications will be applicable:

a) Specific technical specifications mentioned in this Document will prevail over all other documents mentioned below. For items/works not specifically mentioned in this document, the following will be referred to (in order).

b) Road works (and other associated works such as RCC works for utility ducts, road signage, etc. whichever is covered) will be governed by the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" (FIFTH REVISION) 2013 along with other Addendum/Corrigendum or amendments issued up to 28 days before the final date of submission of the bid, issued by the Ministry of Road Transport and Highways (MoRT&H), Government of India and published by the Indian Roads Congress (IRC), with a cross reference to relevant Bureau of Indian Standards (BIS) for materials or other aspects not covered by the IRC.

c) Specifications of materials/ works that are not covered in the above-mentioned MoRTH Specifications 2013, will be governed by the latest Specifications Vol. 1 and 2 (2019) along with Addendum/ Corrigendum or amendments issued up to 28 days before the final date of submission of the bid, issued by the Central Public Works Department (CPWD), Ministry of Housing and Urban Affairs (MoHUA), Government of India provided that in case of Storm Water Drains, the works shall conform to CPHEEO manual on Storm Water Drainage System:1999.

d) Landscaping/ horticulture works will be governed by the specifications as contained in the "DELHI SCHEDULE OF RATES, ANALYSIS OF RATES AND SPECIFICATIONS (HORTICULTURE & LANDSCAPING)" (2018) along with Addendum/ Corrigendum or amendments issued up to 28 days before the final date of submission of the bid, issued by the Central Public Works Department (CPWD), Ministry of Housing and Urban Affairs (MoHUA), Government of India, unless otherwise mentioned hereinunder.

e) In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest codes and specifications of IRC and BIS in that order. Where even these are silent, the construction and completion of the works shall conform to sound international engineering practice as approved by the Engineer-in-Charge.

f) It is important to note that notwithstanding anything mentioned above, any particular Specification/ Standard/ Guideline/ Code that may be published by concerned Department/ Agency [PWD(B&R), PHED, Water Resources Department, MePDCL, District Administration] or local Authority (SMB) before/during construction of the project will have to be complied with by the Contractor.

1.7 Specifications of items/ works for road works

For ready reference, relevant paragraphs of major works are mentioned below:

Sl. No.	Type of work	Reference Section in the "Specifications for Road and Bridge Works (Fifth Revision)" published by MoRTH in 2013
1.	Clearing and Grubbing	Section 201

Sl. No.	Type of work	Reference Section in the "Specifications for Road and Bridge Works (Fifth Revision)" published by MoRTH in 2013
2.	Dismantling Culverts, Bridges and Other structure/ Pavements	Section 202
3.	Excavation for Roadway and Drains	Section 301
4.	Excavation for structures	Section 304
5.	Embankment Construction	Section 305
6.	Soil Erosion and Sedimentation control	Section 306
7.	Turfing with Sods	Section 307
8.	Surface/Sub-Surface Drains	Section 309
9.	Preparation and surface Treatment of Formation	Section 310
10.	Works to be Kept Free of water	Section 311
11.	Rockfill embankment	Section 313
12.	Granular Sub-Base	Section 401
13.	Lime Treated Soil for Improved Sub-Grade/Sub-Base	Section 402
14.	Cement Treated Soil and Cement-Flyash Treated Sub-Base/Base	Section 403
15.	Wet Mix Macadam Sub-Base/Base	Section 406
16.	Cement Concrete Kerb and Kerb with Channel	Section 409
17.	Footpaths and Separators	Section 410
18.	General Requirements for Bituminous Pavement Layer	Section 501
19.	Prime Coat Over Granular - Base	Section 502
20.	Tack Coat	Section 503
21.	Bituminous Macadam	Section 504
22.	Bituminous Concrete	Section 507
23.	Surface Dressing	Section 509
24.	Slurry Seal	Section 512
25.	Fog Spray	Section 513

Sl. No.	Type of work	Reference Section in the "Specifications for Road and Bridge Works (Fifth Revision)" published by MoRTH in 2013
26.	Crack Prevention Courses	Section 517
27.	Supply of Stone Aggregate for Pavement Courses	Section 520
28.	Quality Control for Road Works	
a.	General	Section 901
b.	Control of Alignment, Level and Surface Regularity	Section 902
c.	Quality Control Test During Construction	Section 903
29.	Materials for Structures	
a.	General	Section 1001
b.	Sources of Materials	Section 1002
c.	Bricks	Section 1003
d.	Stones and Blocks	Section 1004
e.	Cast Iron	Section 1005
f.	Cement	Section 1006
g.	Coarse Aggregate	Section 1007
h.	Fine Aggregate	Section 1008
i.	Steel	Section 1009
j.	Water	Section 1010
k.	Concrete Admixtures	Section 1012
l.	Storage of materials	Section 1014
m.	Tests and Standard of Acceptance	Section 1015
30.	Brick Masonry	Section 1300
31.	Stone and Concrete Block Masonry	Section 1400
32.	FORMWORK	
a.	Materials	Section 1502
b.	Design of formwork	Section 1503
c.	Workmanship	Section 1504
d.	Lining of Formwork	Section 1505

Sl. No.	Type of work	Reference Section in the "Specifications for Road and Bridge Works (Fifth Revision)" published by MoRTH in 2013
e.	Precaution	Section 1506
f.	Preparation of form Work Before Concreting	Section 1507
g.	Removal of Formwork	Section 1508
h.	Re-Use of Formwork	Section 1509
i.	Tests and Standards of Acceptance	Section 1511
j.	Measurements of Payment	Section 1512
k.	Rate	Section 1513
33.	STEEL REINFORCEMENT	
a.	Description	Section 1601
b.	General	Section 1602
c.	Protection of Reinforcement	Section 1603
d.	Bending of Reinforcement	Section 1604
e.	Placing of Reinforcement	Section 1605
f.	Bar splices	Section 1606
g.	Testing and Acceptance	Section 1607
h.	Measurement for Payment	Section 1608
i.	Rate	Section 1609
34.	STRUCTURAL CONCRETE	
a.	Description	Section 1701
b.	General	Section 1702
c.	Grades of concrete	Section 1703
d.	Proportioning of Concrete	Section 1704
e.	Admixtures	Section 1705
f.	Size of Coarse Aggregates	Section 1706
g.	Equipment	Section 1707
h.	Batching, mixing, transporting, Placing and Compaction	Section 1708
i.	Construction Joints	Section 1709
j.	Concreting Under water	Section 1710

Sl. No.	Type of work	Reference Section in the "Specifications for Road and Bridge Works (Fifth Revision)" published by MoRTH in 2013
k.	Concreting in Extreme Weather	Section 1711
l.	Protection and Curing	Section 1712
m.	Finishing	Section 1713
n.	Concrete with Blended Cements or Mineral admixture	Section 1714
o.	High Performance Concrete	Section 1715
p.	Tolerances	Section 1716
q.	Tests and Standards of Acceptance	Section 1717
r.	Measurements of Payment	Section 1718
s.	Rate	Section 1719
35.	STRUCTURAL STEEL	
a.	Description	Section 1901
b.	General	Section 1902
c.	Materials	Section 1903
d.	Fabrication	Section 1904
e.	Erection	Section 1905
f.	painting	Section 1906
g.	Tests and Standards of acceptance	Section 1907
h.	Measurements for payment	Section 1908
i.	Rate	Section 1909
36.	Substructure	Section 2200
37.	Concrete Superstructure	Section 2300
38.	Surface and Sub-surface Geotechnical Investigation	Section 2400
39.	River Training Work and Protection Work	Section 2500
40.	Maintenance of Road	Section 3000
41.	**TRAFFIC SIGNS, MARKINGS AND OTHER ROAD APPURTENANCES**	
a.	Traffic Signs	Section 801

Sl. No.	Type of work	Reference Section in the "Specifications for Road and Bridge Works (Fifth Revision)" published by MoRTH in 2013
b.	Overhead Signs	Section 802
c.	Road markings	Section 803
d.	Reflective Pavement Markers (Road Studs) and Solar Powered Road Markers (solar Studs)	Section 804
e.	Distance Indicator Posts	Section 805
f.	Road Delineators	Section 806
g.	Boundary Stones	Section 807
h.	Fencing	Section 808
i.	Tubular Steel Railing	Section 809
j.	Structural Steel Railing	Section 810
k.	Crash Barriers	Section 811
l.	Road Traffic signals	Section 812
m.	Traffic Control and Safety Devices in Construction zone	Section 813
n.	Traffic Impact Attenuators	Section 814
o.	Semi-Automatic Toll Collection System	Section 815
p.	Advanced Traffic Management Systems (ATMS)	Section 816

1.8 Specifications of items/ works for other civil works

For ready reference, relevant paragraphs of major works are mentioned below:

Sl. No.	Type of Work	Reference Para in CPWD Specifications published in 2019
1.	Filling	Para 2.10 of CPWD Spec. Vol 1
2.	Cement Plaster	Para 13.1 of CPWD Spec. Vol 2
3.	Cement Concrete Paver Block	Para 16.57 of CPWD Spec. Vol 2
4.	Kerb Stone	Para 16.58 of CPWD Spec. Vol 2
5.	Random Rubble Stone Masonry	Para 7.1 of CPWD Spec. Vol 1

1.9 Technical Specifications of specific items/ works (non-scheduled)

1.9.1 Injection moulded plastic cable trays/ channels

Injection Molded Cable Trays / channel - Length per pc/per mtr-1000 mm (appx), Width (Internal / External)-240 mm/340 mm, Height (Internal/External)-155mm/230mm, Minimum Weight – Top & Bottom – 8.2 Kg. Tolerance +/- 2% for dimensions and weight, Material- Polyolefin – Engineering Plastic, -Fire Protection Class K 1 in accordance with DIN 53438 part-2, Load bearing capacity ≥15 kN minimum at room Temperature. Each Cable Tray Covers should be with Four Plastic Fastener Locking Device.

1.9.2 Fibreglass Reinforced Polyester Manhole Cover (for covers of Manholes/ Inspection Chambers) and Gratings (for Gully Chambers/ Storm Water Drains beneath carriageway)

- Material: Cross-linked polyesters combined with Fibreglass Reinforced materials of approved make to sustain against wear and tear for heavy load vehicular traffic.
- Load capacity as per IS:1726-1991 & EN-124
    - Light Duty: Test load-2.5 Ton. Suitable for use for areas accessible to pedestrians and bicycles and occasional Light Motor Vehicle traffic.
    - Medium Duty: Test load-10 Ton. Suitable for use under medium-duty vehicular traffic, passenger cars and vehicles of comparable weight including car parking areas.
    - Heavy Duty: Test load-20 Ton. Suitable for use in carriageways with fast moving traffic, including trucks, city trunk roads, bus terminals with heavy duty vehicular traffic.
    - Very Heavy Duty: Test load-40 Ton. Suitable for roads with heavy fire tenders or multi axle trucks.
- Sizes (indicative) for Manhole Covers
    - Storm Water Drain Cover size 600mm x 600mm: Test Load 10T
    - Storm Water Drain Cover Size 450mm x 450mm: Test Load 10T
    - Utility Duct Cover size 1000mm x 1000mm: Test Load 10T
    - Utility Duct Cover size 1000mm x 1000mm: Test Load 40T
- Sizes (indicative) for Gully Chambers/ Grating for Storm Water Drains (where drains are beneath road carriageway)
    - Size 300mm x 300mm: Test Load 40T
    - Size 450mm x 450mm: Test Load 40T

1.9.3 Cationic Bitumen Emulsion (Tack Coat)

Providing and applying RS-1 Cationic Bitumen Emulsion (tack coat) conforming to BIS 8887-2004 at the rate of 0.30 to 0.35 kq/sqm on the prepared non- bituminous surfaces (cement concrete surfaces) cleaned with hydraulic broom complete as per direction of the Engineer-in-Charge.

Important specifications and properties:

- Residue on 600 micron IS sieve % by mass: 0.05% max
- Viscocity @50 degree C (Saybolt), sec: 20-100
- Storage Stability after 24 hours, % max: Less than 2

- Binder-Residue by evaporation: Min 60%
- Settling time: About 15 minutes

1.10 Street-scaping works

1.10.1 Paver Blocks for Footpaths/pedestrian walkway, plaza, parking areas, etc.

For pavements and cycle lanes, providing and laying 60mm thick grey or coloured reflective rubber moulded M-35 Paver blocks over a bed of sand (min. 75mm thick). For car parking areas, providing and laying 80mm thick grey or coloured reflective rubber moulded M-30 Paver blocks over a bed of sand (min. 75mm thick). For bus bay area's areas, providing and laying 100mm thick grey or coloured reflective rubber moulded M-40 Paver blocks over a bed of sand (min. 75mm thick). Job includes spreading sand on excavated and compacted sub base / PCC bed, compacting sand by ramming and interlocking them with the use of a suitable plate vibrator, job includes all incidental works like cleaning the site of debris, etc.

The paver blocks supplied should adhere to the following requirements: Material – 60 mm (M-35)/ 80mm (M30)/ 100mm (M-40) thick (respectively, as stated above) Rubber Moulded Reflective Paver blocks rough finished conforming to IS-15658:2006 compressive strength and grade. Manufacturer Sirex or equivalent.

Where specified in plan, cycleways are also proposed in 100 mm thick M-20 RCC with minimum reinforcement.

1.10.1.1 Scope of Work:

Excavation and compaction up to 300mm depth for the whole area of pavements/ parking / cycle lanes as per drawing in all sorts of soil including removal and stacking / preserving of top 200mm of 'Top Soil' as per GRIHA standards for top soil preservation. Other loose soil / debris shall be removed / carted from site of excavation up to 5 km. The scope of work shall include supplying and laying of precast paver blocks, at site. Since the site is a public place, care should be taken to ensure that the routine activities shall not be disturbed. The job of laying may need to be carried out during night also for no extra cost. The work shall be executed to perfect line and level as per instructions of Engineer in charge. Coloured concrete paver tiles shall be manufactured and shall adhere to clause 4.4 of IS 15658:2006.

The contractor shall guarantee that all materials and components designed, fabricated and supplied and laid by him shall be free of any type of defects due to faulty material / workmanship / laying / erection for a period of three years from the date of completion of work, which shall be considered defect liability period. Within this defect liability period, the contractor shall render free maintenance failing which the same shall be deducted for the retention cost as per contract. All modes of measurements shall be in Square meters.

1.10.2 Garden / Grass Paver Blocks for Footpath Area

Providing and laying 60mm thick grey or coloured reflective rubber moulded M-30 Grass Paver blocks of 300 x 300 x 60mm or 600 x 400 x 60mm over a bed of Stabilized soil with mulch as per Landscape architects specifications (min. 50mm thick). Job includes spreading sand on excavated and compacted stabilized soil base over compacted sand / PCC bed as specified by Landscape Architect, compacting sand by ramming and interlocking them with the use of a suitable plate vibrator, job includes all incidental works like cleaning the site of debris, etc. Edge protection of paved area using concrete retaining curbs as per Engineers instructions. The paver blocks supplied should adhere to the following requirements:

Material – 60mm thick Rubber Moulded Reflective Paver blocks rough finished of M-30 conforming to IS15658:2006 compressive strength and grade of M-30 meant for light traffic as per Table 1 IS 15658:2006. Manufacturer Sirex or equivalent. Size 600 x 400 x 60mm or 300 x 300 x 60mm as selected by Architect / employer.

1.10.2.1 Scope of Work:

- Excavation and compaction up to 300mm depth for the whole area of Footpath in all sorts of soil including removal and stacking / preserving of top 200mm of 'Top Soil' as per GRIHA standards for

top soil preservation. Other loose soil / debris shall be removed / carted from site of excavation up to Municipal dumping yard or as specified by Engineer. The scope of work shall include

- Laying of stabilized soil using conserved top soil mixed with mulch as per specification and compacted using plate compactors to achieve minimum 95 percent Standard Proctor Density per ASTM D 698 for pedestrian areas. Verify subsoils have a permeability between 0.5 and 3.0 inches per hour.
- Verify that geotextiles, if applicable, have been placed in accordance to specifications and instructions of Engineer / Architect.
- Install edge restraints per the drawings and manufacturer's recommendations.
- Supplying and laying of precast Grass paver blocks, at site. Since the site is a public place, care should be taken to ensure that the routine activities shall not be disturbed. The job of laying may need to be carried out during night also for no extra cost. The work shall be executed to perfect line and level as per instructions of Engineer in charge. Coloured concrete paver tiles shall be manufactured and shall adhere to clause 4.4 of IS 15658:2006.
- The contractor shall guarantee that all materials and components designed, fabricated and supplied and laid by him shall be free of any type of defects due to faulty material / workmanship / laying / erection for a period of three years from the date of completion of work, which shall be considered defect liability period. Within this defect liability period, the contractor shall render free maintenance failing which the same shall be deducted for the retention cost as per contract. All modes of measurements shall be in Square meters.

1.10.3 Concrete/ Wall Bench

Concrete Bench Shall as per Approved Drawings. Sitting platform size - 1800 mm length X 450mm width X 50 mm Leg size - 400mm Height X 450mm Width X 150mm. Sitting height is 450 mm (overall) It has to accommodate 3-4 persons comfortably It shall be placed on footpath in a way that the pedestrians pass-by without disturbing the user Materials All components are manufactured using M-30 grade of Concrete using vibro compaction process. All parts shall be joined together with galvanized nuts & bolts of suitable size and all bolts are sealed after assembly.

1.10.4 Bollards

Bollards shall be installed at pedestrian crossing. The bollards are of concrete/cast iron / steel etc & shall serve the purpose of defining the edge of the road and guide pedestrians. Concrete Bollards of M-30 grade, by vibro compaction method using FRP/steel. The Foundation slab shall be made in min. M25 concrete. The bollards shall not be fragile and safely secured to its foundation. All bollards shall be of uniform shape, size, colour on the same width of the road. Overall Dimensions: 918 mm Height X 300 mm Dia. Suitable reinforced to promote long life and to prevent damage during handling, transportation, & erection moulds, so as to achieve shuttering finish.

1.10.5 Tree Grate

The Overall dimensions 1800mm x1800mm x 40/100mm thickness. Suitably reinforced for long use and to prevent damage during transportation & handling. Manufactured with M-30 grade of concrete using vibrocompaction process using joint less FRP moulds so as to achieve shuttering finish on five faces and gurmala finish on the top surface. A choice of standard colours and unlimited custom colours will match any natural stone finish or interlock pavers in the surrounding. The top surface of the tree grates shall be polished.

1.11 Planting and Landscaping

1.11.1 Planting of Shrubs, Creepers, Ground Covers

Plant material shall be well formed and shaped true to type and free from disease, insect and defect such as knots, windburn, sun-cold, injuries, abrasion or disfigurement. All plant materials shall be healthy, sound, vigorous with good foliage, and free from plant diseases, insect pests, or their eggs, and shall have healthy well-developed root systems. Plants supplied shall be conforming to the names listed on the plant list. No plant materials will be accepted if branches are damaged or broken. All material must be protected from the sun and weather until planted.

Preparation of soil for grass, ground cover, edges, shrubs and flower beds: Then prepare the same soil with 23" thick layer of well decomposed, weed free farm yard manure or vermicomposting. Treat the soil with chloriphyriphos / Lindane / Neemcake depends upon the infestation of soil borne pests. Treat the soil with proper herbicide to control the weeds only on need basis. Finally level the soil as per the drawing or planting details.

Preparation of pits for shrubs, creepers and hedges : The bed shall be prepared with good earth mixed with 1/3rd quantity of decomposed farmyard manure along with a sampling of shrubs, ground covers, lilies, suckering plants etc. as per design plant spacing – 30-60 cm. maintaining(application of liquid manures/ growth regulators/ pesticides as per need, weeding regularly so as to keep the plant healthy all the time) it for a period of 12 Months from the date of virtual completion of development work

Planting shrub/ground cover- Planting of shrub in the bed prepared earlier by filling garden soil and manure (67:33 ratio). Planting the shrub with root ball in the pit (tin grown / poly bag grown) after removing carefully and without disturbing the root. Pressing the soil firmly around the tree / shrub planted. Preparing the bed around the shrub and watering after staking and tying. Maintenance of shrub/ground cover up to 12(Twelve)months by regular watering and attending the inter-cultivation practices such as weeding, racking, watering gap filling, free of weeds by regular hoeing etc. The plant should be well maintained, disease free, well-trimmed at the time of handing over. In case of death of the plant the contractor needs to replace the same with equally well grown healthy plant. Nurture the shrubs/ground cover with organic solid manures and liquid manures, spray bio-insecticides, parasites, predators to protect the trees from pest and disease. Amend the soil on regular basis with proper soil amendments to keep the pH level between 7 - 7.5.

Planting hedges / edges - Planting of hedge / edge in the ground prepared earlier by filling garden soil and manure. Preparing a pit of require size (for accommodating the root ball of plant) Planting the plants in 2/3 rows (as per instructions) at root ball removed carefully and without disturbing the root ball from poly bag. Pressing the soil firmly around the plant. Preparing the basin for watering. Maintain hedge / edge up to twelve months by regular watering and attending the inter-cultivation practices such as weeding, raking, gap filling, trimming and pruning etc. The hedge / edge should be well maintained, disease free, well-trimmed at the time of handing over. In case of death of the plant the contractor needs to replace the same with equally well grown healthy plant.

Planting Ground cover - Planting of ground cover plants in the ground prepared earlier by filling garden soil and manure preparing a pit of require size in the ground. Planting the ground cover plant root ball at nine inches apart in the pit after removing carefully and without disturbing the root ball. Pressing the soil firmly around the plant preparing the basin around the plant watering. Maintenance of ground cover up to two months by regular watering and attending the inter-cultivation practices such as weeding, raking, gap filling, trimming and pruning etc. The ground maintained; disease free, well-trimmed at the time of handing over. In case of death of the plant the contractor needs to replace the same with equally well grown healthy plant.

1.11.2 Maintenance Schedule of Planting & Landscaping Works

1.11.2.1 General Obligations

a. The Contractor shall maintain the works for the maintenance period specified in the Bidding Document.

b. The extend of the landscape to be maintained by the Contractor shall be deemed to cover and include all softscape landscape areas within the overall project boundaries as shown on the drawings including any existing soft landscape not affected by the Sub-Contract works and retained intact or nearly so through the end of the Sub-Contract period as well as all the landscape works covered in the Sub-Contract scope of works. No additional charges will be allowed unless specifically agreed to by the Landscape Architect in writing.

c. The Contractor's Horticulturist or Landscape Architect shall inspect the site every day and shall submit report to the Contractor on their actions and closure of the pending works. Also on weekly basis, the Contractor's Horticulturist and Landscape Architect shall prepare a brief schedule of operations planned for the week with target dates.

d. The daily report and the weekly schedule shall be running record of proposed operations which would be checked at the maintenance inspections every month. If in the opinion of the Landscape Architect/Site- In Charge, the maintenance works have not been satisfactorily carried out according to site conditions and the specifications, the payment will be withheld until the works have been satisfactorily carried out besides the penalty as in the penalty clause.

i. The Contractor shall take all necessary measures to ensure that all pot plants, trees and shrubs and other plants shall thrive and become established within this period. All landscape areas will be inspected and list of remedial works issued after each inspection. All items on the remedial lists are to be carried out by the time of the next inspection.

ii. The Contractor shall keep the landscape areas clean and tidy at all times and dispose of all waste materials arising from the cleaning.

iii. If the Contractors works are found to be unsatisfactory, payment shall be withheld and the maintenance period extended for the period of time that the landscapes maintenance has not been satisfactory. All cost associated with the extension of time shall be borne by the contractor.

1.11.3 Maintenance of Planted Areas: Trees, Shrubs, Climbers, Herbaceous Plants and Groundcovers Including Lawn

a. The Contractor shall water all trees, palms, shrubs, groundcover, herbaceous plants and other planting areas as often as necessary to keep the ground moist all around and to the full depth of the roots.

b. All planting beds are to be kept in a weed free condition with a weeding operation as per maintenance schedule or more regularly as required. All weeds, stones and rubbish collected from this operation shall be removed from the site by the Landscape Contractor.

c. Firming up and adjusting of stakes/ties shall be carried out monthly to ensure that the trees and shrubs are firmly held in ground. If required, guy ropes or tree ties shall be adjusted, tightened or loosened. If tree ties or ropes are rubbing the bark of the trees, the ties are to be taken off and retied. Any damaged branches are to be carefully pruned and the wounds sealed.

d. All protective fencing is to be maintained and kept in good condition as long as required on site.

e. All shrubs and groundcovers are to be reviewed monthly and pruned as and when required during the Maintenance Period to promote bushy growth and good flowering characteristics. The shrubs shall be checked and all dead wood, broken, damaged or crossed branches shall be cut back, depending on species.

f. The Contractor shall on continual basis supervise and attend to fertilizer needs/disease control/termite or fungus control as maintenance operations during the entire period of contract an approved fertilizer/insecticides/pesticide shall be applied to each plant.

g. The Contractor shall make regular weekly checks to ensure that the plant material is insect and pest and free.

1.11.4 Maintenance of Lawn Areas

The lawn shall be trimmed and maintained properly without any weeds.

1.11.4.1 Details of Periodic Maintenance Activities

SL. NO	OPERATION	FREQUENCY (TIMES)	PERIOD/DURATION AFTER HANDING OVER
1	Irrigation		As per Demand or as specified under
(a)	In Summer	15	Month- Every Alternate day
(b)	In Rainy Season	5 to 7	Monthly or as per climatic condition
(c)	In Winter	10	Monthly

1.11.4.2 Staking & Supports

Stakes shall always be used when planting instant trees, standards and single stem palms and for tall shrubs as indicated in the drawings and the Stakes shall be mangrove poles, bamboo or equal and shall be appropriate to the size of the plant to be supported.

1.11.4.3 Protection 0f Planted Areas

The Landscape Contractor shall take all necessary precautions to prevent or eradicate any outbreak of disease or insect attack, The Contractor shall be responsible for protecting all planted areas. If it is necessary for the Contractor to erect temporary protective fencing, the Contractor shall be responsible for keeping the fencing in position and in good repair until the end of the maintenance period. Fencing proposals shall be submitted to the Landscape Architect for approval.

1.11.4.4 Maintenance Prior To Completion

i. After planting and prior to the onset of the maintenance period, the Landscape Contractor shall be responsible for carrying out all necessary measures to ensure that the plant material thrives and becomes established and that the landscape areas are kept in a clean and tidy condition.

ii. The Contractor shall allow for carrying out the following maintenance operations when necessary prior to the onset of the maintenance period, all as specified in section 7 of this specification
   - Replacement of dead/missing plants
   - Grass cutting
   - Watering
   - Cultivation and loosening of soil
   - Weeding
   - Pruning and clipping
   - Firming up and adjustment stakes and ties
   - Eradication of pest or insect attack
   - Top drawing and mulching
   - Fertilizing

iii. The Contractor shall be responsible for replacing any plants which fail to survive as a result of inadequate maintenance operations, poor workmanship or poor quality of plant material prior to completion

iv. The Certificate of completion will not be issued until all plans scheduled on the Drawings and Schedule of Works are installed in a healthy condition in the manner specified.

TECHNICAL SPECIFICATIONS FOR "ELECTRICAL WORKS"

2 General

2.1 Applicable Codes/ Standards/ Guidelines

The following Codes/ Standards/ Guidelines will be applicable (in order of applicability, i.e. if specification of an item/ work is not available in a particular Code/ Standard/ Guideline, then the immediate next one will be applicable):

a) Guidelines of the Meghalaya Power Distribution Corporation Limited (MePDCL) or Meghalaya Energy Corporation Limited (MeECL)

b) BIS: Bureau of Indian Standard

c) IEC: International Electro technical Commission standards

d) IEEE: Institute of Electrical and Electronics Engineers standards

e) Regulations laid down by Indian Electricity Act and Rules National Electrical Code (SP 30, 2011) of India

f) Indian Bureau of Energy Efficiency (BEE) Guidelines

g) Guidelines issued by Central Electricity Authority (CEA) CBIP Publications

Any other applicable regulations by the local or state/central government authorities, regulations issued by tariff advisory committee / fire insurance regulations.

Table 2: Codes and Standards

IS Codes and IEC Standards	
IS 3043/IEEE-80	Code of Practice for Earthing
IS/IEC-60947	LV Switchgear
IEC 62271-202	HV Prefabricated Sub-Station (CSS)
IS 3427 / IEC-62271-200	Metal Clad Switchgear
IS 13118/ IEC-62271 -100	HV Circuit Breakers
IS 1180 Part 1	Oil Type Distribution Transformers
IS 5578	Arrangement for Switchgear Bus bars, Main Connection And Auxiliary Wiring
IS 2705	Current transformer
IS 3156	Potential transformer
IS 2544	Bus bar support insulators

IS 3231	Electrical Relays For Power System Protection
IS 13703	HRC FUSES
IS 3646	Code of Practice for interior illumination
IS 1944	Code of Practice for road lighting
IS 2309	Protection of buildings and allied structures against Lightning code of Practice
IS 7098	Specification for XLPE insulated PVC sheathed cables
IS 1554	Specification for PVC insulated cables
IEC: 62259	Secondary cells and batteries containing alkaline or other non-acid electrolytes-Nickel-cadmium prismatic secondary single cells with partial gas recombination
IEC: 60623 / IS 10918	Secondary cells and batteries containing alkaline or other non-acid electrolytes-vented Nickel Cadmium prismatic rechargeable single cells
IS 9000	For Basic climatic and mechanical durability tests for components for electronic and electrical equipment
IS 6619	For Semiconductor rectifier equipment code
IS 2026	Power transformers
SP 72: 2010	National Lighting Code
1944 (Parts 1 and 2)	Code of practice for lighting of Public thoroughfares: Part 1 General principles; Part 2 Lighting of main roads
1944 (Part 5) : 1981	Code of practice for lighting of public thoroughfares: Part 5 Lighting of grade separated junctions, bridges and elevated road (Group D)
1944 (Part 6): 1981	Code of practice for lighting of public thoroughfares: Part 6 Lighting of town and city centres and areas of civic importance (Group E)
CEA	Manual on Transmission planning Criteria

Note: Other International codes and standards shall be considered if the same are, at least equivalent to, Indian Standards or any other international standard which yields a more desirable outcome.

2.2 General Requirements to be complied with by the Bidders

- Tender specific Manufacturers Authorization letter for key items such as HT cable, Package Sub-

station, Ring Main Unit (RMU), SCADA etc. signed by Original Equipment Manufacturer (OEM) must be submitted by the bidders at the time of bid submission.

- The Bidder must submit point by point compliance to the tender technical specification as per bid document to avoid bid rejection.
- In case the Bidder is an OEM authorized design partner, the performance certificate /POs of the OEM shall suffice.

3 Compact Sub-station (Prefabricated Packaged Sub-station)

All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standards. The 12KV Package Sub-station Design must be as per IEC62271-202.

The Prefabricated Package Sub-station offered shall in general comply with the latest issues including amendments of the following standards.

Table 3: Codes and Standards for Compact Sub-station (CSS)

Title	Standards
High Voltage / Low Voltage Prefabricated Sub-station	**IEC: 61330/IEC 62271-202**
High Voltage Switches	**IEC 60265**
Metal Enclosed High Voltage Switchgear	**IEC 60298/ IEC62271-200**
High Voltage Switchgear	**IEC 60694**
Low Voltage Switchgear and Control gear	**IEC 60439**
Power Transformers	**IEC 60076**

3.1 Design Criteria

Package Sub-station consisting of 11KV Non-Extensible SF6 Ring Main Unit with breaker as protection **+ Transformer + Low Voltage Switchgear** with all connection accessories, fitting & auxiliary equipment inside an internal arc type tested single enclosure to supply Low-voltage energy from high-voltage system as detailed in this specification. The complete unit shall be installed on a Sub-station plinth (base) as **Outdoor Sub-station** located at very congested places. 11KV Isolators controls incoming-outgoing feeder cables of the 11KV distribution system. The Vacuum Circuit Breaker shall be used to control and isolate the 11kV/433V Distribution transformer. The transformer Low Voltage side shall be connected to Low Voltage switchgear. The connection cables to consumer shall be taken out from the Low Voltage switchgear.

The prefabricated-package Sub-station shall be designed for a) Compactness, b) fast installation, c) maintenance free operation, d) safety for worker/operator & public. The Switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials. For continues operation at specified ratings temperature rise of the various switchgear components shall be limited to permissible values stipulated in the relevant standard and / or this specification.

3.2 Service Conditions

The Package Sub-station shall be suitable for continuous operation under the basic service conditions indicated below

- Ambient Temperature: 50 Deg C
- Relative Humidity: up to 95%
- Altitude of Installation up to 10 m

The Enclosure of High Voltage switchgear-control gear, Low Voltage switchgear-control gear & Transformer of the package Sub-station shall be designed to be used under **normal outdoor service condition** as mentioned.

The enclosure should take minimum space for the installation including the space required for approaching various doors & equipment inside. Transformer compartment inaccessible from outside considering public safety and can be accessed only after removing the bolted covers for PSS upto 1000kVA rating.

3.3 Specific Requirement

The main components of a prefabricated- package Sub-station are Transformer, High-voltage switchgear-control gear, Low-voltage switchgear-control gear and corresponding interconnections (cable, flexible, bus bars) & auxiliary equipment. All the components shall comply with their relevant IEC standards.

The PSS supplied through Contractor/Consortium or OEM or Licensee Partner of OEM, should house HT /LT components in a common enclosure tested for "AB" category with an IAC rating of 21kA for 1 sec and temperature rise as per IEC 62271-202, tested in an International/National Government Lab/ Recognized Laboratory.

Since it is a compact Sub-station, all the equipment like RMU, Transformer, LT switchgear with all connection, accessories, fittings shall be mounted within a pre-fabricated common enclosure having a common roof as outdoor Sub-station for better performance and safety. No assembled enclosure shall be allowed which leads to failure of PSS.

3.4 Rating

SN	Description	Unit	Value
1.	Rated Voltage / Operating Voltage	kV rms	**11**
2.	(a) Rated frequency & Number of phases	Hz & nos.	**50 & 3**
3.	(b) Rated maximum power of Sub-station	kVA	**630 kVA/500kVA / 315 KVA**
4.	(c) Rated Ingress protection class of Enclosure	IP	**IP-34 for Transformer Compartment and IP: 54 for LT & HT Switchgear Compartment.**
5.	(d) Rated temp Class of Transformer Compartment		**K10 up to 1250kVA**
6.	Rated withstand voltage at	kV rms	**28**

SN	Description	Unit	Value
	power frequency of 50 Hz		
7.	Rated Impulse withstand Voltage	kV peak	**75**
8.	HV Network & Busbar		
9.	Rated current	Amp	**630A**
10.	Rated short time withstand current	kA rms / 1 sec	**25**
11.	Making capacity for switch-disconnector & earthing switches	kA peak	**50kA**
12.	Breaking capacity of Isolators (rated full load)	A	**630A**
13.	**(g) LV Network**		**As per BOQ**

3.5 Specifications of Compact Sub-stations and their tentative locations

SN	Material Description	Tentative locations for reference of the Bidders
1	Supply, installation, testing and commissioning of 11kV, 630 KVA, Outdoor Package / Compact Sub-Station (in compliance IEC 62271-202) shall be consisting of following: HT Switchgear : 11KV, 630A, 25KA for 1 Sec SF6 Insulated SCADA compatible / Integrable **RMU [4 way]** consisting of 2 nos. remote operated motorised Load Break Switch and 2 no. remote operated motorised VCB unit with self-powered microprocessor based 3 ph. numerical relay and metering unit with CTs and PTs. FRTU and SCADA shall be of same make .PSS Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM. Complete PSS enclosure with GI and thickness as 2mm and base as 4mm HRCA PSS should have valid Type test for IAC AFLR. 21KA for 1 sec. FRTU should be integrated to SCADA for remote monitoring (HT & LT) and control (HT). Thermal sensors should be provided in the cable chamber of Ring main unit, Transformer terminations and LV bus/Incomer. Humidity sensor should be provided in the transformer compartment. All the sensors shall communicate with FRTU for remote SCADA	Oakland Road, MTC Compound, Thana Road Police station (2 no's), PWD Building (H.O), MPSC Horse Shoe Building, State Central Library, Kuintoin Road opp. MUDA Parking, PWD Division Office [Bark point], Quinton Road (1st floor)

SN	Material Description	Tentative locations for reference of the Bidders
	monitoring through a sensor Data concentrator.	
	11/ 0.433kV, 630 kVA, Dry type Transformer [Losses as per IS tolerance / ECBC standard.]	
	Metering compartment and LT isolator Breaker LT : I/C - 1000A 433V, 4Pole, 50Hz, 50KA electrically operated type ACB. O/G - 5 nos. 250A, 433V, 3Pole, 50Hz, 36KA MCCB	
2	Supply, installation, testing and commissioning of 11kV, 630 KVA, Outdoor Package / Compact Sub-Station (in compliance IEC 62271-202) shall be consisting of following: HT Switchgear: 11KV, 630A, 25KA for 1 Sec SF6 Insulated SCADA compatible / Integrable **RMU [4 Way]** consisting of 3 nos. remote operated motorised Load Break Switch and 1 no. remote operated motorised VCB unit with self-powered microprocessor based 3 ph. numerical relay and metering unit with CTs and PTs. FRTU and SCADA shall be of same make. PSS Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM. Complete PSS enclosure with GI and thickness as 2mm and base as 4mm HRCA PSS should have valid Type test for IAC AFLR. 21KA for 1 sec. FRTU should be integrated to SCADA for remote monitoring (HT & LT) and control (HT) Thermal sensors should be provided in the cable chamber of Ring main unit, Transformer terminations and LV bus/Incomer. Humidity sensor should be provided in the transformer compartment. All the sensors shall communicate with FRTU for remote SCADA monitoring through a sensor Data concentrator.	Sonabari - 02 No's, Police Bazar Sub-station, Old Jowai Road, MUDA parking 1st floor Quintion road.
	11/ 0.433kV, 630 kVA, Dry type Transformer [Losses as per IS tolerance / ECBC standard.]	
	Metering compartment and LT isolator Breaker LT: I/C - 1000A 433V, 4Pole, 50Hz, 50KA electrically operated type ACB. O/G - 5 nos. 250A, 433V, 3Pole, 50Hz, 36KA MCCB	
3	Supply, installation, testing and commissioning of 11kV, 315KVA, Outdoor Package / Compact Sub-Station (in compliance IEC 62271-202) shall be consisting of following: HT Switchgear: 11KV, 630A, 25KA for 1 Sec SF6 Insulated SCADA compatible / Integrable **RMU [4 way]** consisting of 2 nos. remote operated motorised Load Break Switch and 2 no. remote operated motorised VCB unit with self-powered microprocessor based 3 ph numerical relay and metering unit with CTs and PTs. FPI, RMU & Relay should be of same make for the ease of integration. FRTU and SCADA shall be of same make. PSS Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the	Umsohsun

SN	Material Description	Tentative locations for reference of the Bidders
	OEM.Complete PSS enclosure with GI and thickness as 2mm and base as 4mm HRCA, PSS should have valid Type test for IAC AFLR. 21KA for 1 sec FRTU should be integrated to SCADA for remote monitoring (HT & LT) and control (HT). Thermal sensors should be provided in the cable chamber of Ring main unit , Transformer terminations and LV bus/Incomer. Humidity sensor should be provided in the transformer compartment. All the sensors shall communicate with FRTU for remote SCADA monitoring through a sensor Data concentrator.	
	11/ 0.433kV, 315 kVA, Dry type Transformer [Losses as per IS tolerance / ECBC standard.]	
	Metering compartment and LT isolator Breaker LT: I/C - 800A 433V, 4Pole, 50Hz, 50KA electrically operated type ACB. O/G - 2 nos. 250A, 3nos 125A, 433V, 3Pole, 50Hz, 36KA MCCB	

3.5.1 Minimum requirements of Compact Sub-stations

- PSS Enclosure must be type tested for IAC A & B (Operator & Public Safety) 21kA/3 sec.
- Ring Main unit should have LBS /earth switch rated for M1(1000 O/C) and E3 (100 op) ; Breaker with 2000 mechanical/electrical operations and more than 30 short circuit operations.
- RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU.
- FRTU and SCADA software shall be of same make for the ease of integration.
- Trip status of LV components shall be integrated to SCADA.
- Out of 3 major components of CSS, at least 2 of them (HT and LT preferably) shall be of same make.
- The disconnector and earthing switch of the breaker function shall be provided at the cable side and earth switch should be rated for making duty. Type test reports on making capacity, short-time withstand current and peak short-circuit current shall be supplied. Earthing through breaker shall not be acceptable.
- Separate enclosure should be provided for mounting FRTU, battery and battery charger along with related accessories, the same shall not be mounted on top of the SF6 tank or RMU LV chamber.
- Access to the cable chamber shall be through front only, no side or rear access shall be acceptable.
- CT shall be mounted on separate CT mounting plate, without putting pressure on the cable bushings of the RMU.
- Proper cable support provisions shall be provided for termination of the cable, in addition to the cable clamp provided along with the gland plate. Minimum termination height of around 750mm should be provided for terminating 11kV cables.
- Manufacturer to declare the make of vacuum interrupter offered is same as used in type tests
- ACB /MCCB shall have Rated service short circuit breaking capacity Ics = Icu = Icw (1sec)
- ACB shall have minimum Mechanical life of 20,000 operations
- All ACB's in main LT panel shall be provided with zone selective interlocking which helps in reducing

the thermal and dynamic stress on installation during short circuit and ground faults.

- Thermal sensors should be provided in the cable chamber of Ring Main Unit, Transformer terminations and LV bus/Incomer. Humidity sensor should be provided in the transformer compartment. All the sensors are to communicate sensor data concentrator through Zigbee, which shall further communicate with FRTU for remote SCADA monitoring through MODBUS RTU connection.
- Fire extinguisher (1no.) shall be kept in the compact Sub-station.

3.5.2 Technical particulars for Compact Package Sub-Stations

Table 4: Technical Particulars of Compact Sub-stations

SN	Particular	Details
1.	Rated Voltage / Operating Voltage	12/11 kV rms
2.	Rated frequency & Number of phases	50 Hz & 3
3.	Rated power of the Sub-station	315/500/630/1000 KVA Cast Resin Dry type
4.	Rated Ingress protection class of the enclosure	IP-23/IP34 for Transformer Compartment and IP: 54 for LT & HT Switchgear Compartment
5.	Rated temp Class of Transformer Compartment	K10
HV Insulation Level		
6.	Rated withstand voltage at power frequency of 50 Hz	28 kV rms
7.	Rated Impulse withstand Voltage	75 kV peak
HV Network & Bus bar		
8.	Rated Current	630 Amps
9.	Rated Short Time Withstand Current	21 kA rms / 3 Sec.
10.	Making Capacity for Switch Disconnector & earthing switches	50 kA peak
11.	Breaking capacity of Isolators (rated full load)	ps

3.6 Technical Specifications of Transformers

3.6.1 Applicable Codes and Standards for Transformers

The equipment covered by this specification is, (unless otherwise stated to be designed), constructed and tested in accordance with latest revisions of relevant Indian standards / IEC publications.

Table 5: Codes and Standards for Transformers

SN	Standard Code	Description
1.	IS 1271	Classification of Insulating Materials
2.	IS 2026	Power Transformers (Part I - V)
3.	IS 2099	Bushing for Alternating Voltages above 1000 V
4.	IS 2705	Current Transformers
5.	IS 3202	Code of practice for climate proofing
6.	IS 3639	Power transformer fittings and accessories
7.	IS 4257	Porcelain bushings for transformers
8.	IS 11171	Dry type Transformer
9.	IS 8478	Application guide for tap-changers
10.	IS 10028	Code of practice for selection, installation and Maintenance of transformers

3.6.2 General Design Features

- The transformers shall be of the latest design, dry type Cast Resin.
- The type of cooling is Natural Air cooled (AN) and the corresponding ratings for each transformer shall be provided by the customers.
- Each transformer is suitable for operation at full rated power on all tapings without exceeding the applicable temperature rise.
- It is possible to operate the transformer satisfactorily, with the loading Guide specified in IS-6600. There is no limitations imposed by bushings, Tap changers, and auxiliary equipment to meet this requirement
- The transformers is designed to be capable of withstanding, without damage , the thermal and mechanical effects of short-circuits between phases or between phase and earth at the terminals of any winding with full voltage applied across the other winding for periods given in relevant standards.
- The transformer/off load tap links are able to meet the short circuit level specified (as mentioned in technical specification) without permanent damage.
- Each transformer is designed for minimum no-load and load losses within the economic limit and is able to have minimum loss at the rated load condition.
- All electrical connections and contacts are of ample cross sections for carrying the rated current

without excessive heating.

- The transformer is capable of continuous operation at full load rating under the following conditions.
    - Voltage variation = +/- 10%
    - Frequency variation = +/- 5%
    - Combined voltage and frequency variation (Absolute sum) = 10%

3.6.3 Construction

The transformer shall be dry type, AN cooled suitable for Compact Package Sub-station application.

The core-clamping frame shall be provided with lifting eyes having ample strength to lift the complete core and winding assembly.

Off circuit tapings shall be provided on the HV windings. Tap changing is done by means of off circuit links accessible through openings provided.

The lifting lugs and rollers shall be provided. A winding temp. Scanner shall be provided and is actuated by means of resistance temperature detectors embedded in LV windings of all three phases. It should have alarm and trip contacts at a specified temperature.

The transformer shall be suitable to be installed in the transformer compartment of package Sub-station having IP34 protection class.

3.6.4 Windings

- The winding insulation is of Class 'F" and temperature rise limit to Class F. i.e. 115 deg.C. Windings are of electrolytic copper conductors (circular in shape) of high conductivity and 99.9% purity.
- Windings are designed to withstand the specified thermal and dynamic short circuit stresses.
- The windings are duly sectionalized. No corona discharge result on the winding upon testing the transformer for induced voltage test as specified in IS.
- The end turns of the high voltage windings have reinforced insulation to take care of the voltage surges likely to occur during switching or any other abnormal condition.
- The high voltage and low voltage winding are made of copper Conductors

3.6.5 Core and Coil

- The double wound Core is constructed from non-ageing cold rolled Grain oriented steel sheets.
- The built core is painted with high temperature resistant paint to prevent corrosion at the edges of core plates and to withstand high temperatures.
- By using different core material optimization of core losses can be achieved.
- The yokes are firmly clamped between yoke channels or plates.
- The design of the magnetic circuit is such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and the production of flux component at right angles to the planes of laminations which may cause local heating.

3.6.6 Loses

The maximum allowable losses at rated voltage and rated frequency shall be as ECBC-2017.

3.6.7 Off-Circuit Tap Changing Links

- Off circuit tapings are provided on HV windings. Tap changing is done by means Off circuit links.
- Use of tap changing links eliminates any moving parts as against a manually operated tap changer.

3.6.8 Terminal Arrangement

- HV side and LV side of transformer will have the top bus bar arrangement for connection of HT side by means of cable and LT side by means of bus bar.

3.6.9 Painting

- All steel surfaces are thoroughly cleaned by sand blasting or chemical agents as required to produce a smooth surface free of scale, grease and rust.
- The external surface, after cleaning, is given a cost of high-quality red oxide or yellow quoted primer, followed by filler coats.

3.6.10 Routine Test:

All Routine Tests in accordance with IEC 60076 / IS 2026 are carried out on each transformer.

3.6.11 Nameplate

Each transformer is provided with a nameplate of weather resistant material fitted in a visible position showing but not limited to the following item:

- Kind of transformer
- Number of the specification
- Manufacturer's name
- Year of manufacture
- Manufacturer's serial number
- Number of phases and frequency
- Rated power
- Rated voltages and currents
- Connection symbol
- Impedance voltage at rated current
- Type of cooling
- Total weight
- Weight of insulating oil
- Class of insulation
- Temperature rise
- Connection diagram
- Insulation levels
- Weight of transportation

- Details regarding tapping's

3.6.12 Technical Particulars for Dry Type Transformers

SN	Particular	Details
1.	Type	Three Phase, 50 Hz, Core type, two winding, Cast Resin Dry type Transformer
2.	Make	ABB/ Raychem / Voltamp /Siemens /Schneider
3.	Rating	315/500/630/1000 kVA
4.	Winding Material	Copper
5.	No load voltage ratio	11kV/433V
6.	Connection HV LV	Delta Star with neutral
7.	Vector Group	Dyn 11
8.	Insulation level (KVp/ KVrms) HV LV	 75 / 28 -/ 03
9.	Type of Tap Changer for giving voltage variation to HV	Off circuit tap links
10.	Tapping Range	+5% to -5% in steps of 2.5%
11.	Temperature rise winding over ambient temperature	115^0 C
12.	Class of insulation	Class 'F'
13.	Enclosure	IP 00 (without enclosure)
14.	Method of Cooling	AN (Air Natural)
15.	Max. No load losses at rated voltage & frequency (IS Tol)	Min. Watts

SN	Particular	Details
16.	Max. Full load loss at principle tap at 75º C (IS Tol.)	Min. Watts
17.	Termination HV LV	 Busbar Busbar
18.	Fittings for Dry type	2 Numbers Earthing Terminals, Rating and Diagram Plate, Bi-Directional Rollers, Lifting Lugs, Winding Temp Scanner.
19.	Paint	Enamel-RAL 7032

3.7 SCADA

3.7.1 General

- Furnish a dedicated, edge control, software platform (The Software Platform) that is purpose-built to be the operational interface for a Power Management and Control System (PMCS) whose primary purpose is to support the provision and management of safe, reliable and efficient power within buildings and facilities. The Software Platform shall have specialized data acquisition, visualization, analysis and reporting tools specifically designed for Power Management applications such as:
    - Source and Network Control
    - Electrical Distribution System Monitoring and Alarming
    - Electrical System Capacity Management
    - Power Quality Monitoring and Compliance
    - Multi Source Management
    - Continuous Electrical Thermal Monitoring
    - Breaker Setting Monitoring
    - Backup Power Testing.
    - Power Events Analysis.
    - Energy Usage Analysis and Energy Benchmarking.
    - Utility Bill Verification and Cost Allocation.
    - Energy Performance Analysis and Verification.
- The Software Platform shall be certified to comply with cybersecurity standard IEC62443 SL1 at the component level: IEC62443-4-1 and IEC62443-4-2.
- The Software Platform shall natively support the vendor's continuous electrical thermal monitoring system with the ability to detect abnormal bus bar or cable temperatures due to loose or faulty connections and to prevent equipment damage and fire.
- The Analytics and Reporting Tools shall be certified as part of an Energy Data Management System

in accordance to the data validation requirements of ISO 50001 Section 4.6.1 (Monitoring, measurement and analysis).

- The Analytics and Reporting Tools shall be intelligent enough to make suggestions for harmonic mitigation equipment suitable to counteract any chronic excessive harmonics conditions that may be detected.

SN	Material Description
1	Design, manufacture, supply, installing and testing of SCADA System for remote Control and Monitoring 33/11kV Sub-station including 33kV & 11KV RMU, LT [Monitoring], Network switch etc complete in all respects. SCADA System will have redundant server (Main + Backup server). SCADA, RTU & FRTU should be of same make to ensure seamless integration. SCADA should be Integrable to MePDCL / Smart City Command & Control Centre through Application programming interface. SCADA vendor should have prior experience of Integrating the same.

3.7.2 SCADA INTEGRATION

- PSS / RMU should have inbuilt Field Remote Terminal Unit and Fault Passage Indicator.
- FRTU and SCADA software shall be of same make for the ease of integration.

3.7.3 SCADA Protocol Support

Communication between the FRTU / RTU and SCADA system shall be on IEC 60870-5-104 Protocol.

No loss of data:

Redundant communication shall be provided between FRTU/RTU and SCADA Software. Incase both primary and standby communication fails It shall be possible to backfill the Data from FRTU/RTU to SCADA when communication re-establish.

SCADA shall support the following industry standard protocols:

- IEC60870-5-101 and IEC 60870-5-104 Master and Slave
- DNP3 Level 4-Level 4 conformant Master and Slave serial and DNP3 Level 4 over IP,
- Modbus RTU Master, Modbus RTU Slave
- Open Modbus/TCP Client, Open Modbus/TCP Server
- ICMP and NTP
- SNMP

3.7.4 System Security and Access

The SCADA system shall provide a high level of inherent security. To this end the SCADA software shall provide security access down to data point level, and support individual Users, User Groups and a matrix of system capability and access to any level of the SCADA database. Communication Protocol between FRTU/RTU and SCADA Software shall support Security Authentication V2.

Full-function Rich & Web client interfaces shall require explicit administrative configuration to valid connection to the SCADA server. Client interfaces shall provide the ability to restrict access to sensitive system information based on user privilege. System Administrators shall have the ability to allow/restrict client access to specific system interfaces by IP Address. IP Address Range, and/or CIDR (Classless Inter-Domain Routing) notation.

POTENTIAL FREE SIGNALS
HT Panel (Fixed-Type VCB) - Iso01On, Iso01Off, Iso01 Earth Iso02On, Iso02Off, Iso02 Earth VCB On, VCB Off, VCB Trip on Fault, Line-Earth On, Line-Earth Off, Incoming Feeder Live, Gas-Pressure Low, FPI ON/OFF
Transformer - WTI Alarm, WTI Trip
LT Panel - Main ACB On, Main ACB Off, Feeder MCCB On, Feeder MCCB Off… all MCCBs
Others - Transformer Door Open, LR Switch in Local, LR Switch in Remote

DIGITAL SIGNALS (Modbus via RS-485 Port)
HT Side Multifunction Meter - kV, Amp, pF, Hz, kWh
LT Side Multifunction Meter - Voltage, Amp, kVA, kW, kWh
COMMANDS (Capable of being executed from SCADA)
ISO01 ON, ISO01 OFF, ISO02 ON, ISO02 OFF, VCB ON, VCB OFF, MCCB ON,
MCCB OFF
Local/Remote Switch shall be provided to cut-off control from Remote in Local
Condition
Terminal Block arrangement to act as junction between hard-wired signals being received from HT/LT/Trafo compartment and wiring into the FRTU.
Isolation MCB, and associated aux. supply circuit for Field RTU unit.
LED Indication to indicate aux. supply availability for Field RTU

3.8 Guaranteed Technical Particulars (GTP) of CSS/PSS

Sample of GTP for CSS/PSS is given at para 12.1 (Annexure)Annexure-I: Guaranteed Technical Particulars (. Bidders are required to provide details of the proposed products in their Bids in this format.

4 RING MAIN UNIT

4.1 General Specifications

The RMUs offered shall be compact, maintenance free, easy to install reliable to operate, safe and easy to operate and complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.

The objective of the RMUs is for extremely small construction width, compact, maintenance free, independent of climate, easy installation, operational reliability, Safe and easy to operate, minimum construction cost,

minimum site work and minimum space requirement. For Outdoor RMU enclosure shall be of degree of protection IP 55 and degree of protection of the gas tank shall be IP 67 . The main tank shall be stainless steel sheet with pressure relief arrangement and Type tested design.

The RMUs shall conform in all respects to high standards Of Engineering design, workmanship, and latest revisions of relevant standards at the time of offer.

4.2 Applicable Codes and Standards

The RMU, Switchboard (Switchgear), Load break isolators, Instrument Transformers and other associated accessories conform to the latest revisions and amendments thereof of the following standards:

Table 6: Applicable Codes and Standards for RMUs

SN	Standard Code	Description
1.	IEC 62271-200/IS 12729:1988	General requirement for Metal Enclosed Switchgear
2.	IEC62271-102/IS 9921	AC disconnector's (Load Break Isolators) and Earthing Switch.
3.	IEC 62271-100 / IEC 62271-200	Specification for alternating current circuit breakers
4.	IEC 62 271-1	Panel design, SF6/Vacuum Circuit Breakers
5.	IEC60044-1/IS2705:1992	Current Transformer
6.	IEC 60265/IS 9920:1981	High voltage switches
7.	IEC 60376	Filling of SF6 gas in RMU
8.	IEC 60273/IS :2099	Dimension of Indoor & Outdoor post insulators with voltage > 1000 Volts
9.	IEC 60529/IS 13947(Part-1)	Degree of protection provided by enclosures for low voltage switchgear and control gear.
10.	IS 3043-1987	Code of Practice for earthing
11.	IEC 60044-2	Instrument transformer Part 2: Voltage transformer
12.	IEC 60255	Electrical relays

4.3 Ring Main Unit Specification

SN	Material Description	Tentative locations for reference of the Bidders
1	Supply, testing & commissioning of outdoor type RMU (4 Way Ring Main Unit). comprising 2 Nos. 11 KV, 630 A, 25 KA for 1 sec Load break switches and 2 nos. 630 A VCB 25 KA for 1 sec [Vacuum Interrupter and RMU should be of same OEM make] as outgoings and earth switch bus bars, interlocking ..Suitable for manual & motorized operation, F.PI (Fault position Indication), bushing for 630A, arc proof cable cover complete with interlocking, FRTU and SCADA shall be of same make. RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box for a rating of 21kA RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU RMU Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM	Old Jowai Road, Quinton Road [Parking 1st floor], Thana Road, Lady bird, Keating Road [Mohan Maken Bond], DTO Office, Additional Secretariat, Government Printing Press, BSNL office, MLA Hostel, Ram Krishna Mission
2	Supply, testing & commissioning of outdoor type (7 Way Ring main unit). comprising 2 Nos. 11 KV, 630 A, 25 KA for 1 sec incoming Load break switches and 5 No's 11 KV, 630 A, 25 KA Load Break Switches as outgoing. Suitable for manual & motorized operation, FPI (Fault position Indication), bushing for 630A, arc proof cable cover complete with interlocking, FRTU for SCADA. FRTU and SCADA shall be of same make . RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU. RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box for a rating of 21kA. Both Incomer LBS shall have a provision of mechanical interlocking through Castle Key RMU Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM.	Thana Police Station, All India radio post office
3	Supply, testing & commissioning of outdoor type RMU (3 Way Ring main unit). comprising 2 Nos. 11 KV , 630 A, 25 KA for 1 sec Load break switches and 1 nos. 630 A VCB 25 KA as outgoings [Vacuum Interrupter and RMU should be of same make] and earth switch bus bars, interlocking ..Suitable for manual & motorized operation, F.PI (Fault position Indication), bushing for 630A, arc proof cable cover complete with interlocking, FRTU and SCADA shall be of same make. RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box for a rating of 21kA RMU Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM.	AC Lane Junction,

SN	Material Description	Tentative locations for reference of the Bidders
4	Supply, testing & commissioning of outdoor type RMU (5 Way Ring main unit). comprising 4 Nos. 11 KV , 630 A, 25 KA for 1 sec Load break switches and 1 nos. 630 A VCB 25 KA as outgoings [Vacuum Interrupter and RMU should be of same make] and earth switch bus bars, interlocking ..Suitable for manual & motorized operation, F.PI (Fault position Indication), bushing for 630A, arc proof cable cover complete with interlocking. FRTU and SCADA shall be of same make.RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box for a rating of 21kA RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box. RMU Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM.	Police Bazar Sub-station, DC Office (Kacheri Point)
5	Supply, testing & commissioning of outdoor type RMU (4 Way Ring main unit). comprising 3 Nos. 11 KV , 630 A, 25 KA for 1 sec Load break switches and 1 nos. 630 A VCB 25 KA for 1 sec as outgoings [Vacuum Interrupter and RMU should be of same make] and earth switch bus bars, interlocking ..Suitable for manual & motorized operation, F.PI (Fault position Indication), bushing for 630A, arc proof cable cover complete with interlocking. FRTU and SCADA shall be of same make RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box for a rating of 21kA. RMU Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM.	AG Auditor General, Barik Point [Opp to Bustop], MPSC (Horse shoe Building), Forest Office, City Hut Bhada, Employment Exchange Office, IGP Point [SP office], Oakland road, Near Vishal Mega mart, Hotel Grace Pulin Bihari Road, Govt Girls High school, Police reserve
6	Supply, testing & commissioning of outdoor type (4 Way Ring main unit). comprising 2 Nos. 11 KV, 630 A, 25 KA for 1 sec incoming Load break switches and 2 No's 11 KV, 630 A, 25 KA Load Break Switches as outgoing. Suitable for manual & motorized operation, FPI (Fault position Indication), bushing for 630A, arc proof cable cover complete with interlocking, FRTU for SCADA. FRTU and SCADA shall be of same make. RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU. RMU Manufacturer should have valid Type test for IAC AFLR 1 sec for both tank and cable box for a rating of 21kA. Both Incomer LBS shall have a provision of mechanical interlocking through Castle Key RMU Manufacturer should have valid TYPE TEST REPORTS or design authorisation from the OEM.	Keating road (Mohanmaken Bond)

The main tank shall be stainless steel sheet with a pressure relief arrangement as per type tested design of manufacturer.

The switchgear and busbar shall all be contained in a stainless-steel enclosure filled with SF6 at 0.3 bar relative pressure to ensure the insulation and breaking functions. Sealed for life, the enclosure shall meet the "sealed pressure system" criterion in accordance with the IEC 62271-1 standard.

Capacitor voltage dividers serving live-line cable indicators and all the indicators shall have to be visible in the front of the ring main unit

The RMU metal parts shall be made of painted with Pure Polyster based power paint with a paint shade in line with manufacturer's standard. As a standard the sheet steel shall be treated through 7-tank treatment process and shall be powder coated with thickness of 60-80 microns.

4.4 Minimum requirements of Ring Main Units

- Ring Main unit should have LBS /earth switch rated for M1(1000 O/C) and E3 (100 operations).
- Breaker should have 2000 mechanical/electrical operations and more than 30 short circuit operations, ensuring higher operational life.
- The disconnector and earthing switch of the breaker function shall be provided at the cable side and earth switch should be rated for making duty. Type test reports on making capacity, short-time withstand current and peak short-circuit current shall be supplied. Earthing through breaker shall not be acceptable.
- Internal Arc Type Test Report for IAC AFLR 21 kA for 3 sec for both tank & cable box should have been for minimum 3 way / 3 Function RMU.
- In case of an internal arc, the exhaust should open downwards into the cable chamber , away from the operator standing front , lateral or rear, thus ensuring operator safety.
- FRTU and SCADA shall be of same make for the ease of integration.
- RMU should have Auto Transfer Source Functionality between two LBS Function of RMU via FRTU.
- Separate metering panel/enclosure should be provided for mounting FRTU, battery and battery charger along with related accessories, the same shall not be mounted on top of the SF6 tank or RMU LV chamber. The canopy cover of the Ring main unit and Metering panel door shall be separate and shall be lockable, to prevent tampering.
- All necessary operation of the RMU (switch operation, status monitoring etc) shall be through front only including access to the cable chamber. No side or rear access to the cable chamber shall be acceptable.
- CT shall be mounted on separate CT mounting plate, without putting pressure on the cable bushings of the RMU.
- Proper cable support provisions shall be provided for termination of the cable, in addition to the cable clamp provided along with the gland plate. Minimum termination height of around 750mm should be provided for terminating 11kV cables.
- Thermal sensors should be provided in the cable chamber of Ring main unit. All the sensors are to communicate sensor data concentrator through Zigbee, which shall further communicate with FRTU for remote SCADA monitoring through MODBUS RTU connection.
- Thermal sensor should have discrepancy alarm between phases and threshold alarms for individual phases. Humidity /climatic sensor should provide ambient temperature and ambient humidity signals.
- Manufacturer to declare the make of vacuum interrupter offered is same as used in type tests.

- The equipment offered in the tender should have been successfully type tested at NABL laboratories in India or equivalent international laboratories within 10 years from the date of offer submission.

4.5 Technical Particulars for Ring Main Unit & its Components

4.5.1 Load Break Isolators

Table 7: Technical Particulars for Load Break Isolators

SN	Technical Particular	Details
1.	Construction per phase a	SF6-Single Break
2.	Current Capacity	630A
3.	Making Capacity	50 KA (peak)
4.	Breaking capacity normal load current	630A
5.	Short time rating	21 KA for 3 second
6.	Short circuit current making capacity	50 KA
7.	Impulse withstands voltage to earth between poles	75 kV peak
8.	Power frequency withstand voltage to earth and between poles	28kV RMS for 1 min
9.	Electrical Class of Operation	E1
10.	Auxiliary Contacts	1 NO + 1 NC wired to terminal block
11.	Operating Mechanism for close / open	Electrically operated with motor mechanism
12.	Manual operation of LBS with/without removal of motor shall be possible	Possible with/ without removal of motor
13.	Minimum number of operations at rated current as per IEC 60265	To be guaranteed by firm along with test certificate

SN	Technical Particular	Details
14.	Minimum number of operations at fault current as per IEC 60265	Same as above
15.	Spring Charge Motor	D.C. Motor 24 volts
16.	Re-chargeable Battery Pack for Motor	24 volt D.C.
17.	Charger for Battery Pack	A.C.240V; 50Hz. of suitable Amp.Capacity.

4.5.2 Parameters for Switchgear of DT and LBS

Table 8: Parameters for Switchgear of DT and LBS

SN	Parameter	Details
1.	Type	Metal Enclosed
2.	No. of Phases	3
3.	No. of Poles	3
4.	Rated Voltage	12 kV
5.	Operating Voltage	11 kV (+10% to -20%)
6.	Rated lightning impulse withstand voltage	75 KV
7.	Rated power frequency withstand voltage	28 kV
8.	Insulating gas	SF6
9.	Rated filling level for insulation	0.35 bar/As Per relevant IS/IEC Code
10.	Maximum Permissible site altitude at the above gas pressures (The operating pressure has to be adjusted for greater altitudes)	1000m
11.	Rated short time current	21 kA
12.	Rated short time	3s
13.	Rated peak withstand current	50 KA
14.	Operating mechanism	Circuit breaker with spring assisted anti

		reflex mechanism.
15.	Rated current (Bus)	630A
16.	Rated current (Breaker)	630A
17.	Circuit Breaker interrupter	VCB
18.	Rated frequency	50 Hz
19.	Rated operating sequence	O-0.3sec- CO -3min-CO

4.5.3 Principal Features

SN	Feature	Remarks
1.	Circuit Label	Yes
2.	Mimic Diagram	Yes
3.	Supply voltage indication	Yes
4.	Current Transformer	Yes
5.	Self-Powered Microprocessor based communicable IDMT Relay (3OL)	Yes
6.	Interlock for non-operation of line side earthing when the line side isolator is ON.	Yes
7.	Interlock for non-operation of the earthing when the breaker is in service position and is ON. (With disconnector in ON condition)	Yes
8.	Local /Remote Switch (In case of motorized RMUs only)	Yes
9.	Breaker ON/OFF indication	Yes
10.	Fault Tripping indication	Yes
11.	Bus bar end caps	Yes
12.	The SF6 gas pressure gauge indicator and filling valve.	Yes
13.	The spring assisted mechanism with operating handle for ON/OFF.	Yes
14.	The earth positions with arrangement for padlocking in each position and independent manual operation with mechanically operated indicator are provided	Yes

SN	Feature	Remarks
15.	Status signals to SCADA to be wired to marshaling terminal block (2NO+2NC)	Yes
16.	LBS close /open (potential free contacts)	Yes
17.	LBS& CB Earth Switch close /open (potential free contacts)	Yes
18.	Battery charger Fails (potential free contacts)	Yes
19.	CB close /open (potential free contacts)	Yes
20.	Protection relay operated (potential free contacts)	Yes
21.	FPI operated (potential free contacts)	Yes
22.	SF6 gas pressure Low (potential free contacts)	Yes
23.	Commands from SCADA to be wired to marshaling terminal block	LBS close/ open, FPI reset etc. (For other details please see Automation Philosophy)

4.5.4 Earthing switch for LBS & CB (11 KV Line side Isolation and DT)

SN	Parameter	Details
1.	Rated short time & current	20 kA, 3 Sec
2.	Rated peak withstand current	50 kA
3.	Interlocking facility	Between 11 KV Line side isolator 'ON"& Earthing. Between 11 KV DT side breaker on close condition & Earthing. Between breaker & disconnector on breaker function
4.	Auxiliary contacts	NO + 2 NC wired to terminal block

4.5.5 11 kV Bus Bar

SN	Parameter	Details
1.	Type of Material	Copper
2.	Current Carrying Capacity	630A
3.	Short time rating current for 3 Sec.	20 kA

SN	Parameter	Details
4.	Insulation of Bus Bar	SF6
5.	Bus Bar Connections	Anti-oxide grease

4.6 Guaranteed Technical Particulars (GTP) of RMU

Sample of GTP for RMU is given at para Annexure-I: Guaranteed Technical Particulars (12.2 (Annexure). Bidders are required to provide details of the proposed products in their Bids in this format.

5 FIELD REMOTE TERMINAL UNIT [For PSS (11 kV / 415 V) & RMU]

5.1 TECHNICAL REQUIREMENTS OF FRTU

5.1.1 General

The Feeder Remote Terminal Unit (FRTU) shall be installed in Ring Main Units (RMUs). FRTU shall be used for control of switching devices such as breaker, isolator inside RMU.

5.2 Design Standards

The FRTUs shall be designed in accordance with applicable International Electro-technical Commission (IEC), Institute of Electrical and Electronics Engineer (IEEE), American National Standards Institute (ANSI), and National Equipment Manufacturers association (NEMA) standards, unless otherwise specified in this Technical specification. In all cases the provisions of the latest edition or revision of the applicable standards in effect shall apply.

5.3 FRTU Functions

As a minimum, the FRTU shall be capable of performing the following functions:

- FRTU should be a DIN rail mount. FRTU should have a Head end unit to communicate with upstream control centre and to downstream DI/DO modules (DI-DO module is Acquires Hardwired Digital Input, hardwired Digital Output and Analog Input from MFT or alternatively through transducer- less modules).
- Use of IEC 60870-5-101/104 protocol to communicate with the Master station(s). Use of MODBUS protocol over RS485 interface to communicate with MFTs. FRTU shall support IEC61850 protocol to communicate with Numerical relays.
- Have required number of communication ports for simultaneous communication with Master station(s), MFTs and FRTU configuration & maintenance tool. Ethernet 3 Nos and RS485 1 No ports to be provided as a minimum.
- FRTU shall have the capability of automatic start-up and initialisation following restoration of power after an outage without need of manual intervention. All restarts shall be reported to the connected master stations.
- Remote database downloading of FRTU from master station from SCADA control centre.
- As the SCADA system will use public domain such GPRS/CDMA etc, therefore it mandatory to guard the data/ equipment from intrusion/damage/breach of security & shall have adequate cyber security

features. the FRTU shall be designed to be compliant with NERC and IEC62351 requirements. The FRTU shall support secure access based on RBAC, with the possibility to configure the roles.

- An inbuilt wifi communication modem shall be offered in FRTU for local access via hand held devices (Tablet / smart phone / etc.)
- FRTU shall have capability of minimum 450,000 local events storage.
- FRTU shall have one port (USB) for connecting the portable configuration and maintenance tool for FRTU.
- Configuration - Access to the FRTU by configuration tool shall be possible only through secured connection: HTTPS for Webserver and SSH for console and configuration tool.
- Control Output (16 DO capabilities in Acquisition module) - The FRTU shall provide the capability for a master station to select and change the state of digital output points. These control outputs shall be used to control power system devices such as Circuit breakers, isolator, reset, relay disable/enable and other two-state devices, which shall be supported by the FRTU.
- The internal FRTU time base shall have a stability of 10 ppm. The FRTU shall be synchronised through synchronisation message from master station at every 5 minutes (configurable from 5 minutes to 60 minutes) over IEC 60870-5-104/101/NTP/SNTP.
- Input DC Power Supply - The FRTU will be powered from a 12Vdc / 24Vdc / 48 V DC power supply system. The FRTU shall not place additional ground on the input power source. The characteristics of the input DC power supply shall be Nominal voltage of 12Vdc / 24Vdc / 48 Vdc with variation between +20% & -15% The FRTU shall have adequate protection against reversed polarity, over current and under voltage conditions, to prevent the RTU internal logic from being damaged and becoming unstable causing mal-operation. Voltage of DC Supply should be monitored continuously by FRTU as Measurement/Analog value using DC Transducer with 4-20mA Output and transmitted to SCADA.
- Diagnostic Software - Diagnostic Software shall be provided to continuously monitor operation of the FRTU and report FRTU hardware errors to the connected master stations. The software shall check for memory, processor, and input/output ports errors and failures of other functional areas defined in the specification of the FRTU.
- Environmental Requirements - The FRTU will be installed in inside RMU Panel or in open environment with no temperature or humidity control. The FRTUs shall be capable of operating in ambient temperature from 0 to +55 degree C with rate of temperature change of 20 degree C/hour and relative humidity less than 95%, non-condensing. FRTUs to be installed in the hilly region with the history of snowfall, the same the lower ambient temperature limit shall be -5 degree C.
- DI-DO Acquisition module details:
    - Analog Inputs (4AI capability in Acquisition module):

      The real time values like, Active power, Reactive Power, Apparent power three phase Current & Voltage and frequency, power factor & accumulated values of import /export energy values will be acquired FRTU from the following in the given manner:

        a) Multi-Function Transducers installed in RMU/DTs

        b) RTU shall also take 4-20 mA, 0-20mA, 0- -10mA, 0-+10mA, 0-5V etc as analog inputs to acquire DC power supply voltage etc.

    - Status input (32 DI capability in Acquisition module)

        a) FRTU shall be capable of accepting isolated dry (potential free) contact status inputs. The FRTU shall provide necessary sensing voltage, current, optical isolation and de-bounce filtering independently for each status input

b) FRTU shall support Self-Healing Grid feature, so that it shall support Fault location, Isolation and supply restoration without any manual and SCADA intervention.

c) This feature will enable the RMU to supply 11KV supply without any manual intervention.

d) FRTU shall support peer to peer communication.

e) FRTU manufacturer shall submit the performance certificate from utility.

5.4 Salient Features

- Online Temperature Monitoring in PSS shall be provided with following technical requirements:
- RMU, Transformer & LT section shall have temperature measurement sensors in cable chamber to monitor abnormality of cable termination
- The wireless temperature sensors installed shall have, communication with FRTU
- The FRTU shall allow 2 configurable thresholds (pre-alarm and alarm) which shall be monitored locally via web page access and remotely at Scada
- The system shall be online to immediately provide an abnormal temperature alarm (with identification/location of the abnormal temperature) to the operator
- Wireless sensors shall be self-powered
- Life of the sensors shall be same as that of RMU
- This will, enhance the capability to identify the deteriorating and health of the switchgear in very early stages, aiming to provide online condition monitoring to detect electrical devices impending failures and avoid unscheduled downtime. It is the next step to move from preventive maintenance to predictive maintenance.

6 RTU AND ASSOCIATED HARDWARE [For Sub-Station (22 / 11 kV & 33/ 11 kv)]

6.1 General Requirement

The RTUs shall be designed in accordance with applicable International Electro-technical Commission (IEC), Institute of Electrical and Electronics Engineer (IEEE), American National Standards Institute (ANSI), and National Equipment Manufacturers association (NEMA) standards, unless otherwise specified in this Technical specification. In all cases the provisions of the latest edition or revision of the applicable standards in effect shall apply.

6.2 RTU Functions

As a minimum, the RTUs shall be capable of performing the following functions:

- Collecting and processing the digital status inputs, analog inputs, accumulated values and transmitting to master station(s)
- Receiving and processing digital & analog control commands from the master station(s)
- Accepting polling messages from at least three master station(s) simultaneously using separate logical databases for each master station.
- Communication simultaneously on all Communication ports (as per cl. 1.3) and using multiple concurrent protocols, including the IEC 60870-5-101, 60870-5-104 & MODBUS/103 protocol.

- Data transmission rates from 300 to 9600 baud for serial ports (for both IEC 60870-5-101 & MODBUS/103) and 10/100 Mbps for TCP/IP Ethernet ports.
- RTU shall be compatible with protocol IEC 61850-Ed2 for communication with IEDs./Numerical Relays
- RTU shall have the capability of automatic start-up and initialization following restoration of power after an outage without need of manual intervention. All restarts shall be reported to the connected master station(s).
- RTU shall support time synchronization through messages received from master station using IEC 60870-5-101 protocol.
- RTU shall support downloading of RTU database from the master station for RTUs working on IEC 60870-5-104 protocol.
- RTU shall support SOE (Sequence of events) feature
- Acting as a data concentrator for acquiring data from Slave RTUs and exercising supervisory control on slave RTUs using IEC 60870-5-101 and IEC 60870-5-104 protocol.
- RTU to be equipped with Cyber Security with the following:
    - Users Authorization and authentication (Role Based Access Control)
    - The RTU shall be Hardened to resist to Cyber Security Threats: the specific CS measures are to be described.
    - It shall pass the "Achilles" Test Level 1, indication of its robustness
    - CS Vulnerabilities are to be managed by a CERT and Customer is to be informed in case of Vulnerability Identification
    - Supplier is to offer Cyber Security services such as Risk Analysis, CS Training, CS Patch management, Disaster recovery.
    - RTU firmware is to have a "Firmware signature", identifying the Supplier.
- RTU shall be IEC 61850 Ed1 Level A KEMA certified.

6.3 Communication ports

The RTUs shall have communication ports as follows:

- Two Ethernet ports for connectivity to Master Station (Remote) on IEC 60870-5-104
- Two Ethernet ports for connectivity to IEDs/Numerical Relays on IEC 61850.
- One port for the RTU maintenance and configuration terminal
- The RTU shall use the IEC 61850 protocol for communication with IEDs/Numerical Relays over Sub-station LAN. The RTU shall act as a Client and collect data from the IEDs/Numerical Relays).
- The RTU shall store the data acquired from the MFTs & IEDs/Numerical Relays in its database and do processing like change detection/deadband processing on the data for optimizing its transmission to the Master Station (SCADA Control Centre)

6.4 Communication protocol

- The Contractor shall provide a communication protocol for communicating with SCADA master stations using the IEC 60870-5-101 and IEC 60870-5-104 communication protocol standard
- The RTU shall process the various messages/commands for communication to the Master station using the following priority:

- Control command
- Status data by exception
- Analog data by exception
- Analog data periodic
- Status data integrity scan

6.5 Technical Parameters of RTUs

Table 9: Technical Parameters of RTUs

SN	Description	Value	Comments
1	Data Transmission rate	300 to 9600 bps for serial port & 10/100 Mbps for Ethernet port	Configurable
2	Communication Port	Minimum 8 Ports	Two Ethernet ports for connectivity Master Station IEC 60870-5-104 Two Ethernet ports for connectivity IEDs/Numerical Relays on IEC 61850. Two RS232 ports for communication with Two master stations on IEC 60870-5-101 One port for the RTU maintenance and configuration terminal. Two ports Communication with Local Data Monitoring System (LDMS) Required number (minimum two) of RS 485 ports for polling Multi-function transducers MODBUS/ 60870-5- 103 protocol in multi- drop (party mode. Maximum 8 Numbers of MFTs connected to a single port in multi-drop mode.
3	Communication protocol with Master stations	IEC 60870-5-101/ 104	
4	Communication Protocol with LDMS	IEC 60870-5-104	
5	Communication Protocol with MFTs	MODBUS/IEC 60870-5-103	
6	Communication Protocol with IEDs / Numerical Relays	IEC 61850	
7	Status data transfer to Master station	By Exception	
8	Analog data transfer to Master station	Normally Periodic For major change –	

		by exception	
9	RTU shall be able to capture contact operations	of 20 ms or more duration.	
10	SOE buffer size	at least 1000 events for each master and LDMS	
11	Time stamping	1 ms	
12	Supporting Control of Devices	Two state & OLTC capacitors	
13	Downloading of RTU database from master station	Supported	
14	RTU internal clock stability	At least 2 ppm	
15	Nominal Power supply voltage	48V DC	

7 Moulded-Case Circuit Breakers (MCCB)

7.1 General

- MCCBs shall comply with standards IS/IEC 60947-1 & 2.
- MCCB shall have a rated operational voltage of 415V, insulation voltage of 690 V (AC 50/60 Hz) & impulse voltage of not less than 8kV.
- MCCBs shall be current limiting type preferably having an encapsulated double break design having two fixed contacts, one moving contact and two arc chutes per pole. The design is required to minimize the effects of short circuit currents i.e. limit the let through energy and improve the life of cables.
- MCCB shall not have any line load bias
- MCCB shall comply with the environmental directives like RoHS and WEEE
- All MCCBs upto 630A in main LT panel shall be plug-in type for ease of maintenance

7.2 Performance

- The MCCBs shall have a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) at 415V equal to 36kA. MCCB's Manufactures can optimize breaking capacity of outgoing MCCB's by using cascading technique.
- For maximum safety, the power contacts shall be insulated in an enclosure made of a thermosetting material from other functions such as the operating mechanism, the case, the trip unit and auxiliaries (ON/OFF/Trip Contact, Shunt, Under Voltage etc.).
- MCCBs shall be designed to prevent access to live parts when the cover is removed, means main current path of the circuit breaker should be isolated from auxiliary section i.e. MCCB shall offer class

–II front face as per IEC standards 61140 and 60664-1

- The electrical life of MCCBs shall be 8,000 operations up to 250A & 4,000 operations up to 630A
- MCCBs shall have cross bolted type termination where bus bars or cable lugs can be terminated by crossing the bolt between the lugs/bus bars and MCCB connections, to enhance safety and reliability of the terminations. In case spreaders/rear connectors are used in between MCCB and bus bar/lugs then the spreaders shall be cross bolted with the MCCB connectors.
- The status of MCCB need to be communicated to SCADA

8 Air circuit breaker (ACB)

8.1 General

- ACB shall comply with standards IS/IEC 60947-1 & 2.
- ACB shall have a rated operational voltage of 415V AC, rated insulation voltage of 1000 volts AC, rated impulse voltage of 12kV.
- ACB shall be of 3pole or 4pole (as per BOQ), air break, molded case design for longer life along with less maintenance requirement
- ACB shall have a Ready to close mechanism preferably having a ready to close mechanical indication on front of ACB. All Fixed Manual ACBs ready to close indication contact which shall be used to give a single indication via indicating lamps on panel.
- ACB shall comply with the environmental directives like RoHS and WEEE.

8.2 Performance

- ACB shall have the breaking performance Ics = Icu = Icw (1sec) = 50kA
- ACB shall have minimum Mechanical life of 20,000 operations
- The operating mechanism of ACB shall be of the Open/Closed/Open stored-energy spring type. The closing time shall be less than or equal to 70ms, and of fast opening type with break time of breaker should be <30ms to ensure higher life of distribution cables.
- The racking handle shall be stored on the air circuit breaker in such a manner as to be accessible without defeating the door interlocking.

8.3 Protections

- Air circuit breaker shall be provided with micro-processor release, which should be self-powered type without the need of any auxiliary power supply during normal operation of the breaker.
- The circuit breaker control unit shall measure the true r.m.s value of the current
- Circuit breaker trip unit shall have a display for measurement of current, voltage and energy. It shall be possible to view last 10 trip cause on trip unit.
- All trip units provided shall have thermal memory as standard
- All 4 Pole ACBs shall have fully rated neutral equal to rating of the breaker & shall be protected against over-load faults with provisions for settings neutral unprotected, neutral protection at 0.5In and neutral protection at 1.0 In to ensure precise neutral protection.
- All trip units shall be EMC/EMI tested.

9 LV Feeder Pillar

9.1 General Requirement

Design, Engineering, Manufacture, shop testing, inspection, painting, packing, and supply of Feeder Pillar panels complete with all accessories for efficient and trouble-free operation of the electric distribution network for power utilities. The equipment shall conform in all respects to high standards of Engineering design and workmanship and shall be capable of performing in a manner acceptable to user. The general requirements from the installation are low electrical losses, weather resistance, easy installation & connections, safe & touch proof design, easy sectionalizing & maintenance & maximum service life.

9.2 Specific Requirement

The feeder pillar shall be Compact in size with complete with bus bars, wiring, cabling of proper ratings (not less than 1.5 times the rating of respective switchgears, control gear etc.) for inter connection between switch gear, control gear, metering, safety relays, indicators etc.

The feeder pillar shall have proper arrangement for termination of all incoming and out goings cables. All the bus bars shall be supported on epoxy supports and shall be insulated with colour coded heat shrinkable sleeves. Feeder pillar shall be as per the space available at site. It shall have earthing bolts at both sides interconnected with 50x5 mm Al earthing bus along the width of feeder pillar.

The feeder pillar shall have space and proper arrangements for installation of incoming and outgoing MCCBs with R,Y,B LED type indicating lamps, Smart Energy Meter for Street Light pole.

10 Specifications of Feeder Pillar Panels

10.1 Type:1

Feeder Pillar panels suitable for AC 440 V , 50 HZ supply, fabricated with 14 gauge galvanised steel sheet duly pre-treated and pure polyester thick powder coated 80 micron thickness using Siemens grey colour shade no. RAL-7032 / any other colour if required by client. The feeder pillar shall be double door in cubical formation, compartmentalized in form with front open able doors. The door shall be provided with concealed hinges and with brazing wherever required to avoid deformation and shall be earthed. All the door shall have heavy duty door locks, and shall be sealed with neoprene gaskets. The feeder pillar shall be IP 55, outdoor type weather, dust and vermin proof having canopy type tapered roof self-standing type as per approved GA diagram. Location for Timer Switch for Street light control inside the panel.

The feeder pillar shall be Compact in size with complete with bus bars, wiring, cabling of proper ratings (not less than 1.5 times the rating of respective switchgears, control gear etc.) for inter connection between switch gear, control gear, metering, safety relays, indicators etc. as per the approved single line diagram. The feeder pillar shall have proper arrangement for termination of all incoming and out goings cables. All the bus bars shall be supported on epoxy supports and shall be insulated with colour coded heat shrinkable sleeves. Feeder pillar shall be as per the space available at site. It shall have earthing bolts at both sides inter connected with 50x5 mm Al earthing bus along the width of feeder pillar. Note: -The GA drawing for panel should be approved by consultant / engineer in charge before fabrication. The feeder pillar shall have space and proper arrangements for installation of incoming and outgoing MCCBs with R,Y,B LED type indicating lamps, Smart Energy Meter for Street Light pole.

MCBs etc. complete with interconnection provisions with providing wiring and bus bars with required hardware, sleeves, ferrules, supporters, locks etc. Panel shall have proper space and arrangements for termination of incomer loop in loop out cables, outgoing service cables, with proper offsets in bus bars for cable terminations. Feeder Pillar shall be comprising of following items:

Rating of incomer MCCB TPN 150 A, 35KA (Adjustable thermal O/L with Ics = 100% Icu).

Outgoing MCB , 10KA, of 32A SP -30 nos and MCB , 10KA, of 63A SP -6 nos,

10.2 **Type:2**

Feeder Pillar panels suitable for AC 440 V , 50 HZ supply, fabricated with 14 gauge galvanised steel sheet duly pre-treated and pure polyester thick powder coated 80 micron thickness using Siemens grey colour shade no. RAL-7032 / any other colour if required by client. The feeder pillar shall be double door in cubical formation, compartmentalized in form with front open able doors. The door shall be provided with concealed hinges and with brazing wherever required to avoid deformation and shall be earthed. All the door shall have heavy duty door locks, and shall be sealed with neoprene gaskets. The feeder pillar shall be IP 55, outdoor type weather, dust and vermin proof having canopy type tapered roof self-standing type as per approved GA diagram. Location for Timer Switch for Street light control inside the panel.

The feeder pillar shall be Compact in size with complete with bus bars, wiring, cabling of proper ratings (not less than 1.5 times the rating of respective switchgears, control gear etc.) for inter connection between switch gear, control gear, metering, safety relays, indicators etc. as per the approved single line diagram. The feeder pillar shall have proper arrangement for termination of all incoming and out goings cables. All the bus bars shall be supported on epoxy supports and shall be insulated with colour coded heat shrinkable sleeves. Feeder pillar shall be as per the space available at site. It shall have earthing bolts at both sides inter connected with 50x5 mm Al earthing bus along the width of feeder pillar. Note:-The GA drawing for panel should be approved by consultant / engineer in charge before fabrication. The feeder pillar shall have space and proper arrangements for installation of incoming and outgoing MCCBs with R,Y,B LED type indicating lamps, Smart Energy Meter for Street Light pole.

MCBs etc. complete with interconnection provisions with providing wiring and bus bars with required hardware, sleeves, ferrules, supporters, locks etc. Panel shall have proper space and arrangements for termination of incomer loop in loop out cables, outgoing service cables, with proper offsets in bus bars for cable terminations. Feeder Pillar shall be comprising of following items:

Rating of incomer MCCB TPN 100 A, 35KA (Adjustable thermal O/L with Ics = 100% Icu).

Outgoing MCB, 10KA, of 32A SP - 18 nos. and MCB , 10KA, of 63A SP -6 nos.

10.3 **Type:3**

Feeder Pillar panels suitable for AC 440 V , 50 HZ supply, fabricated with 14 gauge galvanised steel sheet duly pre-treated and pure polyester thick powder coated 80 micron thickness using Siemens grey colour shade no. RAL-7032 / any other colour if required by client. The feeder pillar shall be double door in cubical formation, compartmentalized in form with front open able doors. The door shall be provided with concealed hinges and with brazing wherever required to avoid deformation and shall be earthed. All the door shall have heavy duty door locks, and shall be sealed with neoprene gaskets. The feeder pillar shall be IP 55, outdoor type weather, dust and vermin proof having canopy type tapered roof self-standing type as per approved GA diagram. Location for Timer Switch for Street light control inside the panel.

The feeder pillar shall be Compact in size with complete with bus bars, wiring, cabling of proper ratings (not less than 1.5 times the rating of respective switchgears, control gear etc.) for inter connection between switch gear, control gear, metering, safety relays, indicators etc. as per the approved single line diagram. The feeder pillar shall have proper arrangement for termination of all incoming and out goings cables. All the bus bars shall be supported on epoxy supports and shall be insulated with colour coded heat shrinkable sleeves. Feeder pillar shall be as per the space available at site. It shall have earthing bolts at both sides inter connected with 50x5 mm Al earthing bus along the width of feeder pillar. Note:-The GA drawing for panel should be approved by consultant / engineer in charge before fabrication. The feeder pillar shall have space and proper arrangements for installation of incoming and outgoing MCCBs with R,Y,B LED type indicating lamps, Smart Energy Meter for Street Light pole.

MCBs etc. complete with interconnection provisions with providing wiring and bus bars with required hardware,

sleeves, ferrules, supporters, locks etc. Panel shall have proper space and arrangements for termination of incomer loop in loop out cables, outgoing service cables, with proper offsets in bus bars for cable terminations. Feeder Pillar shall be comprising of following items:

Rating of incomer MCCB TPN 63 A, 35KA (Adjustable thermal O/L with Ics = 100% Icu).

Outgoing MCB , 10KA, of 32A SP -18 nos.

10.4 Guaranteed Technical Particulars (GTP) of Feeder Pillars

Table 10: Guaranteed Technical Particulars of Feeder Pillars

Guaranteed Technical Particulars (GTP) Feeder Pillar		
SN	Description	**Details**
A	General	
1	Name of Manufacturer	**As per list of manufacturers**
2	Product Designation	**Feeder Pillar**
3	Product Details	**Feeder Pillar panels suitable for AC 440 V**
4	Configuration	**Configuration as per BOQ**
5	Incoming Circuit	**Configuration as per BOQ**
6	Outgoing Circuit	**as per BOQ**
7	Application of product	**Outdoor**
8	Humidity	**90% maximum**
B	System Information	
1	Rated Voltage	**415V ±10% Between Ph-Ph**
2	No. of phases	**3 No's**
3	Frequency	**50**
C	Pillar Construction	
9	Painting	**14-gauge galvanized steel sheet duly pre-treated and pure polyester thick powder coated 80 micron thickness.**
10	Color	**Light grey shade RAL 7035**
11	Degree of protection	**IP55**
12	**Panel Dimensions (H x W x D)**	**AS approved**

Bidders are required to provide details of the proposed products in their Bids in the format prescribed at para 12.3.

10.5 Earthing

- All metallic components are earthed to a common earthing point and transformer neutral point to be separate by chemical earthing.
- It is terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/strips & Lug arrangement.
- The continuity of the earth system is ensured taking in account the thermal & mechanical stresses caused by the current it may have to carry.
- The components to be connected to the earth system include:
    - The enclosure of Compact Package Sub-station.
    - The enclosure of High voltage switchgear and control gear from the terminal provided for the purpose.
    - The metal screen & the high voltage cable earth conductor.
    - The transformer tank or metal frame, of transformer.
    - The frame or enclosure of low voltage switchgear.
    - The neutral point of transformer.
    - LT Feeder pillar panel.
- There is an arrangement for internal lighting activated by associated switch for HV, Transformer & LV compartments separately.

11 APPROVED MAKES

11.1 Compact Packaged Sub-station (CSS)

Siemens /ABB / Schneider Electric / L&T / Voltamp

(Note: In the CSS out of 4 Major Components (CSS, RMU, Transformer and LT Switchgear) 3 Nos. of Components should be of same make)

11.2 Dry type transformer in CSS

ABB/ Raychem / Voltamp /Siemens /Schneider Electric

11.3 LT switchgear

Siemens / ABB / Legrand / L&T / Schneider Electric

11.4 HT and LT cables

RPG / Ravin / CCI / Finolex / Havells/ Universal / KEI & Other ISI marked makes (approved by MePDCL) fulfilling the specifications with prior approval of engineer.

12 Annexure

12.1 Annexure-I: Guaranteed Technical Particulars (GTP) (Sample) for CSS/PSS

SN	Description	Particulars
M.V SECTION		
1	**SWITCHGEAR ASSEMBLY**	
1.1	Make	
1.2	Type	
1.3	Reference Standard	
1.4	Voltage (Normal/Max.) kV	
1.5	Phase (Nos.)	
1.6	Frequency (Hz)	
1.7	Short Circuit Rating	
a)	Breaking Symmetrical (kA)	
b)	Breaking Asymmetrical (kA)	
c)	Short time for 1 Sec.	
d)	Short time for 3 sec.	
1.8	Insulation Level	
a)	Impulse Withstand (kV peak)	
b)	1 minute 50 Hz. Voltage Withstand (kV rms)	
1.9	Metal Clad Construction	**Yes/ No**
1.10	Degree of protection:	
1.11	Switchgear completely wire and tested at factory:	**Yes/ No**
2	**CONSTRUCTION**	
2.1	Overall Dimensions	
a.	Breaker	
	i) Length (mm)	
	ii) Breadth (mm)	
	iii) Height (mm)	

SN	Description	Particulars
b.	Isolator	
	1)Length (mm)	
	2) breadth (mm)	
	3) Height (mm)	
c.	Total Extensible RMU	
	1) Length (mm)	
	2) Breadth (mm)	
	3) Height (mm)	
2.2	Weight	
	a) Breaker (kg)	
	b) Isolator (kg)	
	c) Complete RMU (kg)	
3	**Bus Bar**	
3.1	Make	
3.2	Material & Grade	
3.3	Reference Standard	
3.4	a) Cross Sectional area (m m2)	
	b) Size (m m2)	
3.5	Continuous Current	
a)	Standard	
b)	At site conditions and within cubicle	
3.6	Maximum temperature rise over ambient (c)	
3.7.	Short time current for 3 Sec. (KA rms)	
3.8	Minimum clearance from bare bus bar connection	
a)	Phase to phase (mm)	
b)	Phase to earth (mm)	
3.9	Bus Bar provided with	
a)	Insulation Sleeve	

SN	Description	Particulars
b)	Phase barriers	
c)	Cast Resin shrouds for joints	
3.10	Bus bar connection	
a)	Silver Plated	
b)	Made with anti- oxide grease	
3.11	Bus bar support spacing (mm)	
3.12	Bus support insulators	
a)	Make	
b)	Type	
c)	Reference Standard	
d)	Voltage Class (kV)	
e)	Minimum Creepage distance (mm)	
f)	Cantilever strength Kg/mm2	
g)	Net Weight (kG)	
4	**CIRCUIT BREAKER**	
4.1.	Make	
4.2.	Type	
4.3.	Reference Standard	
4.4.	Rated Voltage	
4.5	Rated Frequency	
4.6	No. of Poles	
4.7	Rated Current	
a)	Normal (Standard) Amps	
b)	De-rated (Site) Amps	
4.8	Maximum temperature rise over ambient °C	
4.9	Rated operating Duty	
4.10	Rupturing capacity at rated voltage (MVA)	
4.11	Breaking capacity at rated voltage & operating duty	

SN	Description	Particulars
a)	Symmetrical (kA rms)	
b)	Asymmetrical (kA rms)	
4.12	Rated making Current (kA peak)	
4.13	a) Short time current for 1 sec. (kA rms)	
	b) Short time current for 3 Sec. (kA rms)	
4.14	Transient Recovery Voltage	
a)	Rate of rise (kV/ms)	
b)	Peak Voltage (kV)	
4.15	Insulation Level	
a)	Impulse voltage withstand on 1/50 full wave	
b)	1 minute 50 Hz. Voltage withstand	
4.16	Opening time maximum No load condition (ms)	
4.17	Opening and closing time under loss condition (ms)	
4.18	At 100% Breaking capacity	
a)	Opening time-Max. (ms)	
b)	Arcing time-Max (ms)	
c)	Total break time (ms)	
4.19	At 60% breaking capacity	
a)	Opening time-Max. (ms)	
b)	Arcing time-Max. (ms)	
c)	Total break time (ms)	
4.20	At 30% breaking capacity (ms)	
a)	Opening time-Max. (ms)	
b)	Arcing time-Max. (ms)	
c)	Total break time (ms)	
4.21	At 10% breaking capacity (ms)	
a)	Opening time-Max. (ms)	
b)	Arcing time-Max. (ms)	

SN	Description	Particulars
c)	Total break time	
4.22 a)	Make time (Max) (ms)	
b)	Total closing time (ms)	
4.23	Number of breaks per pole	
4.24	Total length of breaks per pole (mm)	
4.25	Total length of contact travel (mm)	
4.26	Speed of break (100% short circuit current)	
4.27	Rate of contact travel	
a)	At tripping M/sec.	
b)	At closing M/sec.	
4.28	No. of breaker operations permissible without requiring inspection, replacement of contacts and other main parts.	
a)	At 100% rated current	
b)	At 100% rated breaking current	
4.29	Type of contacts	
a)	Main	
b)	Arcing	
4.30	Material of contact	
a)	Main	
b)	Arcing	
c)	Whether contacts silver plated	
d)	Thickness of silver plating	
4.31	Contact pressure at No load (Kg)	
4.32	Type of arc control device provided	
4.33	Operating mechanism-closing	
a)	Type	
b)	No. of breaker operations stored	
c)	Trip free or fixed trip	

SN	Description	Particulars
d)	Anti-pumping features provided	
e)	Earthing for operating mechanism and metal parts furnished	
f)	Earth terminal size and material	
4.34	Operating mechanism-tripping	
a)	Type	
b)	No. of breaker operations stored	
c)	Trip free or fixed trip (V)	
d)	Anti-pumping features provided (%)	
e)	Earthing for operating mechanism and metal parts furnished	
f)	Earth terminal size and material	
4.35	a) Spring Charging mechanism	
	b) Make	
	c) Type	
	d) Size	
	e) rating	
4.36	Breaker suitable for capacity switching Operating duty Max. rating of capacitor bank that can be safely controlled	
4.37	Tripping Coil	
a)	Voltage	
b)	Permissible voltage variation (%)	
c)	Tripping Current at rated Voltage (A)	
d)	Power at rated voltage (W)	
e)	2-Over current trip with 1- earth fault furnished as specified.	
4.38	Breaker/Accessories such as control switch indication lamps etc. furnished as specified: (Please attach separate sheet giving details of all accessories, inter locks and safety shutters)	
a)	Mechanical Safety Interlock	
b)	Automatic Safety Interlock	
c)	Operational Interlock	

SN	Description	Particulars
d)	Emergency manual trip	
e)	Operation counter	
f)	Charge/discharge indicator	
g)	Manual spring charging facility	
4.39	Impact load foundation design (to include dead load plus impact value on opening at maximum interrupting rating) (Kg)	
5	**Isolators**	
5.1	Make	
5.2	Type	
5.3	Reference Standard	
5.4	Rated Voltage (KV)	
5.5	Rated Frequency Hz	
5.6	No. of Poles (No)	
5.7	Rated Current Normal (Standard) De-rated (Site) Amp	
5.8	Maximum temperature rise over ambient °C	
5.9	Rated Operation duty	
5.10	Rupturing Capacity at rated voltage MVA	
5.11	Rated making current KA Peak	
5.12	Short time current	
a)	for 1 Sec KA RMS	
b)	for 3 Sec KA RMS	
5.13	Impulse voltage withstand on 1/50 full wave	
b)	1 minute 50 Hz voltage withstand	
5.14	Maximum over voltage factor when switching off	
a)	Loaded feeder cable	
5.15	Minimum SF6 Gas pressure required	
5.16	No. of isolator operation permissible without requiring inspection, replacement of contacts and other main Parts	

SN	Description	Particulars
	At 100% rated current	
	At 100% rated breaking current	
5.17	Isolator provided with the following	
	Mechanical safety	
	Mechanical ON, OFF , CABLE EARTH indicators	
	Operation counter	
	Manual spring charging facility	
5.18	Impact load for foundation design (To include dead load plus impact values on opening at maximum interrupting rating) Kg	
6	**CURRENT TRANSFORMER**	
6.1	Make	
6.2	Type & voltage level	
6.3	Reference standard	
6.4	C.T. ratio as specified	
6.5	Rated frequency	
6.6	Short circuit withstand	
I)	Short time current for 3 Sec. KA RMS	
ii)	Short time current for 5 Sec. KA RMS	
iii.	Dynamic current kA peak	
6.7	Class of insulation	
6.8	Temperature rise over ambient ° C	
6.9	Basic insulation level	
6.10	For tripping	
	CT Ratio	
	Class of accuracy	
	Rated burden VA	
	Knee point voltage V	
	Excitation current at Vk/2 Amps	

SN	Description	Particulars
	Rated saturating current Amp	
	Over current rating	
	Continuous % over load (%)	
7	**CABLE TERMINATIONS**	
7.1	Circuit Breaker	
	Type	
	Material	
	Dimensions	
	Size	
	Height of cable box from ground level	
	Arrangement for supplying bus end cable box furnished for extensible ring main unit	
	Arrangement for mounting an extra cable box on each equipment furnished	
7.2	Isolator	
	Type	
	Material	
	Dimensions	
	Size	
	Height of cable box from ground level	
8	**Name Plate**	
8.1	Material	
8.2	Thickness	
8.3	Size for	
	a) Breaker cubicle	
	b) Instruments/devices	
9	**Painting**	
9.1	Finish of Breaker	
	Inside	

SN	Description	Particulars
	Outside	
9.2	Finish of Isolator	
	Inside	
	Outside	
10	No. of Accessories Furnished	
a)	Earthing Equipment	
b)	Test Plug	
11	**TESTS**	
11.1	Reference Standard	
11.2	Routine tests to be performed on switchgear	
11.3	Type Tests quoted	
12	**Drawing / Data**	
12.1	General arrangement for Panel Board	
12.2	Foundation plan	
12.3	Breaker tripping & material schematic	
12.4	Bill of material	
12.5	Breaker LT Panel Wiring Diagram	
TRANSFORMER SECTION		
1	**General**	
1.1	Make	
1.2	Type	
1.3	Reference Standard	
2	**Rating**	
2.1	Rated output with cooling (kVA)	
2.2	Type of cooling	
2.3	Rated Voltage (kV)	
a)	H.V.	
b)	L.V.	

SN	Description	Particulars
2.4	Rated Current (Amps)	
a)	H.V.	
b)	L.V.	
2.5	Guaranteed No Load current @ 100% rated voltage	
a)	H.V.	
b)	L.V.	
2.6	Guaranteed No Load current @ 110% rated voltage	
a)	H.V.	
b)	L.V.	
2.7	No. of phases	
2.8	No. of windings per phase	
2.9	Rated Frequency (Hz)	
2.1	Vector Group reference	
3	**Temperature**	
3.1	Reference ambient temperature (◦C)	
3.2 a)	Temperature rise over reference Ambient	
b)	Winding by resistance (◦C)	
3.3	Maximum continuous overloading capacity of the transformer without exceeding the specified winding temperature	
4	**Tappings**	
4.1	Type	
4.2	Capacity	
4.3	Range-Steps x % variation	
4.4.	Taps provided on H.V. windings	
4.5	Details of Tappings	
	Tap Position	
	1	
	2	

SN	Description	Particulars
	3	
	4	
	5	
4.6	Off load Tap Links	
a)	Operating Voltage (kV)	
b)	Rated Current (Amp)	
c)	Type	
d)	Reference Standard	
e)	Number of Poles	
f)	Defined features provided	
5	**Impedance at principal tap rated current and frequency (%)**	
5.1	Impedance	
5.2	Reactance	
5.3	Resistance	
5.4.	Zero Sequence impedance	
a)	H.V.	
b)	L.V.	
5.5	Resistance of the winding @ 75 Deg C	
a)	H.V.	
b)	L.V.	
6	**Guaranteed Losses at principal tap full load and 75 Deg C without any positive tolerance**	
6.1	No load losses (kW)	
6.2	Load Losses (kW)	
6.3	Total Losses (kW)	
6.4	No Load loss at maximum permissible voltage and frequency (approx.) kW.	
7	**Efficiency**	
7.1.	Efficiency at 75 Deg C and unity power factor (%)	

SN	Description	Particulars
a)	at 110% load	
b)	at 100% load	
c)	at 80% load	
d)	at 60% load	
e)	at 40% load	
f)	at 20% load	
7.2	Efficiency @ 75deg C and 0.8 power factor lag (%)	
a)	at 110% load	
b)	at 100% load	
c)	at 80% load	
d)	at 60% load	
e)	at 40% load	
f)	at 20% load	
	Maximum efficiency (%)	
	Load and power factor at which it occurs	
8	**Regulation**	
	Regulation at full load @75 Deg C	
a)	at Unity power factor	
b)	at 0.8 Power factor lagging	
	Regulation at 110% load @ 75 Deg C	
a)	at Unity power factor	
b)	at 0.8 Power factor lagging	
9	**No. load current (Amps)**	
	At 100% voltage	
a)	H.V.	
b)	L.V.	
	At 110 % voltage	
a)	H.V.	

SN	Description	Particulars
b)	L.V.	
10	**Maximum flux density (Lines/cm2)**	
	At 100% rated voltage	
	At 110% rated voltage	
11	**Maximum current density Amps/ cm2.**	
	H.V. Winding	
	L.V. Winding	
	Withstand time and current as multiple of full load current without injury for (Amps x Sec.)	
	Three phase dead short circuit at terminal with rated voltage maintained on the other side.	
	Single phase short circuit at terminal with rated voltage maintained on other side	
12	Cooling System (if applicable)	
	Type of cooling	
	No. of cooling exhaust fans	
	Capacity of cooling exhaust fan	
13	**Core**	
	Type/Core/or shell	
	Core Material	
	Thickness of lamination (mm)	
	Insulation of lamination (mm)	
	Equivalent cross section area (mm2)	
14	**Coils**	
14.1	Type of coils	
a)	H.V.	
b)	L.V.	
14.2	Conductor material	
	Gauge/area of cross section of conductor	

SN	Description	Particulars
a)	H.V.	
b)	L.V.	
14.3	Insulating material (class F)	
a)	H.V. Turn	
b)	L.V. Turn	
c)	L.V. Core	
d)	H.V – L.V.	
14.4	Insulating material thickness (mm)	
a)	H.V. Turn	
b)	L.V. Turn	
c)	L.V. Core	
d)	H.V – L.V.	
15	**Minimum design clearance (mm)**	
	H.V. to earth in air	
	L.V. to earth in air	
	Between H.V. & L.V. in air	
	Top Winding and Yoke	
	Bottom winding and yoke	
16	**Transformer impulse level (kV)**	
	H.V. Winding	
	L.V. Winding	
17	**Bushing**	
	Make	
	Type	
	Reference Standard	
	Voltage Class (kV)	
	Creepage distance factor (mm/kV)	
	Weight (Kg)	

SN	Description	Particulars
	Free space required for bushing removal (mm)	
18	**Terminal connections**	
	H.V	
	L.V	
	L.V. Neutral	
19	**Accessories**	
	Each Transformer furnished with fittings and accessories as per Clause No.5.00.00 (Please attach separate sheet giving details)	
20	**Overall dimensions**	
	Length (mm)	
	Breadth (mm)	
	Height (mm)	
21	**Weight Data Kg)**	
	Core and frame (Kg)	
	Core windings etc. (Kg)	
	Total Weight (Kg)	
22	**Shipping Data**	
	Weight of heaviest package (Kg)	
	Dimensions of the largest package (L x B x H) (mm)	
23	**Tests**	
	Routine tests as per IS:11171/1985	
	Core bolt withstand voltage for 1 minute	
	Type Test quoted:	
	Temperature rise test at ANAN rating	
	Impulse Test (kV peak)	
	(Add Sheets if necessary)	
	Partial Discharge Level:	

12.2 Annexure-II: Guaranteed Technical Particulars (Sample) for RMU

SN	Description	MePDCL Requirement
1.0	SWITCHGEAR ASSEMBLY	
1.1	Make	
1.2	Type	
1.3	Reference Standard	
1.4	Voltage (Normal/Max.) kV	
1.5	Phase (Nos.)	
1.6	Frequency (HZ)	
1.7	Short Circuit Rating for 3 Sec. (KA)	
1.8	Insulation Level	
	a) Impulse withstand (KV peak)	
	b) 1 Minute 50 Hz. Voltage withstand (KV rms)	
1.9	Metal Clad Construction	
1.10	A) Degree of protection for outer enclosure: B) Degree of protection for main tank:	
1.11	Switchgear completely wire and tested at factory (yes/No)	
2.0	CONSTRUCTION	
2.1	Overall Dimensions	
A	Extensible Way RMU	
	i) Width (W) (mm)	
	ii) Depth (D) (mm)	
	iii) Height (mm)	
2.2	Overall Weight of RMU	
3.0	Bus bar	
3.1	Make	
3.2	Material & Grade	
3.3	Reference Standard	

SN	Description	MePDCL Requirement
3.4	a) Cross sectional area (mm2)	
3.5	Continuous Current	
	a) Standard	
	b) At site conditions and within cubicle	
3.6	Maximum temperature rise over ambient (c)	
3.7	Minimum clearance from bare bus bar Connection	
	a) Phase to phase (mm)	
	b) Phase to Earth (mm)	
3.9	Bus Bar provided with	
	a) Insulation Sleeve	
	b) Phase barriers	
	c) Cast Resin shrouds for joints	
3.10	Bus bar connection	
	a) Silver Plated	
	b) Made with anti-oxide grease	
3.11	Bus Bar support spacing (mm)	
3.12	Bus support insulators	
	a) Make	
	b) Type	
	c) Reference Standard	
	d) Voltage Class (KV)	
	e) Minimum creep age distance (mm)	
	f) Cantilever strength Kg/mm2	
	g) Net Weight (Kg)	
3.13	SF6 gas pressure (filing pressure at 20 deg. C)	
4.0	SF6/VCB CIRCUIT BREAKER	
4.1	Make	

SN	Description	MePDCL Requirement
4.2	Type (Vacuum/ SF6)	
4.3	Reference Standard	
4.4	Rated Voltage	
4.5	Rated Frequency	
4.6	No. of Poles	
4.7	Rated Current	
	a) Normal (Standard) Amps	
	b) Rated (Site) Amps	
4.8	Maximum temperatures rise over ambient. (deg. C)	
4.9	Rated operating Duty	
4.11	Breaking Capacity at rated voltage & operating duty	
4.12	Rated making current (KA peak)	
	b) Short time current for 3 Sec. (KA rms)	
4.13	Transient Recovery Voltage	
	a) Rate of rise (KV/ms)	
	b) Peak Voltage (KV)	
4.14	Insulation Level	
	a) Impulse Voltage with stand on 1/50 full wave	
	b) 1-minute 50Hz voltage withstand	
4.15	Opening time Maximum, No load condition (ms)	
4.16	Opening and closing time under SF6 gas loss or vacuum loss condition (ms)	
4.17	At 100% Breaking capacity	
	a) Opening time – max (ms)	
	b) Arcing time – max (ms)	
	c) Total break time (ms)	
4.18	At 60% Breaking capacity	
	a) Opening time – max (ms)	

SN	Description	MePDCL Requirement
	b) Arcing time – max (ms)	
	c) Total break time (ms)	
4.19	At 30% Breaking capacity	
	a) Opening time – max (ms)	
	b) Arcing time – max (ms)	
	c) Total break time (ms)	
4.20	At 10% Breaking capacity	
	a) Opening time – max (ms)	
	b) Arcing time – max (ms)	
	c) Total break time (ms)	
4.21	Number of breaks per pole	
4.22	No of breaker operations permissible without requiring inspection replacement of contacts and other main parts.	
	a) At 100% rated current	
4.23	Type of contacts	
	a) Main	
	b) Arcing	
4.24	Material of contacts	
	a) Main	
	b) Arching	
	c) Whether contacts silver plated	
	d) Thickness of silver plating	
4.25	Operating mechanism- closing	
	a) Type	
	b) No of breaker operations stored	
	C) Trip free or fixed trip	
	d) Anti pumping features provided	

SN	Description	MePDCL Requirement
	e) Earthing for operating mechanism and metal parts furnished	
	f) Earth terminal size and material	
4.26	Operating mechanism- tripping	
	a) Type	
	b) No of breaker operations stored	
	c) Trip free or fixed trip (V)	
	d) Anti pumping features provided (%)	
	e) Earthing for operating mechanism and metal parts furnished	
	f) Earth terminal size and material	
4.27	Spring charging mechanism	
	2) Make	
	3) Type	
	4) Size	
	5) Rating	
4.29	Breaker suitable for capacity switching 4 operating duty 5Max.rating of capacitor bank that can be safely controlled	
4.30	Tripping coil	
	a) Voltage	
	b) Permissible voltage variation (%)	
	c) Tripping current at rated voltage (A)	
	d) Power at rated voltage (W)	
	e) 2-Over current trip with TLF (5A) and 1-earth fault furnished as specified	
4.31	Breaker /Accessories such as control switch indication Lamps etc. furnished as specified : (please attach separate sheet giving details of all accessories, inter locks and safety shutters)	
	a) Mechanical safety Interlock	
	b) Automatic Safety Interlock	
	C) Operational Interlock	

SN	Description	MePDCL Requirement
	d) Emergency manual trip	
	e) Operation counter	
	f) Charge /discharge indicator	
	g) Manual spring charging facility	
4.32	Impact load foundation design (to include dead load plus impact value on opening at maximum interrupting rating) (KG)	
5.0	Isolators/Load Break Switch	
5.1	Make	
5.2	Type	
5.3	Reference standard	
5.4	Rated voltage (KV)	
5.5	Rated Frequency HZ	
5.6	No. Of poles (No)	
5.7	Rated current	
	a) Normal (Standard) Amps	
	b) De-rated (site) Amp	
5.8	Maximum temperature rise over ambient Deg. C	
5.9	Rated operation duty	
5.10	Rupturing Capacity at rated voltage MVA	
5.11	Rated making current KA peak	
5.12	Short time current	
	b) For 3 sec KA rms	
5.13	Impulse voltage withstands on 1/50 full wave	
5.14	Maximum over voltage factor when switching off a) Loaded feeder cable	
5.15	Operating SF6 Gas pressure	
5.16	No of isolator operation permissible without requiring inspection, replacement of contacts and other main parts	

SN	Description	MePDCL Requirement
	At 100% rated current At 100% rated breaking current	
5.17	Isolator provided with the following; Mechanical safety Mechanical ON, OFF, CABLE EARTH indicators Operation counter Manual spring charging facility	
5.18	Impact load for foundation design (To include dead load plus impact Values on opening at maximum interrupting rating) Kg	
6.0	CURRENT TRANSFORMER	
6.1	Make	
6.2	Type & voltage level	
6.3	Reference standard	
6.4	C.T. ratio as specified	
6.5	Rated frequency	
6.7	Class of insulation	
6.8	Temperature rises over ambient. Deg. C	
6.9	Basic insulation level	
6.10	For tripping CT RATIO Class of accuracy	
	Rated Burden VA	
	Knee Point Voltage V	
	Excitation Current at Vk/2 Amps	
	Rated Saturating Current Amps	
	Over Current Rating	
	Continuous % Over Load %	
7.0	Cable terminations	
7.1	Circuit Breaker	
	Type	
	Materials	
	Dimensions	

SN	Description	MePDCL Requirement
	Size	
	Height of Cable box from ground Level	
	Arrangement for supplying bus end cable box furnished for extensible ring main Unit	
	Arrangement for mounting an extra cable box on each equipment furnished	
7.2	Isolator	
	Type	
	Materials	
	Dimensions	
	Size	
	Height of Cable box from ground Level	
	Arrangement for supplying bus end cable box furnished for extensible ring main Unit	
	Arrangement for mounting an extra cable box on each equipment furnished	
8.0	Name Plate	
8.1	Material	
8.2	Thickness	
8.3	Size for Breaker Cubicle Instruments / Devices	
9.0	Painting	
9.1	Finish of Breaker	
	Inside	
	Outside	
9.2	Finish of Isolator	
	Inside	
	Outside	
10.0	Drawing / Data	
10.1	General arrangement for Panel Board	

SN	Description	MePDCL Requirement
10.2	Foundation plan	
10.3	SF6/VCB tripping and material Schematic	
10.4	Bill of Material	
10.5	**SF6/VCB LT panel wiring diagram**	

12.3 Annexure-III: Guaranteed Technical Particulars (Sample) for Feeder Pillars

Guaranteed Technical Particulars (GTP) Feeder Pillar		
SN	Description	**Details**
A	General	
1	Name of Manufacturer	
2	Product Designation	
3	Product Details	
4	Configuration	
5	Incoming Circuit	
6	Outgoing Circuit	
7	Application of product	
8	Humidity	
B	System Information	
1	Rated Voltage	
2	No. of phases	
3	Frequency	
C	Pillar Construction	
9	Painting	
10	Color	
11	Degree of protection	
12	**Panel Dimensions (H x W x D)**	

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