

PARTICULAR SPECIFICATION (Cont....)**1. GENERAL REQUIREMENT**

- 1.1 These particular specifications shall be read in conjunction with MES Standard Schedule of Rates 2009 (Part I) Specifications and MES Standard Schedule of Rates 2020 (Part II) Rates.
- 1.2 General specifications referred to mentioned in IAFW-2249 (1989 print) and other tender documents mean specifications including other provisions & preambles given in MES Standard Schedule Rates 2009 (Part I) Specification and 2020 (Part II) Rates including amendments and errata as mentioned here-in-before.
- 1.3 Materials & Workmanship required for these Works/Services shall be as described against 'Specifications & Workmanships' in the various Trade/Sections of the MES Schedule duly modified by these Particular Specifications here-in-after.
- 1.4 Provisions contained in the MES Schedule Part II in the Preambles to the relevant Items of SCHEDULE 'A' shall also be read in conjunction with the Provisions contained in these documents.
- 1.5 Particular Specifications given here-in-after shall be read in conjunction with the Provisions in the MES Schedule and relevant Indian Standards referred to thereto and in these Particular Specifications. In case of any discrepancy, the Provisions in these Particular Specifications shall take precedence.
- 1.6 Materials/Accessories/Equipments for which MAKE have not been specified in these Particular Specifications, shall be of Standard Makes and shall strictly comply with Current Appropriate IS Specifications, for which IS Specification has not been issued/available, they shall comply with the Currents BS Specifications or as approved by GE.
- 1.7 These Particular Specifications shall deem to be includes the APPENDICES attached here-in-after.
- 1.8 Reference to some paragraphs of MES Schedule has been made in these particulars specifications but other paragraphs and provisions as applicable are also be followed e.g. reference to paras pertaining to general workmanship for brick work, block walling, joinery, iron and steel work, etc, have not been made but provisions therein as required for work are applicable.
- 1.9 Where specifications for any item of work are not given in MES Schedule or in these particular specifications, specification given in relevant Indian Standard specification or code of practice shall be followed.
- 1.10 Where specifications/provisions for any item of work given in these particular specifications are at variance with the provisions/specifications given in MES Schedule, Specifications / provisions given in these particular specifications shall be followed and will take precedence.

2 SCOPE OF WORK

- 2.1 Scope of work includes for the full, final and entire completion of works described in Schedule 'A' included in GENERAL SUMMARY and specified in these particular specifications and/or shown in drawings forming part of the Tender documents.
- 2.2 Tenderers are advised to visit the SITE (S) and ascertain for themselves the exact scope of Work and its Working Conditions, viz Working Hours, Availability of Site(s), etc. and quote their Tenders accordingly. Any Claim whatsoever, on such/these accounts will not be entertained by the Government at a later Date/Stage.
- 2.3 The contractor shall submit Quality Control Plan Part I to the AGE within 30 days of the commencement of work. The Part II of Quality Control Plan shall be completed by AGE and shall be forwarded to GE for approval. The quality Control Plan shall be approved by GE and a copy there of shall be forwarded to Accepting Officer .

3. SITE OF WORK

- 3.1. The Works shall be carried out at different Locations/Site(s). The Contractor shall finalize the programme with the Engineer-in-Charge well in advance in such a way that neither the USERS feel inconvenience nor Work is delayed.
- 3.2. Buildings under occupation of USERS where Works to be executed, the Contractor shall make himself aware about the Nature of the Work involved for carrying out Works against the Items catered in SCHEDULE 'A'. The Contractor is deemed to have inspected the Site of Work and nothing extra shall be admissible to Contract or on this ground.
- 3.3. The proposed Location of Various Works shall be as directed by the Engineer-in-Charge at Site(s) of Works.

4. VISIT OF SITE

- 4.1. The Tenderers are advised to Contact GE on any Working Day during Working Hours, who will arrange for their Visit to Site of Work.
- 4.2. The Tenderers shall be deemed to have visited the Site of Work before Quoting their LUMP SUM AMOUNT/PERCENTAGE/UNIT RATES and no Claim for any EXTRA PAYMENT on account of any misunderstanding, etc. will be entertained by the Department, irrespective of the fact whether they have actually visited the Site or not.

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PARTICULAR SPECIFICATION (Cont....)**5 MATERIALS**

- 5.1 All material to be supplied by the contractor for incorporation in the work shall conform to relevant specification. Any material needed for incorporation in the work, if not contained in any where in the contract documents, the specification of such materials proposed to be incorporated in the work shall be got approved in writing from GE before their incorporation in work by the contractor without any price adjustment.
- 5.2. The relevant Indian Standards shall be of Latest Revision including Amendments if any. The Contractor shall incorporate in the work Materials complying with the requirements of relevant Indian Standards of the Latest Publication (Edition)including Amendments/Revision there of without any Price Adjustment in the Quoted rate.
- 5.3 As for as practicable all manufactured materials/articles other than those manufactured in contractor's workshop at site shall bear IS certification marks. In case any article not bearing IS certification marks but conforming to a relevant IS sample of the same shall be got approved in writing from Garrison Engineer before its incorporation in work. The contractor shall submit sufficient evidence to the GE to show that the articles conform to the relevant IS specifications and no price adjustment shall be made on the account.
- 5.4 Manufactured materials/articles shall be brought at site in original sealed containers, packing-bearing manufacturers marking unless the quantity required is in fraction of smallest packing. Letters conveying approval of samples/materials by Garrison Engineer shall interalia mentions the sources of supply, name of manufacturer, trade name/brand (if applicable) and reference to Clause of tender documents containing specification of particular material.
- 5.5 Materials of Proprietary nature such as Paints, Water Proofing Compound, Chemicals for Anti-Termite Treatment and the like, Quantity of which cannot be Checked after incorporation in the Work shall be Measured and Recorded in the MEASUREMENT BOOK as soon as those are brought at Site. These Measurements shall be signed both by the Engineer-in-Charge and the Authorised Representative of the Contractor. ORIGINAL STAMP RECEIPTED BILLS along with the relevant INVOICES from the Manufacturers or their AUTHORISED DEALERS (if any) in support of having brought the Full Quantity required for incorporation in the Work, shall be produced to Engineer-in-Charge.

5. APPROVAL OF SAMPLES/MATERIALS

- 5.1. Approval of Samples/Materials by GE shall in a Register labelled as 'SAMPLE APPROVAL REGISTER' to be maintained by the Engineer-in-Charge which inter alia shall mention Sources of Supply, Name of Manufacturer, Trade Name/Brand (if applicable) and reference to Clause of Tender Documents containing Specifications of Particular Materials.
- 5.2. Letters conveying Approval of Samples/Materials by Garrison Engineer shall interalia mention sources of Supply, Name of Manufacturer, Trade Name/Brand (if applicable) and reference to Clause of Tender documents containing Specifications of Particular Materials.

6. STANDARD OF QUALITY & WORKSMANSHIP

- 6.1. The Work shall strictly comply with the provisions contained in the Latest Edition of INDIA STANDARD CODE OF PRACTICE and/or IS SPECIFICATION as applicable, Works except where such Regulations and Rules are modified by these Particular Specifications.
- 6.2. All Works shall be carried out by properly Skilled Trademan. The Contractor shall on demand shall produce such evidence of Qualifications of his Workmen/Skilled Trademan / Supervisors / Engineers, either at the commencement of Work or at any time thereafter/during currency of the Contract. The entire Work shall be High Class with the best Workmanship and to the entire satisfaction of Engineer-in-Charge/GE.

7. EXCAVATION AND EARTH WORK.**8.1 PREPARATORY WORK**

- 8.1.1. Before setting out the layout of building and commencing the construction, contractor shall carry out the preparatory work such as removal of grass, bushes, vegetation etc and trimming/surface dressing of the area as per Clause 3.6, 3.8 and 3.10 of MES Standard Schedule of Rates 2009 (Part I) Specification to the entire satisfaction of Engineer-in-Charge. The 'area' referred to implies the entire building plot extending upto three metres all around from the outer edge of plinth protection of the building. The cost of such work as may be necessary shall be deemed to be included in the contractor's quoted ate.

Note: In case buildings to be constructed under this contract are located on the area of site clearance, above condition number 4.1.1 shall not be applicable.

8.2 EXCAVATION

- 8.2.1 Soft/loose soil, hard/ dense soil and mud shall be classified as any type of soils.
- 8.2.2 Unit rates for excavation and earth work is for the soil as specified in Schedule 'A' and as specified in MES Standard Schedule of Rates 2009(Part I) Specifications.
- 8.2.3 However, in the event of deviation involving excavation and earth work, the rate shall be the average of loose/soft soil and hard/dense soil.

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PARTICULAR SPECIFICATION (Cont....)

- 8.2.4 The measurement of excavation shall be as explained in MES Standard Schedule of Rates 2010 (Part-II) Rates with the exception that separate quantities of soft/loose soil, hard/dense soil and mud shall not be worked out but these materials shall be grouped together as any type of soil as aforesaid.
- 8.2.5 Boulders and stones obtained from excavation shall be sorted out and neatly stacked at site by the contractor as directed by the Engineer-in-Charge, without any extra cost to the Govt. The aforesaid boulders and stones in stacks shall be the property of Govt. These boulders may be used in the work in soling/WBM/Hard Core/hand packing in retaining wall/Filling in wire crates etc, after breaking them into specified size as approved by GE through Deviation Order. Balance boulders/stones, if required will be arranged by the Contractor and nothing extra shall be payable on this account.
- 8.2.6 If rock (soft/hard/disintegrated) is met at site, contractor shall immediately notify the fact to the GE in writing, who will after the verification, regularize the change through a proper deviation order.

8.3. FILLING IN TRENCHES/UNDER FLOORS AND REMOVAL

- 8.3.1 The approved earth obtained from excavation in foundations shall be used for filling in trenches, under floors and any other situation as specified after removing big stones, grass roots and vegetable moulds, or other organic matter. Earth mixed with small stones/pebbles (if approved by GE) is permitted for use in filling under floors and foundations. The filling around pipes, after the pipes are laid and tested shall however be with earth-free from pebbles/stones. Any additional earth required for the purpose of filling shall be arranged by the contractor at no extra cost to the department from outside of defence land.
- 8.3.2 Filling under floors/sides of trenches shall be in layers not exceeding 250mm thick, and Each layer shall be watered and well rammed.
- 8.3.3 Surplus spoil (obtained in Schedule 'A') shall be removed and spread at places as directed by the Engineer-in-Charge and leveled as directed by Engineer-in-Charge.

8.4. TRENCHES FOR FOUNDATIONS AND PIPES

- 8.4.1 The excavation shall be restricted to dimensions as specified in MES SSR. Excavation made, if any, in excess of required depth/width shall be made good by the contractor with cement concrete PCC M-10(Nominal mix) without extra cost to the Govt.
- 8.4.2 The bed of the trenches, if in soft or made up earth, shall be watered and well rammed and any depressions thus formed shall be filled with approved earth as required to the level and slope as directed by Engineer-in-Charge.

8.5 DRESSING AROUND BUILDINGS

- 8.5.1 After construction and before handing over any building, the area around, as defined in Clause 2.1 here-in-before shall be dressed without extra cost to the Govt. Spoil obtained from surface dressings shall be removed to a distance exceeding 50 metres and not exceeding 100 metres, spread and levelled as directed by Engineer-in-Charge.

8.6 FOUNDATION AND PLINTH

- 8.6.1 Any change in foundation/plinth necessitated due to undulating ground, which may have to be carried out as per the decision of the GE, shall be adjusted through a proper deviation order.
- 8.6.2 For the purpose of reckoning the depth of the foundation, the average level of the ground after surface dressing shall be considered except at the places where cutting is involved.

8.7 Blank**8.8 HARD CORE**

- 8.8.1 Hard core shall be of hard broken stone or boulders broken to gauge not exceeding 63mm. The material of hard core shall be well graded for providing dense and compact sub grade. Hard core shall be deposited, spread and levelled in layers not exceeding 15cm thick and watered and well rammed to a true surface and compacted with sufficient fine material. The thickness of hard core shall be as specified in Schedule 'A' and the thickness mentioned is after consolidation.

9.1 CEMENT

- 9.1.1 Cement will be procured by the contractor at his own arrangements. The cost of cement, its transportation, storage, testing charges, its accounting and preservation etc till consumed in work shall be borne by the contractor.

9.2 TYPE OF CEMENT

- 9.2.1 Cement shall be Ordinary Portland cement Grade 43 conforming to IS: 8112 of 2013 or Portland Pozzolana cement conforming to IS 1489. However, the contractor may also use Portland Pozzolana cement conforming to IS-1489-1991 at his discretion without any price adjustment except in over head tanks, sumps, water retaining structure and the like where in only OPC shall be used.

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PARTICULAR SPECIFICATION (Cont....)

9.2.2 Cement brought by the contractor at site(s) of work shall be in jute/polythene/paper bags containing 50Kg cement in Each bag originally sealed by manufacturer. Before allowing any on account payment for materials at site, test check shall be carried out to ascertain average weight of cement per bag.

9.2.3 Contractor shall produce purchase vouchers, test certificates and other valid documentary proof to the entire satisfaction of the GE for entire quantity of Each consignment to prove that cement has been purchased from the main producers as in para3.2.2.1above.Thecontractor shall also submit particulars of the manufacturer of cement for every lot for verification by the site staff and GE.

9.4. CURING AND MINIMUM PERIOD FOR STRIKING OF FORMWORK WITH :-

9.4.1. The periodicity of striking the form work and curing for works with ordinary Portland cement, shall be as stipulated in Clause 11.3 and 13.5 of IS 456 of 2000 and the same shall be suitably modified by the GE when PPC is used. No claim, whatsoever on this account shall be admissible.

9.4.2. PPC is used for RCC works in various locations , the minimum period for curingand striking off form work shall be as under in lieu of that specifiedinclause4.11.6.3 of MES Schedule Part-I.

(a) Curing:-

(i) Structural RCCwork, : 21 days

(ii) PCC work, plastering etc : 14 days

(b) Striking off form work:-

(i) Walls ;columns and vertical sides of beams: 3 to 4 days.

(ii) Slabs(Props left under) : 8 days.

(iii) Beams soffits (Props left under) : 9 days.

(c) Removal of props to slab/beam:-

(i) Spanningupto6MSpan :16days

(ii) Spanning beyond6 M Span:22 days

(iii) For cantilever portion of slab form work with support shall be retained until the completion
The casting of the entire frame work of the building.

9.4.3. In case of bad weather, periods mentioned above may be revised at the discretion of the Engineer-in-Charge. The contractor shall be deemed to have considered the above provision before tendering and quote lump sum accordingly. No claim will be entertained if longer periods required for striking off form work and curing and all such effected matters are looked into upon the use of pozzolana cement as a result being issued to the contractor in full or part of for bad weather.

9.4.4. Curing shall be carried out using pump of suitable capacity at no extra cost to the Govt all as directed by Engineer-in-Charge.

9.4.5 COARSE AND FINE AGGREGATE FOR PLAIN & REINFORCEDCEMENT CONCRETE

Coarse aggregate for all concrete shall be graded crushed hard granite, trap or basalt stone as approved by the GE and shall conform to the requirements laid down in clause 4.4 of MES SSR2009 Part-I (Specifications). Hand broken stone aggregate shall not be permitted for use in the work. Size and grading of aggregate shall be as per clause4.4.7.1 of MES SSR 2009Part-I(Specifications).

9.4.6 GRADING OF AGGREGATES

GRADING OF COARSE AGGREGATE - Grading of Coarse Aggregate for Plain and Reinforced Concrete i.e. Stone Aggregate shall be as perClauseNo.4.4.7.1of MESSSR 2009Part-I(Specifications).

Grading of Coarse Aggregate unless otherwise specified shall be as follows:-

For Reinforced/Structural Element of depth/thickness 50mm or under:12.5mm graded

For Reinforced/Structural Element of depth/thickness over 50mm:20mm graded

For Plain Cement Concrete thickness exceeding 25mm but not exceeding 75mm:20mm graded

For Plain Cement Concretethickness75mmmandover:40mmgraded

FINE AGGREGATE:- Fine aggregate for all concrete work shall be naturally occurring river sand conforming to the specification in Para 4.4.7.2 of MES SSR 2009 Part-I (Specifications). Use of sand conforming to grading Zone IV ofIS 383 (1970 second revision or as amended)shall not be allowed for RCC works.

9.4.7 to 9.11 BLANK

PARTICULAR SPECIFICATION (Cont....)**9.12. WATER PROOFING COMPOUND**

- 9.12.1. Water proofing liquid shall be ISI marked and shall be approved by GE before incorporation in work. Refer Clause No. 4.8 of MES SSR 2009 Part-I (Specifications).

9.13. WATER

- 9.13.1. Water shall conform to the requirement stipulated in IS-456 and as per Clause No. 4.9 and 4.9.2 of MES SSR 2009 Part-I (Specifications).

PLASTICISER

- 9.13.2. Plasticiser shall be used in Design Mix Concrete as per the Manufacturer's instruction without any Extra Cost to achieve the desired Results Strength and Workability. Plasticiser manufactured by M/s SIKA INDIA Pvt. Ltd./M/s BASF INDIA Ltd. / M/s CICO TECHNOLOGIES Ltd. / FOSROC CHEMICALS Pvt. Ltd. / MC BAUCHEMIE INDIA Pvt.Ltd. shall be used. However Plasticiser should confirm to IS-9103.

9.14. WORKMANSHIP**9.14.1. GENERAL**

- 9.14.1.1. Refer Clause No. 4.11 of MES SSR 2009 Part-I (Specifications) as applicable and as directed by the Engineer-in-Charge.

9.15. MIX OF CONCRETE

- 9.15.1. **VOLUMETRIC MIX CONCRETE**– Wherever the Concrete is specified/ordered in Volumetric Proportion the same shall be provided by Volumetric Mix. Volumetric Mix shall be done all as specified in Clause No. 4.11.2.4 of MES SSR 2009 Part-I (Specifications).

9.16. WORK ABILITY OF CONCRETE

Refer Clause No. 4.11.4 of MES SSR 2009 Part-I (Specifications) and Clause No.7 of IS-456-2000 and as directed by the Engineer-in-Charge.

9.17. MIX & GRADE OF CEMENT CONCRETE

- 9.17.1. Refer Clause No. 4.11 of MES SSR 2009 Part-I (Specifications). The type and grade of concrete shall be as given in Schedule "A".
- 9.17.2 Unless otherwise specified elsewhere in these particular specifications, mix of cement concrete in various situations shall be as under:-

SITUATIONS**TYPE OF CONCRETE**

- | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------|
| a) Lean concrete under foundation of wall / plinths / to e beam/ steps & in gaps between plinth beam/column footings. | : | M-10(Nominal mix) |
| b) Foundation concrete under column footings | : | M-10(Nominal mix) |
| c) PCC cills, PCC block for holder bats, holdfasts/lugs for doors, windows and ventilators , plugging for scaffolding holes and plinth protection. | : | M-15(Nominal mix) |
| d) PCC in bed blocks/plates, kerbs padding, benching, splash stones, coping and PCC in any other situation (except subfloor / subbase of floor and flooring) not covered above. PCC Filling in back of Pressed Steel Door Frame, Drain, Solid PCC | : | M-15(Nominal mix) |
| e) Block and Plugging of Holes left due to Scaffolding, etc. and the like | : | M-10(Nominal mix) |
| f) All RCC works not specified else where in the Schedule and tender documents | : | M-25(Design mix) |

9.18. FORM WORK & SCAFFOLDING**9.18.1. GENERAL**

PARTICULAR SPECIFICATION (Cont....)

- 9.18.1.1. Form work shall comply with the requirements of clause No. 4.11.6 & 7.15.1 to 7.15.12 of MES SSR 2009 Part-I (Specifications). The shuttering shall be of steel only except at places where it is not feasible to use steel shuttering on technical grounds plywood shuttering can be used with written approval of GE.
- 9.18.1.2. Exposed Surfaces of RCC Lintel, Beams, Columns and the like which are continuous with plastered surface of Wall shall be Plastered as that for adjoining Walls Surfaces.
- 9.18.1.3. Irrespective of whatever mentioned elsewhere in these Tender documents and/or Drawings, all Form work used in the work shall be properly designed Steel Formwork (both Vertical Props and Surfaces). However all other relevant provisions as mentioned in the MES SSR 2009 Part-I (Specifications) Clauses reflected above and relevant Drawings and other documents forming part of this Contract shall be followed.
- 9.18.1.4. Exposed Surfaces of Concrete such as Soffits/Sides of RCC Chajja, Beams, Stairs Case and Shelves, etc. which are not in continuation with the Adjoining Plastered Surfaces shall be finished as specified in Clause No. 4.11.16.2(a) of MES SSR 2009 Part-I (Specifications). However, the Soffit of RCC Roofs/Floor Slab shall be finished as specified in Clause No. 4.11.16.2(b) of MES SSR 2009 Part-I (Specifications). Refer Clause No. 14.14.3 of MES SSR 2009 Part-I (Specifications) in this connection.

9.19. CLEANING & TREATMENT OF FORMS

- 9.19.1. Refer Clause No. 4.11.6.2 of MES Schedule Part-I (as applicable) and as directed by the Engineer-in-Charge.

9.20. STRIPPING TIME WHERE PORTLAND POZZOLLANA CEMENT IS USED

- 9.20.1. Refer Clause No. 4.11.6.3 of MES SSR 2009 Part-I (Specifications). Where Pozzolana Cement is used for RCC Works in various Locations, the Minimum Period for Striking Off Formwork shall be as under in lieu of that specified in MES SSR 2009 Part-I (Specifications) :-
- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Walls ; Columns and Vertical Sides of Beams | : 3 to 4 |
| Days Slabs (Props left under) | : 8 |
| Days | |
| Beams Soffits (Props left under) | : 9 |
| Days <u>Removal of Props to Slab/Beam:-</u> | |
| (a) Spanning upto 6.0 METRE Span | : 16 Days |
| (b) Spanning beyond 6.0 METRE Span | : 22 Days |
| (c) For Cantilever Portion of Slab Formwork with Support shall be retained until the completion the Casting of the Entire Frame Work of the Building. | |

9.21. REMOVAL OF FORMWORK

- 9.21.1. Refer Clause No. 4.11.6.4 and 4.11.6.5 of MES SSR 2009 Part-I (Specifications) and as directed by the Engineer-in-Charge.
- 9.21.2. In case of Bad Weather, Periods mentioned here-in-above may be revised at the discretion of the Engineer-in-Charge. The Contractor shall be deemed to have considered the above provision before tendering and Quote Lump Sum accordingly. No Claim will be entertained if Longer Periods required for Striking Off Formwork and Curing and all such effected matters is looked into upon the use of Pozzolana Cement as a Result being issued to the Contractor in Full or Part of for Bad Weather.

9.22. FINISHES

- 9.22.1. Refer Clause No. 4.11.16 of MES SSR 2009 Part-I (Specifications) (as applicable) and as directed by the Engineer-in-Charge. Form work (as required) for concrete surface where expose to view shall be 'Rough finished'.

9.23. ASSEMBLY OF REINFORCEMENT

- 9.23.1. Refer Clause No. 4.11.7 of MES SSR 2009 Part-I (Specifications) (as applicable) and as directed by the Engineer-in-Charge.

9.24. COVER TO REINFORCEMENT

- 9.24.1. Cover to reinforcement for various locations of RCC shall be as per latest IS and Clause No. 4.11.8 of MES SSR 2009 Part-I (Specifications) (as applicable) and as directed by the Engineer-in-Charge.

9.25. TRANSPORTING

- 9.25.1. Refer Clause No. 4.11.9 of MES SSR 2009 Part-I (Specifications) (as applicable) and as directed by the Engineer-in-Charge.

9.26. PLACING

- 9.26.1. Refer Clause No. 4.11.10 and 4.11.10.3 of MES SSR 2009 Part-I (Specifications) (as applicable) and as directed by the Engineer-in-Charge.

9.26.2. COMPACTION

PARTICULAR SPECIFICATION (Cont....)

Refer Clause No. 4.11.11 of MES SSR 2009 Part-I (Specifications). Compaction of Concrete in RCC Slab, Beam Walls and Columns shall be done with Approved Mechanical Vibrator. In other Locations Hand Compaction may be permitted by Tamping or Roding as approved by the GE.

CURING:-

Refer Clause No. 4.11.13 of MES SSR 2009 Part-I (Specifications) (as applicable) and as directed by the Engineer-in-Charge.

- 9.26.3 Curing shall be carried out using Pump of suitable capacity at no Extra Cost to the Govt. all as directed by Engineer-in-Charge.

9.27 PROTECTION

Refer Clause No.4.11.14 of MES SSR2009 Part-I(Specifications)and as directed by Engineer-in-Charge.

9.28 INSPECTION

Refer Clause No. 4.11.15 of MES SSR 2009 Part-I(Specifications) and as directed by Engineer-in-Charge.

10. BRICK WORK

- 10.1 Cement: Shall be as specified for concrete work.
- 10.2 Sand for mortar: Refer to paras 5.4,5.4.1 of MES Standard Schedule of Rates 2009 Part-I (Specification).
- 10.3 Bricks:Refer to paras5.6.1 to 5.6.9 of MES Standard Schedule of Rates 2009 Part-I (Specification). The bricks shall have minimum compressive strength of 75Kg / Sqcm and shall be of sub class 'B', old size bricks as specified in paras 5.6.2,5.6.2.1 and 5.6.3. of MES Standard Schedule of Rates 2009 Part-I (Specification). Sampling and testing of bricks shall be carried out by the contractor as per IS-5454 and IS-3495 (Part -I to IV) as directed by GE without any extra cost to department. The size of bricks shall as per MES Standard Schedule of Rates 2009 Part-I (Specification) i.e. 23 x 11.5 x 7.5 cm. However the permissible tolerance in size shall be +8% and centerline dimension shall be maintained.
- 10.4 All brick work shall be built in English bond except in half brick walls which shall be in stretcher bond.
- 10.5 Frequency of various test of bricks shall be as per Appendix "A" and cost of material and testing shall be borne by the contractor and nothing extra shall be paid on this account.

11. BLANK**12. EXTERNAL ELECTRIFICATION**

- 12.1 SCOPE OF WORK
- 12.1.1 The extent of work is as per items given in schedule 'A'. All references to Clause in the succeeding paragraphs pertain to MES Schedule part-1.
- 12.2 GENERAL REQUIREMENT
- 12.2.1 Materials, execution, testing and record of installation shall conform to relevant IS certifications and as given in Clause 19.2.1 to 19.2.6 of MES Schedule part-1 and as also in accordance with Indian Electricity Rules 1956.
- 12.2.2 The location and distribution of various items in the drawing is tentative. The GE as per the site requirements can make alternations and there shall be no price adjustment on this account.
- 12.2.3 On completion of entire work, the contractor shall submit in triplicate to the Engineer-in-Charge layout plan showing actual position of poles, routes, cable run, and all other information's and details as directed by the GE that will be necessary for record of maintenance and operation.
- 12.3 SAMPLE AND MATERIALS
- 12.3.1 All materials, fittings and appliances etc. to be incorporated in this work shall be of highest standard and unless otherwise specified here in after shall strictly comply with the relevant IS specifications. The contractor will supply the samples of the following items/materials to GE for approval.
- (a) All types of insulators
 - (b) All types of under ground cables
 - (c) Danger Notice Boards
 - (d) Stay assembly and stay wire and anti-climbing device.
 - (e) All type of conductors
 - (f) Earthing plates/electrodes

PARTICULAR SPECIFICATION (Cont....)

- (g) MCCB
- (h) HT/LT insulators
- (j) MCB &ELCB or RCBO
- (k) Distribution boards
- (l) Cable Route Indicator

In addition to the above, other materials mentioned below, required to be incorporated in the work, shall be invariably got approved in writing from GE:

- (i) Pre-stressed concrete poles/steel poles.
 - (ii) Set of lightning Arrestor HT/LT.
 - (iii) LT Panel Board.
 - (iv) Voltmeter and Ammeter
 - (v) Transformer copper coil
 - (vi) Transformer Oil
 - (vii) Any other item as directed by GE.
- 12.3.2 The material and the equipment to be supplied and installed under this contract shall be of indigenous make. In case tenderer offers any imported materials, he may do so out of his existing stock. No foreign exchange will be given by the department to the tenderer for importing any equipment for this job.
- 12.3.3 Steel incorporated in work need to be of tested quality and the contractor shall procure all steel required to be incorporated in the work from market.
- 12.3.4 The contractor after obtaining written approval of samples from the GE shall purchase material and equipment from the approved firms or through their authorised agents only all as specified in these tender documents and as directed the GE. As a proof that a particular materials have been purchased from the firm/their authorised agents, the contractor shall produce such evidence to the satisfaction of GE when asked for. With regard to quality the materials shall be brought to the site with maker's original packing with seal intact.
- 12.3.5 All electric works shall be carried out in conformity with the requirements of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 framed there under and fire insurance act as applicable and else the relevant regulations of electric supply authorities concerned as amended from time to time.
- 12.3.6 Unless otherwise exempted under the rules of the Indian Electricity Rules, all electrical works shall be carried out under the supervision of person holding a certificate of competency issued by the recognized authority. The workman shall also hold certificate of competency.
- 12.3.7 Good workmanship is an essential requirement for compliance with their specifications. The work shall be executed in the manner as directed by the Engineer-in-Charge.
- 12.4 MAKING GOOD :The contractor is deemed to have included in his lumpsum cost of cutting holes/making chases when required through roads/bricks or concrete work for taking in cables, conduits and conductors etc and making good the same to match with the existing work.

13. EQUIPMENT AND MATERIALS

- 13.1 **STANDARD OF QUALITY AND WORKMANSHIP:-** All equipments and materials to be incorporated in the work shall be one of the following makes as approved by the Garrison Engineer in writing and shall strictly comply with latest appropriate, Indian standard specifications or where IS specification is not available, those shall comply with the latest BS specifications.
- 13.2 Materials and equipments for which make has not been specified shall be of standard makes and shall strictly comply with current appropriate IS specifications or where IS specifications has not been issued, they shall comply with the latest BS specifications.
- 13.3 The supply and installation of all electrical equipments and accessories shall strictly comply with the provisions contained in the latest edition of India Standard code of Practice IS specification as applicable to above mentioned work except where such regulations and rules are modified by these specifications.
- 13.4. (See condition 25 of General conditions of contracts IAFW-2249). All electrical works shall be carried out by properly skilled and licensed electricians under the supervision of qualified electrical supervisors/Engineers. The contractor shall on demand by the Engineer-in-Charge. Produce such evidence of qualification of his workmen/Supervisors/Engineers, either at the commencement of work or at any time there in after during the currency of the contract. The entire work shall be of high class with the best workmanship and to the entire satisfaction of the Engineer-in-Charge.

14. LAYOUT OF EQUIPMENT

- 14.1 Layout of various equipments, cables, control box, LT Panel Board etc, shall be as directed by the Engineer-in-charge to suit the site requirements.

15. STEEL TUBULAR POLES.

Contd...

PARTICULAR SPECIFICATION (Cont....)

- 15.1 Steel tubular poles shall comply with the requirements of IS 2713 Part I to III (Specification for steel tubular pole for overhead power lines) and shall be described in Schedule 'A'. The contractor shall produce copy of the manufacturer's test certificate to this effect that the poles comply with the requirement of IS-2713 Part I to III if called upon by the Engr-in-charge.
- 15.2 Erection of pole shall be carried in accordance with IS-5613 (Part-I) in PCC foundation. The embedding of the pole shall be as specified here-in-after.
- 15.3 The pole shall be erected with due care, in such a manner that they are truly vertical position as directed by Engr-in-charge. These shall be erected exactly in a line except where line changes direction. Proper erection equipment such as derrick, cranes, shear ages etc shall be used by the contractor at the time of erection of pole, so that they are not improperly strained or damaged during operation and are finally stayed till the foundation has properly done and secured.
- 15.4 Refer para 19.3 of MES Schedule Part-I (1991) including sub para as applicable.
- 15.5 The steel tubular poles shall be erected all as specified under para 19.50, 19.51, 19.51.1, 19.51.2, 19.52 of MES Schedule Part-I.
- 15.6 The poles shall be numbered as directed by the Engr-in charge. With letters and figures of height 75mm at a height 2.60 meter from ground level. The cost for numbering is deemed to be included in the cost of Schedule 'A' item.

16. CROSS ARMS, CLAMP SETC.

- 16.1 Sizes of cross arms, bracings clamps etc shall be all as specified and directed by Engineer-in-charge and as described in Schedule 'A'. Some of the cross arms may have to be made to required shape as directed by Engineer-in-charge. No extra payment shall be made on this account.
- 16.2 Steel section shall be cut to conform exact shapes and lengths as directed.
- 16.3 Shape and size of clamps, bolts etc shall be all as directed. Normally clamps shall be made out of flat iron and shall be secured within the adequate size of bolts and nuts etc.
- 16.4 The rate quoted shall include for drilling, punching holes. Holes shall be punched clean and burrs removed and edges fixed square and smooth.
- 16.5 Cross arms and clamps shall be painted with two coats of aluminum paint over a coat of red oxide primer.
- 16.6 The work of steel cross arms shall be carried out all as specified in para 19.9, 19.53.3 including sub paras of MES Schedule Part-I and the same shall be fixed in an approved manner as per direction of Engineer-in-charge.

17. ACSR CONDUCTOR.

- 17.1 ACSR conductor shall comply with the requirement of IS 398.
- 17.2 All jointing in ACSR shall be twisted jointing. This joint consists of two oval shaped aluminum sleeves, angle enough to slip over dead ends of cables to be jointed. Pressure twisted type joints shall be made.
- 17.3 For connection of conductors dead end to the insulators on poles dead end pooling is to be done after taking the cable around the thimble by using a finished joint.
- 17.4 For laying conductor to insulator aluminium binding wire of suitable size for different conductors as per manufacturer's instruction shall be provided.
- 17.5 For connection of service wire, jumper, main line conductor, MS clamps of approved quality are to be used.

18. INSULATOR, STAY WIRES, STAY ASSEMBLY.

- 18.1 Refer para 19.6, 19.7 and 19.8 of MES Schedule Part-I

19. EXPULSION TYPE LIGHTNING ARRESTERS

- 19.1 All as specified under para 19.13 and 19.13.1 of MES Schedule Part-I.

Contd...

PARTICULAR SPECIFICATION (Cont....)**20. TRIPLE POLE AIR BREAK SWITCH**

20.1 Refer para 19.69 of MES Schedule Part-I (2009)

21. CURRENT TRANSFORMERS(CTs):

21.1 Refer clause No 19.99.13 of MES Schedule Part-I(2009).

22. CABLETERMINATION&JOINTKITS :

22.1 Refer clauseNo19.22 of MES Schedule Part-I(2009).

23. PAINTINGOFPOLES, CROSSARMSETC. :

23.1 Refer clauseNo19.71 of MES Schedule Part-I(2009).

24. CABLE WORK

24.1 Where the cables are to be laid in the trenches 80 mm thick cushion of clean dry sand shall be provided below the bottom of cable. The cable shall be covered by a further layer of clean drys and above the cable, to the height as mentioned in MES Schedule. The cable cover/Bricks shall be laid dry and side by side to protect the cable from mechanical injury, the cables shall be looped at ends for furthers joints. The above additional length of cable as directed by Engineer-in-Charge shall also be measured and paid for under the respective item of cable in Schedule 'A'. Laying bricks at places where cables area shackd, shall be done as directed by the Engineer-in-Charge shall also be measured and paid for under the respective items of in Schedule 'A'. Cable gland shall be provided at cable termination in the DBS and feeder pillar-box, the cost of which is deemed to be included in the rate of cable.

24.2 All jointing materials such as tape, cables compound and cable boxes, etc. for straight joints shall be provided by contractor without extra cost to Government.

24.3 The cables being of short length for various connections, there shall be no straight through joints. The cable shall be terminated in switch fuse units through suitable pin type hugs.

24.4 The cost of cutting through roads drains path for laying cable under the road/drain/path and making good shall be deemed to be included in the unitrate quoted against GI pipes.

24.5 Sand cushioning – The sand shall be local sand as approved by Engineer-in-Charge. For laying of Cable in trenches, provision of cushioning shall be carried out all as a specified in clause 19.75 and 19.77 of MES Schedule Part I.

24.6. LAYING OF HT CABLES

(i) The HT XLPE insulated PVC sheathed underground cables shall be of 11000volts(E),grade armoured, heavy-duty underground cable, conforming toIS-7098(Part-I&II).

(ii) The cable should be laid at a depth of not less than 750mm plus radius of complete cable.

(iii) HT Cable shall bear ISI certification mark.

(iv) Both ends of pipe protecting the cable shall be sealed with wooden bushes cut into two halves of appropriate size.

(v) The cable shall be protected by means of 15cm of sand cushionon top and under the cable as described in SSR Part I.

(vi) Earthwork, sand cushioning & cable protection shall be measured and paid separately.

24.7. HT CABLES

24.7.1 The HT XLPE insulated PVC Sheathed cable shall comply with IS7098(Part-I&II) and as specified in Para 19.19 of MES Schedule Part-I . Laying of cables shall be carried out as specified in relevant para of MES Schedule para of MES Schedule Part-I.

24.8 TESTING OF CABLES

24.8.1 ThisshallbecarriedoutallasspecifiedinPara19.93to19.93.1and19.93.67ofMESSchedulePart-I.

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PARTICULAR SPECIFICATION (Cont....)**24.9 TEST CERTIFICATE**

24.10 The Contractor shall submit Manufacturer's test certificate and literature for HT Cable.

24.11. LAYING OF LT CABLES

- (i) The XLPE insulated PVC sheathed (Heavy Duty) underground cable shall be of 1100 volts, grade armoured, heavy-duty underground cable, conforming to IS-7098 (Part-I).
- (ii) The cable should be laid at a depth of not less than 450mm plus radius of complete cable.
- (iii) LT Cable shall bear ISI certification mark. Both ends of pipe protecting the cable shall be sealed with wooden bushes cut into two halves of appropriate size.
- (iv) The cable shall be protected by means of 15cm of sand cushion on top and under the cable as described in SSR Part I.
- (v) Earthwork, sand cushioning & cable protection shall be measured and paid separately.

24.12 LT CABLES

24.12.1 The PVC insulated PVC Sheathed cable shall comply with IS 7098 (Part-I) and as specified in Para 19.19 of MES Schedule Part-I. Laying of cables shall be carried out as specified in relevant para of MES Schedule para of MES Schedule Part-I.

24.13 TESTING OF CABLES

This shall be carried out all as specified in Para 19.93 to 19.93.1 and 19.93.67 of MES Schedule Part-I.

24.14. TEST CERTIFICATE

24.14.1 The Contractor shall submit Manufacturer's test certificate and literature for LT Cable.

24.15 CABLE JOINTING

24.15.1 Cable as far as possible shall be laid in complete lengths, uncut lengths from one termination to the other. Before start of cable laying, cable schedule shall be prepared and approved by EIC to minimize /avoid straight through required in the entire network shall be worked out and approved by the EIC. All cable jointing in terminal or through joint boxes shall be carried out by experienced/trained and qualified cable jointers.

24.15.2 Cable Jointing work shall be carried out only by a licensed/experienced cable jointer. Sufficient surplus cable approximate 3 meter shall be left on each end of the cable and on each side of underground joints at the time of original installation. A caution board indicating "CAUTION CABLE JOINTING WORK IN PROGRESS" shall be displayed to public and traffic where necessary.

24.15.3 CABLE TERMINATIONS AND STRAIGHT THROUGH JOINT KITS FOR 3 CORE HT XLPE CABLES

24.15.3.1 The cable termination kits and straight through joint kits shall be suitable for HT. XLPE cable shall be of Cold shrinkable or push type on with sound and proven technology. These terminations shall be environmental friendly and flame retardant.

24.15.3.2 Each kit shall contain all necessary components accessories, including cable glands wherever required cable lugs (climbing type) jointing materials and consumables to make a complete termination in such away that no live parts of the terminal and connecting lugs are exposed.

24.15.3.3 The basic raw material used in construction of Joints and termination shall be Electrical grade EPDM (Ethylene Propylene Diene Monomer Rubber component) with high dielectric strength. The termination shall control the voltage distribution of electrical field effectively and shall minimize the surface stress by uniformly redistributing the electrical field over the entire surface of the insulator. Insulators shall be made of silicon rubber with long service life.

Contd...

PARTICULAR SPECIFICATION (Cont....)

24.15.3.4 The straight through joint kits shall be suitable for underground buried installation with uncontrolled back fill and chances of flooding by water and suitably designed to be protected against rodent and termite attack. Further the joint kit shall be in capsulated in cast resin compound to provide excellent mechanical & moisture protection in sub soil conditions. While making termination, earthing connection & outer protection arrangement shall also be ensured.

24.15.3.5 The test certificates from the manufacturer for termination kits and straight through joints kits shall mention results of the following tests:-

- (i) AC Voltage with stand test(asperIEC-68)
- (ii) Partial discharge test
- (iii) Impulse with stand test (asperIEC-68)
- (iv) Load cycling test (as per VDE-2078)
- (v) Thermal short circuit test.
- (vi) DC Voltage with stand test.
- (vii) Humidity test (asperIEC-166)
- (viii) Dynamic short circuit test (asperVDE-2078)
- (ix) Salt Fog(outdoor termination only)test.
- (x) Impact test (for joints only)

24.15.4 CABLE END TERMINATION AND STRAIGHT THROUGH JOINT FOR 1100V GRADE XLPE CABLES

Cable end termination Indoor/outdoor type and straight through joints for LT cables shall be based on cast resin system. The casting resin shall be polyurethane based having compatibility with the cable components. The termination kit shall be designed for easy installation and have a crutch sealing arrangement for environmental protection on the core trifurcation. The joints shall be suitable to withstand mechanical impact, heat shock tests,load cycle test and water, penetration test (under pressure) without damage to the outer sheath.

24.15.5 CABLE TERMINATIONS

All cables shall be terminated at the end in such a manner as to prevent ingress of moisture into cable. The type and method of termination of cable shall depend on the voltage of cable and type of termination whether indoor or outdoor. All types of cable and termination joints shall be indicated as prescribed by the cable manufacturers. However the following types of joints and termination systems are common and popular.

- (i) Tape x system
- (ii) Heat shrinkable sleeve type
- (iii) Push on or slip on type technique

24.16 CABLE ENDS

24.16.1 Refer Para19.86ofMESSchedulePart-I

24.17. CABLE ENDS

24.18 Refer Para 19.86.1 of MES Schedule Part-I (2009) .All PVC cables upto 1100 volts gde shall be terminated into the equipment by means of compression type cable glands having screwed nipples and checknuts. The cable conductors shall be provided with crimped types older less cable sockets or connectors to suit the termination arrangement of the equipment. The crimping shall be done by hand/ hydraulically operated crimping tool after applying conducting jelly. The insulation of the cable shall be removed just immediately before the crimping is done.

25 SAND CUSHIONING

- 25.1 Sand : Sand shall be durable clean and free from adherent costing, organic matter and shall not considered and reliable amount of clay balls.
- 25.2 Sand cushioning shall be done to the full width of the trenches and shall be carried out all as specified in para19.75ofMES Schedule part-I

26 CABLE PROTECTION:-

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PARTICULAR SPECIFICATION (Cont....)**27.1 PRECAST CABLE PROTECTION**

- 27.1.1 Refer Para 19.88 of MES Schedule Part-I (2009). Protection of Cables Where indicated, the final protection shall be provided by laying precast concrete cable covers of the type and size as indicated

27.2. BRICKS FOR CABLE PROTECTION

- 27.2.1. Bricks shall be common burnt clay building bricks(old size bricks) of sub class'B' locally available and best quality.
- 27.3 The un-reinforced pre cast cover and bricks are provided for protection of cable for covering the cables. The un-reinforced pre cast cover shall be laid flat (width of protection being equal to length of brick). After the layer of un-reinforced pre cast cover is laid the remaining trenches will be filled with excavated earth.
- 27.4 Cable path indicators shall be provided at distance of every 100 meters and at cable joints and turning of all cables except for street light cables and 2 core cables size and voltage written on it. The CI path indicator shall be fixed on MS angle iron. The cable path indicators shall be erected at the time of refilling the trenches and the cable path indicator shall be painted as under.-
- (i) For HT 11KV cables-"BROWN"
 - (ii) For LT cables -"BLUE"

28 EXPULSION FUSES

- 28.1. Shall comply with IS 9385 (Part2)-1980, Specification for high voltage expulsion fuses and similar fuses.

29. GI TUBING

- 29.1 GI tubing for cable protection shall to be light grade of make TATA/JINDAL/BANSAL/GST and all as per para 18.4 of MES schedule part-I (2009).

30. TRANSFORMER

30.1 This Specification provides for design, manufacture, assembly, stage inspection, final inspection and testing before despatch, packing and delivery at destination Sub-station by road transport, transit insurance, unloading at site of installation of Power Transformers, complete with all fittings, accessories, associated equipment, Spares, 10% extra Transformer Oil, required for its satisfactory operation.

30.2 The core shall be constructed either from high grade, non-aging Cold Rolled Grain Oriented (CRGO) silicon steel laminations conforming to H-iB / H-iB-LS grade with lamination thickness not more than 0.23mm to 0.27mm or better grade core shall be used. The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall not be more than 1.5 Tesla. The Bidder shall provide saturation curve of the core material, proposed to be used. Laminations of different grade(s) and different thickness (s) are not allowed to be used in any manner or under any circumstances.

30.3 The Power Transformer shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the GE shall have the power to reject any work or material, which, in his judgment, is not in full accordance therewith. The Transformer(s) offered, shall be complete with all components, necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of supply, irrespective of whether those are specifically brought out in this specification and / or the commercial order or not. The GE reserves the right to reject the transformers if on testing the losses exceed the declared losses beyond tolerance limit as per IS or the temperature rise in oil and / or winding exceeds the value, specified in technical particular or impedance value differ from the guaranteed/specified value including tolerance as per this specification and if any of the test results do not match with the values, given in the guaranteed technical particulars and as per technical specification. The GE reserves the right to retain the rejected Transformer and take it into service until the supplier replaces it, at no extra cost to the Department by a new transformer. Alternatively, the supplier shall repair or replace the Transformer within a reasonable period as decided by the GE to GE's satisfaction at no extra cost to the Department.

PARTICULAR SPECIFICATION (Cont....)

31. SPECIFIC TECHNICAL REQUIREMENTS

1	Rated MVA (ONAN rating)		3.15 MVA
2	No. of Phases		3
3	Type of installation		Outdoor
4	Frequency		50 Hz (□5%)
5	Cooling medium		Insulating Oil (ONAN)
6	Type of mounting		On Wheels, to be Mounted on rails
7	Rated voltage :		
a)	High Voltage winding		33 KV
b)	Low Voltage winding		11 KV
8	Highest continuous system voltage :		
a)	Maximum system voltage ratio (HV/LV)		36 KV / 12 KV
b)	Rated voltage ratio (HV/LV)		33 kV / 11 KV
9	No. of windings		Two winding Transformer
10	Type of Cooling		ONAN (Oil natural and Air natural)
11	MVA Rating corresponding to ONAN cooling system		100%
12	Method of connection :		
	HV		Delta
	LV		Star
13	Connection Symbol		DYn 11
14	System Earthing		Neutral of LV side to be solidly earthed
15	Percentage impedance voltage on normal tap and MVA base at 75°C corresponding to HV / LV rating and applicable tolerances		% Impedance % Tolerance
a)	3.15 MVA Tr		6.25 +10
			(No negative tolerance will be allowed)
16	Intended regular cyclic overloading of windings		As per IEC – 76-1, Clause 4.2
17 a)	Anticipated unbalanced loading		Around 20%
b)	Anticipated continuous loading of windings (HV / LV)		110% of rated current
18 a)	Type of tap changer	i)	On-load tap changer
b)	Range of tapping	ii)	+5% to –15% in 8 equal steps of 2.5% each on HV winding
19	Neutral terminal to be brought out		On LV side only
20	Over Voltage operating Capability and duration		112.5% of rated voltage (continuous)

PARTICULAR SPECIFICATION (Cont....)

21	Maximum Flux Density in any part of the core and yoke at rated MVA, rated voltage i.e. 33 KV / 11KV and system frequency of 50 HZ		1.5 Tesla
22	Insulation levels for windings		33 KV 11 KV
a)	1.2 / 50 microsecond wave shape Impulse withstand (KVp)		170 75
b)	Power frequency voltage withstand (KVrms)		70 28
23	Type of winding insulation		
a)	HV winding		Uniform / Insulating Paper (Min.TPC)
b)	LV winding		Uniform / Insulating Paper (Min.TPC)
24	Withstand time for three phase short circuit		2 Seconds
25	Noise level at rated voltage and frequency		As per NEMA Publication No. TR-1
26	Permissible Temperature Rise over ambient temperature of 35°C :		
a)	Of top oil measured by thermometer		40 ° C
b)	Of winding measured by resistance		50 ° C
27	Minimum clearances in air (mm) :-		Phase to phase Phase to ground
a)	HV		350 320
b)	LV		255 140
28	Terminals :		
a)	HV Winding Line end		36 KV oil filled porcelain communicating type of bushings (Antifog type) as per IS 3347
b)	LV winding		12 KV porcelain type of bushing (Antifog type) as per IS 3347
29	Insulation level of bushing		HV LV
a)	Lightning Impulse withstand(KVP)		170 75
b)	1 minute Power Frequency withstand Voltage (KV – 4ms)		70 28

PARTICULAR SPECIFICATION (Cont....)

c)	Creepage distance (MM) (minimum)	900	500
30	Material of HV & LV Conductor	Electrolytic copper	
31	Maximum Current density for HV and LV winding for rated current	2.5 A / mm ²	
32	Polarisation index i.e. ratio of megger values at 600 Sec to 60 sec for HV to earth, LV to earth and HV to LV	Shall be greater than or equal to 1.5, but less than or equal to '5'	
33	Core Assembly	Boltless type	
34	Temperature Indicator :		
a)	Oil	One number	
b)	Winding	One number	
35	Maximum permissible no load loss at rated voltage and rated frequency. (Max) for 3.15 MVA	3.0 KW	
36	Maximum permissible load loss at rated current and at 75 °C (Max) for 3.15 MVA Tr	16.0KW	

31.1 MARSHALLING BOX

A metal enclosed, weather, vermin and dust proof marshalling box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch etc. shall be provided with transformer to accommodate temperature indicators, terminal blocks etc. It shall have degree of protection of IP 55 or better as per IS: 2147 (Refer Clause 3.12).

31.2 PERFORMANCE

- i) Transformer shall be capable of withstanding for two seconds without damage to any external short circuit, with the short circuit MVA available at the terminals.
- ii) The maximum flux density in any part of the core and yoke at rated MVA. Voltage and frequency shall be **1.5 Tesla** (maximum).
- iii) Transformer shall under exceptional circumstances due to sudden disconnection of the load, be capable of operating at the voltage approximately 25% above normal rated voltage for a period of not exceeding one minute and 40% above normal for a period of 5 seconds.
- iv) The transformer may be operated continuously without danger on any particular tapping at the rated MVA \pm 12.5% of the voltage corresponding to the tapping.
- v) The thermal ability to withstand short circuit shall be demonstrated by calculation.
- vi) Transformer shall be capable of withstanding thermal and mechanical stress caused by any symmetrical and asymmetrical faults on any winding.

31.3 DRAWINGS/ DOCUMENTS INCORPORATING THE FOLLOWING PARTICULARS SHALL BE SUBMITTED AFTER AWARD OF CONTRACT

- (a) General outline drawing showing shipping dimensions and overall dimensions, net weights and shipping weights, quality of insulating oil, spacing of wheels in either direction of motion, location of coolers, marshalling box and tap changers etc.
- (b) Assembly drawings of core, windings etc. and weights of main components / parts.
- (c) Height of center line on HV and LV connectors of transformers from the rail top level.
- (d) Dimensions of the largest part to be transported.

PARTICULAR SPECIFICATION (Cont....)

- (e) GA drawings / details of various types of bushing
- (f) Tap changing and Name Plate diagram
- (g) Type test certificates of similar transformers.
- (h) Illustrative & descriptive literature of the Transformer.
- (i) Maintenance and Operating Instructions.

31.4 MISCELLANEOUS

31.4.1 Padlocks along with duplicate keys as asked for various valves, marshalling box etc. shall be supplied by the supplier, wherever locking arrangement is provided. Foundation bolts for wheel locking devices of Transformer shall be supplied by the supplier.

31.5 ALTITUDE FACTOR

If the equipment is to be installed in the hilly area, necessary correction factors as given in the Indian Standard for oil temperature rise, insulation level etc. shall be applied to the Standard Technical Parameters given above.

.6 NAME PLATE

Transformer rating plate shall contain the information as given in clause 15 of IS-2026 (part-i). The details on rating plate shall be finalized during the detailed engineering. The name plate shall also include

- (ii) The short circuit rating,
- (iii) Measured no load current and no load losses at rated voltage and Rated frequency,
- (iv) Measured load losses at Rated current and 75°C (Normal tap only),
- (v) D.C resistance of each winding at 75°C.

32. SYSTEM CONDITIONS

The equipment shall be suitable for installation in supply systems of the following characteristics.

Frequency	50 Hz + 5%
Nominal system voltages	33KV
	11KV
Maximum system voltages	
33 KV System	36.3 KV
11 KV System	12 KV
Normal short circuit level (Basing on apparent power)	
33 KV System	1.1 KA
11 KV System	3.3 KA
Insulation levels: 1.2/50 μ sec impulse withstand voltage	
33 KV System	170KV (peak)
11 KV System	75KV (peak)
Power frequency one minute withstand (wet and dry) voltage	
33 KV System	70KV (rms)
11 KV System	28KV (rms)
Neutral earthing arrangements	
11 KV System	Solidly Earthed

33. CODES & STANDARDS

33.1 The design, material, fabrication, manufacture, inspection, testing before dispatch and performance of power transformers at site shall comply with all currently applicable statutory regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards and codes of practice. Nothing in this specification shall be construed to relieve the supplier of this responsibility.

33.2 The equipment and materials covered by this specification shall conform to the latest applicable provision of the following standards.

PARTICULAR SPECIFICATION (Cont....)

IS:5	:	Colour for ready mixed paints
IS:325	:	Three Phase Induction Motors
IS:335	:	New insulating oil for transformers, switch gears
IS:1271	:	Classification of insulating materials for electrical machinery and apparatus in relation to their stability in services
IS:2026 (Part I to IV)	:	Power Transformer
IS:2071	:	Method of high voltage testing
IS:2099	:	High voltage porcelain bushings
IS:2147	:	Degree of protection
IS:2705	:	Current Transformers
IS:3202	:	Code of practice for climate proofing of electrical equipment
IS:3347	:	Dimensions for porcelain Transformer Bushings IS:3637
	:	Gas operated relays
IS:3639	:	Fittings and accessories for power Transformers
IS:5561	:	Electric Power Connectors
IS:6600/BS:CP'10:0	:	Guide for loading of oil immersed Transformers
IS:10028	:	Code of practice for selection, installation and maintenance of transformers, Part I. II and III
C.B.I.P. Publication	:	Manual on Transformers

If the standard is not quoted for any item, it shall be presumed that the latest version of Indian Standard shall be applicable to that item.

The equipment complying other internationally accepted standards, may also be considered if they ensure performance superior to the Indian Standards.

34 GENERAL CONSTRUCTIONAL FEATURES

- 34.1 All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions without distortion or deterioration or the setting up of undue stresses which may impair suitability of the various parts for the work which they have to perform.
- 34.2 Similar parts particularly removable ones shall be interchangeable.
- 34.3 Pipes and pipe fittings, screws, studs, nuts and bolts used for external connections shall be as per the relevant standards. Steel bolts and nuts exposed to atmosphere shall be galvanized.
- 34.4 Nuts, bolts and pins used inside the transformers and tap changer compartments shall be provided with lock washer or locknuts.
- 34.5 Exposed parts shall not have pockets where water can collect.
- 34.6 Internal design of transformer shall ensure that air is not trapped in any location.
- 34.7 Material in contact with oil shall be such as not to contribute to the formation of acid in oil. Surface in contact with oil shall not be galvanized or cadmium plated.
- 34.8 Labels, indelibly marked, shall be provided for all identifiable accessories like Relays, switches current transformers etc. All label plates shall be of in corrodible material.
- 34.9 All internal connections and fastenings shall be capable of operating under overloads and over-excitation, allowed as per specified stands without injury.
- 34.10 Transformer and accessories shall be designed to facilitate proper operation, inspection, maintenance and repairs.
- 34.11 No patching, plugging, shimming or other such means of overcoming defects, discrepancies or errors will be accepted.
- 34.12 Schematic Drawing of the wiring, including external cables shall be put under the prospane sheet on the inside door of the transformer marshalling box.

35 PAINTING

All paints shall be applied in accordance with the paint manufacturer's recommendations. Particular attention shall be paid to the following: Proper storage to avoid exposure as well as extremes of temperature.

PARTICULAR SPECIFICATION (Cont....)

- (a) Surface preparation prior to painting.
- (b) Mixing and thinning
- (c) Application of paints and the recommended limit on time intervals between coats.
- (d) Shelf life for storage.

- 35.1 All paints, when applied in normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.
- 35.2 All primers shall be well marked into the surface, particularly in areas where painting is evident, and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to the manufacturer's recommendations.
- 35.3 The supplier shall, prior to painting protect nameplates, lettering gauges, sight glasses, light fittings and similar such items.

36. BLANK**37. Tank**

- 37.1** The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the shall be of welded construction.
- 37.2** Tank shall be designed to permit lifting by crane or jacks of the complete transformer assembly filed with oil. Suitable lugs and bossed shall be provided for this purpose.
- 37.3 All breams, flanges, lifting lugs, braces and permanent parts attached to the tank shall be welded and where practicable, they shall be double welded.
- 37.4 The main tank body of the transformer, excluding tap changing compartments and radiators, shall be capable of withstanding pressure of 760mm of Hg.
- 37.5 Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.
- 37.6 Gaskets of nitrile rubber or equivalent shall be used to ensure perfect oil tightness. **All gaskets shall be closed design (without open ends) and shall be of one piece only.** Rubber gaskets used for flange type connections of the various oil compartments, shall be laid in grooves or in groove-equivalent sections on bolt sides of the gasket, throughout their total length. Care shall be taken to secure uniformly distributed mechanical strength over the gaskets and retains throughout the total length. Gaskets of neoprene and / or any kind of impregnated / bonded core or cork only which can easily be damaged by over-pressing are not acceptable. Use of hemp as gasket material is also not acceptable.
- 37.7 Suitable guides shall be provided for positioning the various parts during assemble or dismantling. Adequate space shall be provided between the cores and windings and the bottom of the tank for collection of any sediment.

38. Tank Cover

The transformer top shall be provided with a detachable tank cover with bolted flanged gasket joint. Lifting lugs shall be provided for removing the cover. The surface of the cover shall be suitable sloped so that it does not retain rain water.

39. UNDER CARRIAGE

The transformer tank shall be supported on steel structure with detachable plain rollers completely filled with oil. Suitable channels for movement of roller with transformer shall be space accordingly, rollers wheels shall be provided with suitable rollers bearings, which will resist rust and corrosion and shall be equipped with fittings for lubrication. It shall be possible to swivel the wheels in two directions, at right angle to or parallel to the main axis of the transformers.

45. CORE

- 43.1 Each lamination shall be insulated such that it will not deteriorate due to mechanical pressure and the action of hot transformer oil.
- 43.2 The core shall be constructed either from high grade, non-aging Cold Rolled Grain Oriented (CRGO) silicon steel laminations conforming to H-IB / H-IB-LS grade with lamination thickness

PARTICULAR SPECIFICATION (Cont....)

not more than 0.23mm to 0.27mm or better grade core shall be used. The maximum flux density in any part of the cores and yoke at normal voltage and frequency shall not be more than 1.5 Tesla. The Bidder shall provide saturation curve of the core material, proposed to be used. Laminations of different grade(s) and different thickness (s) are not allowed to be used in any manner or under any circumstances.

- 40.3 Core material shall be directly procured by the manufacturer either from the manufacturer or through their accredited marketing organization of repute, but not through any agent. Proof of the same shall be provided by the contractor from the transformer manufacturer
- 40.4 The laminations shall be free of all burrs and sharp projections. Each sheet shall have an insulting coating resistant to the action of hot oil.
- 40.5 The insulation structure for the core to bolts and core to clamp plates, shall be such as to withstand 2000 V DC voltage for one minute.
- 40.6 The completed core and coil shall be so assembled that the axis and the plane of the outer surface of the core assemble shall not deviate from the vertical plane by more than 25mm.
- 40.7 All steel sections used for supporting the core shall be thoroughly shot or sand blasted, after cutting, drilling and welding.
- 40.8 The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.
- 40.9 The core clamping structure shall be designed to minimize eddy current loss.
- 40.10 The framework and clamping arrangements shall be securely earthed.
- 40.11 The core shall be carefully assembled and rigidly clamped to ensure adequate mechanical strength.
- 40.12 Oil ducts shall be provided, where necessary, to ensure adequate cooling inside the core. The welding structure and major insulation shall not obstruct the free flow of oil through such ducts.
- 40.13 The design of magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earth clamping structure and production of flux component at right angle to the plane of the lamination, which may cause local heating. The supporting framework of the cores shall be so designed as to avoid the presence of pockets, which would prevent complete emptying of the tank through the drain valve or cause trapping of air during filling.
- 40.14 The construction is to be of boltless core type. The core shall be provided with lugs suitable for lifting the complete core and coil assembly. The core and coil assemble shall be so fixed in the tank that shifting will not occur during transport or short circuits.
- 40.15 The temperature gradient between core & surrounding oil shall be maintained less than 20 deg. Centigrade.

45 INTERNAL EARTHING

- 43.1 All internal metal parts of the transformer, with the exception of individual laminations and their individual clamping plates shall be earthed.
- 43.2 The top clamping structure shall be connected to the tank by a copper strap. The bottom clamping structure shall be earthed by one or more the following methods:
 - By connection through vertical tie-rods to the top structure.
 - By direct metal to metal contact with the tank base.
 - By a connection to the structure on the same side of the core as the main earth connection to the tank.
- 43.3 The magnetic circuit shall be connected to the clamping structure at one point only and this shall be brought out of the top cover of the transformer tank through a suitably rated insulator. A disconnecting link shall be provided on transformer tank to facilitate disconnections from ground for IR measurement purpose.
- 43.4 Coil clamping rings of metal at earth potential shall be connected to the adjacent core clamping structure on the same side as the main earth connections.

45 WINDING

Winding shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.

- 43.1 All low voltage windings for use in the circular coil concentric winding shall be wound on a performed insulating cylinder for mechanical protection of the winding in handling and placing

PARTICULAR SPECIFICATION (Cont....)

around the core.

- 43.2 Winding shall not contain sharp bends which might damage the insulation or produce high dielectric stresses. No strip conductor wound on edge shall have width exceeding six times the thickness.
- 43.3 Materials used in the insulation and assembly of the windings shall be insoluble, non catalytic and chemically inactive in the hot transformer oil and shall not soften or the otherwise affected under the operating conditions.
- 43.4 Varnish application on coil windings may be given only for mechanical protection and not for improvement in dielectric properties. In no case varnish or other adhesive be used which will seal the coil and prevent evacuation of air and moisture and impregnation by oil.
- 43.5 Winding and connections shall be braced to withstand shocks during transport or short circuit.
- 43.6 Permanent current carrying joints in the windings and leads shall be welded or brazed. Clamping bolts for current carrying parts inside oil shall be made of oil resistant material which shall not be affected by acidity in the oil steel bolts, if used, shall be suitably treated.
- 43.7 Terminals of all windings shall be brought out of the tank through bushings for external connections.
The completed core and coil assemble shall be dried in vacuum at not more than 0.5mm of mercury absolute pressure and shall be immediately impregnated with oil after the drying process to ensure the elimination of air and moisture within the insulation. Vacuum may be applied in either vacuum over or in the transformer tank.
The winding shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repairs to the winding can be made readily without special equipment. The coils shall have high dielectric strength.
Coils shall be made of continuous smooth high grade electrolytic copper conductor, shaped and braced to provide for expansion and contraction due to temperature changes.
Adequate barriers shall be provided between coils and core and between high and low voltage coil. End turn shall have additional protection against abnormal line disturbances.
The insulation of winding shall be designed to withstand voltage stress arising from surge in transmission lines due to atmospheric or transient conditions caused by switching etc.
Tapping shall not be brought out from inside the coil or from intermediate turns and shall be so arranged as to preserve as far as possible magnetic balance of transformer at all voltage ratios.
Magnitude of impulse surges transferred from HV to LV windings by electromagnetic induction and capacitance coupling shall be limited to BILL of LV winding.
The current density adopted in all winding shall not exceed 2.5 A/mm². The total net cross sectional area of the strip conductors for calculating current density for each winding shall be obtained after deducting the copper area lost due to rounding up of the sharp edges at the rectangular conductors.

45 **INSULATING OIL**

The insulating oil for the transformer shall be of EHV grade, generally conforming to IS: 335. No inhibitors shall be used in the oil.

The quantity of oil required for the first filling of the transformer and its full specification shall be stated in the bid. The bidder shall quote the price of transformer complete with all fittings, accessories and new transformer oil required for first filling plus 10% extra oil. The extra quantity of oil shall be supplied in non-returnable drums along with the oil required for the radiator banks. The design and materials used in the construction of the transformer shall be such as to reduce the risk of the development of acidity in the oil. Supplier shall warrant that oil furnished is in accordance with the following specifications.

S.No	Characteristic	Requirement	Method of Test
01	Appearance	The oil shall be clear & transparent & free from suspended matter or sediment	A representative sample of oil shall be examined in a 100 mm thick layer at ambient temp.
02	Density at 20 °C	0.89 g/cm ³ Max.	IS:1448
03	Kinematic Viscosity at 27 deg. C Max	27 CST	IS:1448

PARTICULAR SPECIFICATION (Cont....)

04	Interfacial tension at 27 °C Min.	0.03 N/m	IS:6104
05	Flash Point	136 °C	IS:1448
06	Pour Point Max.	-6 °C	IS:1448
07	Naturalization Value (Total Acidity) Max.	0.03 mg KOH/gm	IS:335
08	Electric strength Breakdown (voltage) Min.	72.5 KV	IS:6792
09	Dielectric dissipation factor tan delta at 90°C	0.03 Max	IS:6262
10	Min specific resistance(resistivity) at 90°C	35×10^{12} ohm cm (min.)	IS:6103
11	Oxidation stability		
12	Neutralization value after oxidation	0.40mg KOH/g	
13	Total sludge after oxidation	0.10% by weight max.	
14	Presence of oxidation Inhibitor	The oil shall not contain Anti-oxidant Additives.	IS:335
15	Water content Max:	Less than 14 ppm	IS:2362

VALVES

Valves shall be of forged carbon steel up to 50mm size and of gun metal or of cast iron bodies with gun metal fittings for sizes above 50mm. They shall be of full way type with screwed ends and shall be opened by turning counter clockwise when facing the hand wheel. There shall be no oil leakage when the valves are in closed position.

Each valve shall be provided with an indicator to show the open and closed positions and shall be provided with facility for padlocking in either open or closed position. All screwed valves shall be furnished with pipe plugs for protection. Padlocks with duplicate keys shall be supplied along with the valves.

All valves except screwed valves shall be provided with flanges having machined faced drilled to suit the applicable requirements, Oil tight blanking plates shall be provided for each connection for use when any radiator is detached and for all valves opening to atmosphere. If any special radiator valve tools are required the supplier shall supply the same.

Each transformer shall be provided with following valves on the tank:

Drain valve so located as to completely drain the tank & to be provided with locking arrangement.

Two filter valves on diagonally opposite corners of 50mm size & to be provided with locking arrangement.

Oil sampling valves not less than 8mm at top and bottom of main tank & to be provided with locking arrangement.

One 15mm air release plug.

Valves between radiators and tank.

Drain and filter valves shall be suitable for applying vacuum as specified in the specifications.

43.

ACCESSORIES**43.1 Bushing**

All porcelain used in bushings shall be homogeneous, non-porous, uniformly glazed to brown colour and free from blisters, burns and other defects.

Stress due to expansion and contraction in any part of the bushing shall not lead to deterioration.

Bushing shall be designed and tested to comply with the applicable standards.

Bushing rated for 630A and above shall have non-ferrous flanges and hardware.

PARTICULAR SPECIFICATION (Cont....)

Fittings made of steel or malleable iron shall be galvanized

Bushing shall be so located on the transformers that full flashover strength will be utilized. Minimum clearances as required for the BIL shall be realized between live parts and live parts to earthed structures.

All applicable routine and type tests certificates of the bushings shall be furnished for approval.

Bushing shall be supplied with bi-metallic terminal connector/ clamp/ washers suitable for fixing to bushing terminal and HT power cable as mentioned above. The connector/clamp shall be rated to carry the bushing rated current without exceeding a temperature rise of 55°C over an ambient of 35°C. The connector/clamp shall be designed to be corona free at the maximum rated line to ground voltage.

Bushing of identical voltage rating shall be interchangeable.

The insulation class of high voltage neutral bushing shall be properly coordinated with the insulation class of the neutral of the low voltage winding. Each bushing shall be so coordinated with the transformer insulation that all flashover will occur outside the tank.

43.2 Protection & Measuring Devices**Oil Conservator Tank**

The Conservator tank shall have adequate capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment.

The conservator tank shall be bolted into position so that it can be remove for cleaning purposes.

The conservator shall be fitted with magnetic oil level gauge with low level electrically insulated alarm contact.

Plain conservator fitted with silica gel breather.

Pressure Relief Device.

The pressure relief device provided shall be of sufficient size for rapid release of any pressure that may be generated in the tank and which may result in damage of the equipment. The device shall operate at a static pressure of less than the hydraulic test pressure of transformer tank. It shall be mounted direct on the tank. A pair of electrically insulated contract shall be provided for alarm and tripping.

Buchholz Relay

A double float type Buchholz relay shall be provided. Any gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation. A copper tube shall be connected from the gas collector to a valve located about 1200 mm above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent potential free contracts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

Temperature Indicator**Oil Temperature Indicator (OTI)**

The transformers shall be provided with a mercury contact type thermometer with 150 mm dial for top oil temperature indication. The thermometer shall have adjustable, electrically independent potential free alarm and trip contacts. Maximum reading pointer and resetting device shall be mounted in the local control panel. A temperature sensing element suitably located in a pocket on top oil shall be furnished. This shall be connected to the OTI by means of capillary tubing. Accuracy class of OTI shall be $\pm 1\%$ or better. One No electrical contact capable of operating at 5 A ac at 230 volt supply.

Winding Temperature indicator (WTI)

A device for measuring the hot spot temperature of the winding shall be provided. It shall comprise the following.

- i. Temperature sensing element.
- ii. Image Coil.
- iii. Mercury contacts.

PARTICULAR SPECIFICATION (Cont....)

- iv. Auxiliary CTS, If required to match the image coil, shall be furnished and mounted in the local control panel.
- v. 150mm dial local indicating instrument with maximum reading pointer mounted in local panel and with adjustable electrically independent ungrounded contacts, besides that required for control of cooling equipment, one for high winding temperature alarm and one for trip.
- vi Calibration device.
- Vii Two number electrical contact each capable of operating at 5 A ac at 230 Volt supply.

43.3 Oil Preservation Equipment**43.1 Oil Sealing**

The oil preservation shall be diaphragm type oil sealing in conservator to prevent oxidation and contamination of oil due to contact with atmospheric moisture.

The conservator shall be fitted with a dehydrating filter breather. It shall be so designed that.

Passage of air is through a dust filter & Silica gel.

Silica gel is isolate from atmosphere by an oil seal.

Moisture absorption indicated by a change in colour of the crystals of the silica gel can be easily observed from a distance.

Breather is mounted not more than 1400 mm above rail top level.

45 MARSHALLING BOX

Sheet steel, weather, vermin and dust proof marshalling box fitted with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch, water- tight hinged and padlocked door of a suitable construction shall be provided with transformer to accommodate temperature indicators, terminal blocks etc. The box shall have slopping roof and the interior and exterior painting shall be in accordance with the specification. Padlock along with duplicate keys shall be supplied for marshalling box. The degree of protection shall be IP-55 or better.

The schematic diagram of the circuitry inside the marshalling box be prepared and fixed inside the door under a prospone sheet.

The marshalling box shall accommodate the following equipment:

Temperature indicators.

Terminal blocks and gland plates for incoming and outgoing cables.

All the above equipments except b) shall be mounted on panels and back of panel wiring shall be used for inter-connection. The temperature indicators shall be so mounted that the dials are not more than 1600 mm from the ground level and the door (s) of the compartment(s) shall be provided with glazed window of adequate size.

To prevent internal condensation, a metal clad heater with thermostat shall be provided. The heater shall be controlled by a MCB of suitable rating mounted in the box. The ventilation louvers, suitably padded with felt, shall also be provided. The louvers shall be provided with suitable felt pads to prevent ingress of dust.

All incoming cables shall enter the kiosk from the bottom and the gland plate shall not be less than 450 mm from the base of the box. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture from the cable trench.

45 TAP CHANGER**45.1 ON-LOAD TAP-CHANGERS**

The transformers shall be provided with On-load Taps

The Transformer with on-load tap changing gear shall have taps ranging from +5% to -15% in equal steps of 2.5% each on HV winding for voltage variation

The tap changing switch shall be located in a convenient position so that it can be operated from ground level. The switch handle shall be provided with locking arrangement along with tap position indication, thus enabling the switch to be locked in position.

46. FITTINGS AND ACCESSORIES

PARTICULAR SPECIFICATION (Cont....)

The following fittings and accessories shall be provided on the transformers: Conservator with isolating valves, oil filling hole with cap and drain valve. The conservator vessel shall be filled with constant oil pressure diaphragm oil sealing system.

Magnetic type oil level gauge (150 mm dia) with low oil level alarm contacts.

Prismatic/ toughened glass oil level gauge.

Silica gel breather with oil seal and connecting pipe complete with first fill of activated silica gel or Alumina mounted at a level of 1300 mm above ground level.

Pressure relief devices (including pressure relief valve) and necessary air equalizer connection between this and the conservator with necessary alarm and trip contacts.

Air release plugs in the top cover.

Inspection cover, access holes with bolted covers for access to inner ends of bushing etc.

Winding temperature (hot spot) indicating device for local mounting complete in all respects.

Winding temperature indicator shall have two set of contacts to operate at different settings :

To provide winding temperature high alarm

To provide temperature too high trip

Dial thermometer with pocket for oil temperature indicator with one set of alarm and one set of trip contacts and maximum reading pointer.

Lifting eyes or lugs for the top cover, core and coils and for the complete transformer.

Jacking pads

Haulage lugs.

Protected type mercury / alcohol in glass thermometer and a pocket to house the same.

Top and bottom filter valves on diagonally opposite ends with pad locking arrangement on both valves.

Top and bottom sampling valves.

Drain valve with pad locking arrangement

Rating and connection diagram plate.

Two numbers tank earthing terminals with associated nuts and bolts for connections to existing grounding strip.

Bi-directional flagged rollers with locking and bolting device.

Marshalling Box (MB)

Shut off valve on both sides of flexible pipe connections between radiator bank and transformer tank.

Cooling Accessories :

Requisite number of radiators provided with:-

- One shut off valve on top
- One shut off valve at bottom
- Air release device on top
- Drain and sampling device at bottom
- Lifting lugs.

Air release device and oil drain plug on oil pipe connectors:

Terminal marking plates for Current Transformer and Main Transformer

On- Load Tap Changer

Oil Preservation Equipment

Oil Temperature indicator

Note :

The fittings listed above are indicative and any other fittings which are generally required for satisfactory operation of the transformer are deemed to be included in the quoted price of the transformer.

The contacts of various devices required for alarm and trip shall be potential free and shall be adequately rated for continuous, making and breaking current duties as specified.

47. CONTROL CONNECTIONS AND INSTRUMENT AND WIRING TERMINAL BOARD AND FUSES

Normally no fuses shall be used anywhere instead of fuses MCB's (both in AC & DC circuits) shall be used. Only in cases where a MCB cannot replace a fuse due to system requirements, a HRC fuse can be accepted.

All wiring connections, terminal boards, fuses MCB's and links shall be suitable for tropical

PARTICULAR SPECIFICATION (Cont....)

atmosphere. Any wiring liable to be in contact with oil shall have oil resisting insulation and the bare ends of stranded wire shall be sweated together to prevent seepage of oil along the wire. Panel connections shall be neatly and squarely fixed to the panel. All instruments and panel wiring shall be run in PVC or non-rusting metal cleats of the compression type. All wiring to a panel shall be taken from suitable terminal boards.

Where conduits are used, the runs shall be laid with suitable falls, and the lowest parts of the run shall be external to the boxes. All conduit runs shall be adequately drained and ventilated.

Conduits shall not be run at or below ground level.

All box wiring shall be in accordance with relevant IS. All wiring shall be of stranded copper (48 strands) of 1100 Volt grade and size not less than 2.5 sq.mm

All wires on panels and all multi-core cables shall have ferrules, for easy identifications, which bear the same number at both ends, as indicated in the relevant drawing.

At those points of interconnection between the wiring carried out by separate contractors, where a change of number can not be avoided double ferrules shall be provided on each wire. The change of numbering shall be shown on the appropriate diagram of the equipment.

The same ferrule number shall not be used on wires in different circuits on the same panels.

Ferrules shall be of white insulating material and shall be provided with glossy finish to prevent the adhesion of dirt. They shall be clearly and durably marked in black and shall not be affected by dampness or oil.

All circuits in which the voltage exceeds 125 volts, shall be kept physically separated from the remaining wiring. The function of each circuit shall be marked on the associated terminal boards.

Where apparatus is mounted on panels, all metal cases shall be separately earthed by means of stranded (48 No.) copper wire of strip having a cross section of not less than 2 sq. mm where strip is used, the joints shall be sweated. The copper wire shall have green coloured insulation for earth connections.

Terminal blocks shall have pairs of terminals for incoming and outgoing wires. Insulating barriers shall be provided between adjacent connections. The height of the barriers and the spacing between terminals shall be such as to give adequate protection while allowing easy access to terminals. The terminals shall be adequately protected with insulating dust proof covers. No live metal shall be exposed at the back of the terminal boards. CT terminals shall have shorting facilities. The terminals for CTs should have provision to insert banana plugs and with isolating links.

All interconnecting wiring, as per the final approved scheme between accessories of transformer and marshalling box is included in the scope of this specification and shall be done by the Transformer supplier.

The schematic diagram shall be drawn and fixed under a transparent prospane sheet on the inner side of the marshalling box cover.

To avoid condensation in the Marshalling Box, a space heater shall be provided with an MCB and thermostat.

Suitable MV, CFL light shall be provided in the Marshalling Box for lightning purpose.

48. RADIO INTERFERENCE AND NOISE LEVEL

Transformers shall be designed with particular care to suppress at least the third and fifth harmonic voltages so as to minimize interference with communication circuits. Transformer noise level when energized at normal voltage and frequency shall be as per NEMA stipulations.

49. TESTING**49.1 FACTORY TESTS**

All standards routine tests in accordance IS: 2026 with dielectric tests corresponding as per latest amendments to IS: 2026 shall be carried out.

All auxiliary equipment shall be tested as per the relevant IS. Test certificates shall be submitted for bought out items.

High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly.

Following additional routine tests shall also be carried out on each transformer:

Magnetic Circuit Test: Each core shall be tested for 1 minute at 2000 Volt DC

Oil leakage test on transformer

49.1.1 Type Test

PARTICULAR SPECIFICATION (Cont....)

The Transformer manufacturer must have successfully carried out type test of 3MVA or 3.15 MVA, 33/11 KV or above rating transformer from any NABL accredited laboratory. The said type test report should not be prior to 5 year from the date of opening of the technical bid. Type test is mandatory. The loss parameters of the offered transformer shall be identical to that of the one which has been type tested. Details of the type test certificates are as under:

- i. Dynamic ability to withstand short circuit test
- ii. Lightning impulse voltage withstand test.
- iii. Temperature rise test

49.1.2 Routine Tests

Transformer routine tests shall include tests stated in latest issue of IS: 2026 (Part –1). These tests shall also include but shall not be limited to the following:

- (i) Measurement of winding DC resistance.
- (ii) Voltage ratio on each tapping and check of voltage vector relationship.
- (iii) Impedance voltage at all tappings.
- (iv) Magnetic circuit test as per relevant ISS or CBIP manual or latest standard being followed.
- (v) Measurement of Load losses at normal tap and extreme taps.
- (vi) No load losses and no load current at rated voltage and rated frequency, also at rated voltage in steps.
- (vii) Absorption index i.e insulation resistance for 15 seconds and 60 seconds (R 60/ R 15) and polarization index i.e Insulation Resistance for 10 minutes and one minute (R 10 mt / R 1 mt).
- (viii) Induced over voltage withstand test.
- (ix) Separate source voltage withstand test.
- (x) Tan delta measurement and capacitance of each winding to earth (with all other windings earthed) & between all windings connected together to earth.
- (xi) Measurement of zero sequence impedance
- (xii) Tests on on- load tap changer (fully assembled on transformer) as per IEC : 214/ 1976 and BS: 4571/ 1970.
- (xiii) Auxiliary circuit tests
- (xiv) Oil BDV tests
- (xv) Measurement of neutral unbalance current which shall not exceed 2% of the full rated current of the transformer.
- (xvi) Magnetic balance test
- (xvii) Leakage test

50 PRE-SHIPMENT CHECK AT MANUFACTURERS WORKS

- i) Check for proper packing and preservation of accessories like radiators, bushings, explosions vent, dehydrating breather, rollers, buchholz relay, control cubicle connecting pipes and conservator etc.
- ii) Check for proper provision of bracing to arrest the movement of core and winding assembly inside the tank.

51 PERFORMANCE

The performance of the transformer shall be measured on the following aspects.

- i) The transformer shall be capable of being operated without danger on any tapping at the rated KVA with voltage variations and $\pm 10\%$ corresponding to the voltage of the tapping
- ii) Radio interference and Noise Level
- iii) The transformer shall be designed with particular attention to the suppression of third and fifth harmonics so as to minimize interference with communication circuits.

PARTICULAR SPECIFICATION (Cont....)**52 O & M MANUALS:**

O & M manuals for the installation, operation and maintenance of transformers shall be furnished one month before dispatch of equipment.

53 The manual should contain at minimum, the following details:

- (a) General description of equipment.
- (b) Approved Technical Data Sheet
- (c) Salient constructional features.
- (d) Technical leaflets of fittings/ important parts.
- (e) All drawings.
- (f) Type and routine test certificates.
- (g) Instructions to be followed on receipt of equipment at site & for storage.
- (h) Instructions for foundation arrangement.
- (i) Erection procedures and checks.
- (j) Pre-commissioning checks.
- (k) Commissioning procedures.
- (l) Withdrawal arrangement/ material handling instructions.
- (m) Operation instructions.
- (n) Maintenance instructions.
- (o) Trouble-shooting.
- (p) Safety instructions.

54 **BLANK**

55 TRANSFORMER TESTING

The transformer is required to be got tested by CPRI (Central power research institute) Bangalore/Bhopal and test reports are to be submitted along with the transformer without any extra cost.

56 COMMISSIONING TEST

Commissioning test shall be got carried by the nominated electrical inspector. All necessary arrangement shall be made by the contractor for test without any extra cost.

57 RUNNING TEST

The contractor shall shown the running/working tests of transformer for 3 days continuously running after completion of the work.

58 WORK IN ACCORDANCE WITH SPECIFICATION

Work under this contract shall be carried out as per brief description given in Sch 'A', particular specifications. Work shall also be in conformity with IE rules, relevant IS specification and SSR which are forming part of the contract. The entire work shall be carried out properly with due care and under the supervision of competent technical personnel.

59 SUBMISSION OF COMPLETION OF E/M PORTION

On physical completion of work, contractor is to submit the following drawings and other relevant literature as enumerated below to the deptt. This is a pre-requisite before completion certificate is issued to the contractor. Schematic diagram of power wiring including cable sizes of LT Panel Board.

60 TECHNICAL LITERATURE

Technical literature of transformer containing operation and maintenance instructions shall be submitted to the department by the contractor.

Six copies of the above said drawings and literature shall be supplied in calico bound bookform. Drawings should not be submitted on Ammonia print but it shall be Photostat copy on white paper. Front and back cover shall be laminated hard material or any other superior material approved by GE. Any cost incurred on this account is deemed to be included in the quoted rate for the transformer. It should also indicate parts of transformer and list of tools and spares.

61 PURCHASE VOUCHER & TEST CERTIFICATES

The payment of transformer shall only be allowed after production of original purchase vouchers, test certificates from the manufacturer by the contractor and result of testing carried out by the Department are found satisfactory after testing.

PARTICULAR SPECIFICATION (Cont....)62 nd 63 **BLANK****64 WORK IN ACCORDANCE WITH SPECIFICATION**

Work under this contract shall be carried out as per brief description given in Sch 'A', particular specifications. Work shall also be in conformity with IE rules, relevant IS specification and SSR which are forming part of the contract. The entire work shall be carried out properly with due care and under the supervision of competent technical personnel.

65 PAINTING TO STEEL AND IRON WORK

Refer Clause No. 17.8 of MES Schedule Part-I.

Filler coat is not required to be applied. Where painting is indicated in Schedule of finishes, it shall be done in three coats viz primer, under coat and finishing coat. Primer for steel surfaces shall be red oxide zinc chrome and under coat and finishing coat shall be of synthetic enamel paint.

All exposed surfaces of iron and steel other than galvanised surfaces and reinforcement shall be painted with two coats of synthetic enamel paint over a coat of primer. Primer for steel work shall be red oxide zinc chrome primer. Steel brackets of cisterns/WHB shall be given two coats of aluminium paint over a coat of primer. However, steel members of roof, hidden by ceiling shall be painted with two coats of red oxide primer.

PAINTING TO CONCRETE / PLASTERED SURFACES :- Irrespective of what is shown on drawing, plastered/concrete surfaces of inside wardrobe, lofts, cupboard and open shelves shall be applied two coats of synthetic enamel paint over a coat of primer (white).

66 SUBMISSION OF COMPLETION OF E/M PORTION

On physical completion of work, contractor is to submit the following drawings and other relevant literature as enumerated below to the deptt. This is a pre-requisite before completion certificate is issued to the contractor.

67 DRAWINGS

Schematic diagram of power wiring including cable sizes of LT Panel Board, Transformer and DG Set.

68 LT PANEL BOARD

CPRI Approved Factory Made LT Panel Board shall be fabricated with 2.00mm CRCA sheet for indoor panel and 3.15mm CRCA sheet for outdoor panel, built cubical, fully Compartmentalized type, dust and vermin proof, suitable for indoor installation, with bottom cable entry, structure treated under 8-Tank metal treatment process and duly powder coated, with electrolytic copper bus-bars supported on non-hygroscopic fibers, instrument wiring with suitable rating copper conductor and provided with GI Earthing strips, ventilating louvers, cable alleys etc. comprising of components indicated in Schedule-A. Connection of control wiring of LT Panel Board shall be done with screw less connection strips and ferrules for identification of both ends.

The Structural and connection Diagram shall be got approved by Engineer-in Charge & GE before Fabrication of panel.

The payment of LT Panel Board shall only be allowed after production of original purchase vouchers, test certificates by the contractor and result of testing carried out by the Department are found satisfactory after testing.

69 BUS BAR:

Bus Bar of rectangular cross section suitable for full rated current for phase bus bar, and half rated current for neutral bus bar and shall be extendable on either side. Bus Bar shall be made of high conductivity copper. The rating of busbar shall be for a maximum total operating temperature of 110deg.C, at an ambient of 40 deg.C.

The Bus bars shall be fully insulated with heat shrinkable PVC Sleeves. The sleeves shall be colour coded for easy identification of individual phase and neutral.

Two nos. of GI earth studs of suitable size with double washers shall be provided on the body of power distribution panel. The terminal shall be permanently marked 'E'.

Danger notice plate of 1.6 mm thick mild steel sheet, vitreous enameled with letters, figures and conventional skull and bones in signal red colour of size 20 cm x 15 cm shall be fixed on the front cover with four Nos of screws.

70 Testing of LT Panel Board. The following tests are to be carried out at the expense of the contractor and to the satisfaction of the Engineer-in-Charge. Over and above the factory test and test certificate furnished.

- (i) Earth Test.
- (ii) Insulation Test.

PARTICULAR SPECIFICATION (Cont....)

- (iii) Commissioning Test as per IE Rules.

71 EARTHING

Earthing shall be done in accordance with latest 13:3:42 code of practice for earthing and MES Schedule Part-I and IE rules. The contractor shall obtain approval of Engr-in-Charge before commencement of earthing work and it shall be executed in the presence of an authorised MES representative.

The earth electrode shall be located at least 2 m from the footing of the nearest foundation. Test links (test points) shall be provided in the earth circuit for carrying out resistance measuring test.

In side and bottom of concrete pit shall be plastered 10mm thick in CM 1:4 and cover shall be with pre-cast RCC 1:2:4 type B1 reinforced with 8mm dia MS bar 15cm distance in both ways. Funnel shall be made with 20 gauge GI wire.

Charcoal, dust and salt filling shall be done in layers as shown in as shown in electrical plate No.3 of SSR, Part-I. Surplus soil shall be disposed off and site left clean on completion.

Testing shall be carried out off completion as per IE rule in the presence of Engr-in-Charge.

TESTING :- All electrical works shall be tested as specified in relevant Para's under section 10 or SSR Part-I, IE rule and as directed by Engineer-in-Charge. Tools/apparatus etc. requires for testing shall be supplied and standard by the contractor and the cost of testing shall be borne by the contractor.

72 LIGHTNING PROTECTION

Arrangement for lightning protection shall be made on Locations as directed by Engineer-In-charge. The arrangement shall conform to IS-2309. On Ridge of Building aluminium Strip 25x

3.150 mm shall be fixed with J Bolts on both side of Ridge as shown in Drawing. Both side, aluminium Strip shall be in contact with each other through Air Termination Point. If Extermination Point is separately fixed and not giving contact to both the aluminium strip in the case at every 10 Metre both the aluminium Strip shall be connected separately by a piece or same aluminium Strip so that Lightning have an easy and Shortest Passage to ground.

Air Termination Point shall be fixed as shown in Drawing. Aluminium Down Conductors shall run along CGI Sheet and on Wall fixed by means of Brass Saddles. Aluminium strip down conductor shall be terminated at Test Point. GI Strip coming from earth pit and from another te point shall meet Copper Down Conductor at Test Point. All Test Point shall be inter connect through Copper Strip as shown in Drawing.

All the Roof Conductors and Down Conductors (i.e aluminium Strip 25x.15mm) and Air Termination Copper Rod (12 mm dia & 300mm long) shall be mounted on suitable size of Porcelain Insulator. Due care be taken to ensure that any portion of the Lightning Protection Air Termination Rod and the Strip are not in contact with the Building. The cost of porcelain insulator is deemed to be included in the Quoted Rate/Amount of the concerned item.

73 DEMOLITION/DISMANTLING/TAKINGDOWN

Refer to relevant paras under section 21 of MES SSR 2009 Part-I (Specifications).

The contractor shall take proper precaution for demolition/dismantling work. If any damage caused due to dismantling/demolition to the existing structure, the contractor shall make good the same at his own cost without any extra cost to the Govt.

Unserviceable materials as per Credit Schedule obtained from demolition/dismantling shall be property of the contractor and shall be credited as per schedule of credits. All demolished/dismantled materials shall be removed from the site of the contractor as directed by the Engineer-in-Charge without any extra cost to the Govt. Demolished / Dismantled items not catered for in the Credit Schedule shall be the property of Govt and shall be handed over to Department store yard without any extra cost to the Govt.

74 SITE CLEARANCE:

On completion of work, site shall be left clean and tidy. Work shall be regarded as completed only after clearance of site to the entire satisfaction of the Engineer-in-Charge. Rate quoted by the contractor in Schedule 'A' is deemed inclusive of the same.

75 RECORD DRAWINGS :-

The contractor shall submit 3 copies of the electrical layout plan drawings duly signed by him and the Engineer-in-Charge on completion of the work.

76 MAKES

The list of makes of various items and articles to be incorporated in the work is as given in Appendix 'F', same shall be incorporated in works after approval by GE.

PARTICULAR SPECIFICATION (Cont....)**77. APPROVED MAKES:-**

S No	<u>ITEMS</u>	<u>MAKES</u>
(a)	<u>IRON MONGRIES</u>	ISI MARKED FITTING TO BE USES
(b)	<u>BARBED WIRE</u>	ISI MARKED
(c)	<u>CEMENT</u>	J K CEMENT, AMBUJA CEMENT, STAR CEMENT, ULTRA TECH CEMENT, CENTURY CEMENT, MEGHALAYA CEMENTS and DALMIA CEMENT
(d)	<u>CHAIN LINK FENCING AND CONCERTINA COILS</u>	Global Technocrates Pvt Ltd, A-1 Fence & Consec (group -I)
(e)	<u>PAINT / DISTEMPER / POLISH / VARNISHES</u>	
	Acrylic Washable Distemper	Jotun, Nerolac, British Paint, Velvet Acrylic Distemper (Crimson Paints Pvt Ltd), Berger, Asian
	Plastic Emulsion Paint	Jotun, Silk (Berger), Dulux Velvet Touch (ICI), Shalimar, Asian Paints, Nerolac.
	Synthetic Enamel / Acrylic Paint	Jotun, Apcolite (Asian), Luxol (Berger), Jenson & Nicholson Paints Ltd. (Borolac), Shalimar Paints Ltd (Superlac)
	Cement Base Paint	Jotun, Snowcem Plus, Berger, Asian Paints (Gutucam), Crimocem Super Cerment paints
	Exterior Acrylic Emulsion Weather Coat Paint	Royal Acrylic (Crimson Paints Pvt Ltd), Dulax, Shalimar Paints Ltd (Extra Maxium Ultra), Berger Paints Ltd (Weather Coat), Asian Paints Ltd (Appex Ultima), Jotun, Nerolac
(f)	<u>STEEL (TMT BAR)</u>	Sail, Tata (Tisco) SRMB, Jindal and Panther

Note:-

1. The make have been given trade wise only for the purpose of easily locating the items and otherwise makes given are applicable to the entire contract.
2. Wherever word "equivalent make" has been specified the option of equivalent make will only be considered after approval from the Accepting Officer and only where products of brand/ manufacturer specified are not available in market.
3. Makes specified in Sch 'A' shall only be provided when makes are mentioned in Sch 'A'.
4. Makes specified in Particulars Specifications shall be provided only when no makes are specified in Sch 'A'.
5. Makes specified in this Appendix shall be provided only when no makes are mentioned in Sch 'A' and Particulars Specifications.
6. Contractor will supply the material only after obtaining the written approval from AGE (I) regarding use of specific make of items and will supply the material at appropriate time as and when required by the AGE (I).
7. To ensure genuineness of material the contractor will order only on manufacture or authorized dealer and the Engineer-in-Charge will receive material after verifying the delivery challan of the supplier and after satisfying the genuineness of material.

SIGNATURE OF CONTRACTOR**ACWE (CONTRACTS)**

PARTICULAR SPECIFICATION (Cont....)**Appendix'F'****LIST OF PRODUCTS FOR WHICH SPECIFIC MAKES ARE TO BE INCORPORATED IN WORKS**

<u>LT WIRES & CABLES (PVC INSULATED CABLE UPTO 1100 VOLTS COPPER/ALUMINIUM CONDUCTOR SHEATHED/UNSHEATHED AS PER IS 694:1990</u>		
A) HPL INDIA LTD	B) HAVELLS INDIA LTD	C) RRKABEL LTD
D) FINOLEX	E) NICCO	F) KEI
G) INDO AMERICAN ELECTRICALS LTD	H) PLAZA	J) MES CAB
K) POLY CAB		
<u>PVC/XLPE IN DULATED PVC SHEATHED HEAVY DUTY ARMoured/UNARMoured CABLES UPTO 1100 VOLTS, ALUMINIUM/COPPER CONDUCTORS, SOLID/STRANDED AS PER IS 1554 PT1 : 1998 & IS 7098 PT1:1988</u>		
A) HPL INDIA LTD	B) HAVELLS INDIA LTD	C) GLOSTER CABLES LTD
D) KEI INDUSTRIES LTD	E) GRANDLEY	F) FINOLEX
G) CRYSTAL CABLE INDUSTRIES	H) MES CAB	J) POLY CAB
<u>HT XLPE CABLES</u>		
A) HAVELLS INDIA LTD	B) GLOSTER CABLES LTD	C) KEI INDUSTRIES LTD
D) ASIAN (RPG)	E) CCI	F) CRYSTAL CABLE INDUSTRIES LTD
G) RAVIN CABLES LTD	H) POLY CAB	
<u>OTHER CAT OF CABLES/ABC CABLE</u>		
A) RAVIN CABLES LTD	B) CRYSTAL CABLE INDUSTRIES LTD	
<u>PIPES CI & DI PIPE FITTINGS</u>		
A) ELECTRO STEEL	B) KESORAM	C) TATA METALIKS
D) LANCO	E) KEJRIWAL	
<u>DI PIPES WITH ISI MARKS IN RANG OF 80MM TO 1000MM</u>		
A) RASHMI METALIC LTD	B) JINDAL SAW LTD	C) ELECTRO STEEL CASTING LTD
D) TATA METALIKS	E) LANCO INDUSTRIES LTD	F) ELECTRO THERM
G) NECO		
<u>ERW MS PIPES/GI PIPES/FITTINGS</u>		
A) SURYA ROSHNI LTD	B) TATA	C) JINDAL STEEL
D) PRAKASH	E) ZENITH	F) BANSAL
G) SWASTIK	H) BST	
<u>PVC, UPVC & HDPE PIPES & FITTINGS (PVC PIPES & FITTINGS)</u>		
A) KISAM MOULDINGS LTD	B) ORI-PLAST	C) SUPREME
D) PRINCE	E) FINOLEX	F) JAIN IRRIGATION SYSTEMS LTD
G) TRIPATI	H) DUTRON	
<u>UPVC/CPVC/RWP</u>		
A) ORI-PLAST	B) SUPREME	C) PRINCE
D) FINONOS	E) DINESH IRRIGATION	F) TRIPTI
G) DUTRON		
<u>CONDUIT STEEL ERW</u>		
A) TATA	B) JINDAL	C) KALINGA
D) BEC	E) AKG	F) PRAKASH
G) STEEL KRAFT		
<u>CONDUIT PVC</u>		
A) PRESTOPLAST	B) FINOLEX	C) INDO AMERICAN ELECTRICALS LTD
D) KALINGA GOLD	E) PRINCE	F) PLAXA
G) AKG	H) RICHA CABLES PVT LTD	J)

Contd...

PARTICULAR SPECIFICATION (Cont....)

	PVC CASING CAPING		
	A) PRESTO	B) FINOLEX	C) KALINGA
	D) PRINCE	E) PLAZA	F) AKG
	LIGHT FITTINGS/LAMPS (FLAME PROOF FITTINGS)		
	A) BAJAJ	B) CROMPTON GREAVES	C) SUDHIR
	D) ATLAS	E) BALIGA	F) SHYAM
	FLUORESCENT TUBELIGHT/CFL FITTINGS		
	A) PHILIPS	B) CROMPTON GREAVES	C) HAVELLS
	D) SURYA ROSHN LTD	E) HALONIX	F) BAJAJ
	G) WIPRO	H) HPL INDIA LTD	
	FTL/CFL/PLS /HPSV/HPMV/ METAL HALIDE FITTINGS/LAMPS (OUTDOOR LIGHTING)		
	A) PHILIPS	B) CROMPTON GREAVES	C) HAVELLS
	D) SURYA ROSHN LTD	E) HALONIX	F) BAJAJ
	G) WIPRO	H) HPL INDIA LTD	J)
	LED LIGHT FITTINGS (EXTERNAL/INTERNAL)		
	A) PHILIPS	B) HAVELLS INDIA LTD	C) SURYA ROSHN LTD
	D) INSTA POWER	E) ELECKTRON LIGHTING SYSTEM	F) GOLDWYN
	G) VIN SEMICONDUCTOR SPVT LTD		
	SWITCH FUSE/CHANGE OVER SWITCH		
	A) L&T	B) LEEGRAND	C) ABB
	D) SIEMENS	E) C&S	F) HPL INDIA LTD
	G) GE	H) HAVELLS INDIA LTD	J) NOVATEUR ELEC & DIGITAL SYSPVT LTD
	MCB, RCCB, RCBO & DISTRIBUTION BOARDS FORMCBS		
	A) LEGRAND	B) L&T (HAGER)	C) SIEMENS
	D) ABB	E) SCHNIEDER	F) GE
	G) HPL INDIA LTD	H) HAVELLS INDIA LTD	J) NOVATEUR ELEC & DIGITAL SYS PVT LTD
	<u>MCCB, AIRCB</u>		
	A) LEGRAND	B) L&T	C) SIEMENS
	D) ABB	E) SCHNIEDER	F) GE
	G) HPL INDIA LTD	H) HAVELLS INDIA LTD	J) NOVATEUR ELEC & DIGITAL SYS PVT LTD
	K) C&S ELECTRIC		
	<u>SWITCHES /BUZZER/SOCKET/BELL/ CEILING ROSE/REGULATOR PIANO TYPE</u>		
	A) HAVELLS	B) ANCHOR	C) LEGRAND
	D) CONA	E) PLAZA	F) SSK
	<u>SWITCHES/SOCKETS, REGULATOR MODULAR TYPE</u>		
	A) HAVELLS (CRABTREE)	B) ANCHOR (WOODS)	C) LEGRAND
	D) RRKABLE LTD	E) NOVATEUR ELEC & DIGITAL SYS PVT LTD	F) CONA
	G) PLAZA	H) EON ELECTRIC LTD	
	<u>SUBSTATION/TRANSFORMER (POWER TRANSFORMER 33/11KV)</u>		
	A) CROMPTON GREAVES	B) BHEL	C) ABB
	D) SIEMENS	E) VOLTAMP	F) ANDREW YULE
	G) ELECTRIFIELD COMPANY	H) INDIAN TRANSFORMERS AND ELECTRICALS PVT LTD, GURGAON	

Contd...

PARTICULAR SPECIFICATION (Cont....)

	<u>TRANSFORMERS 11KV, DISTRIBUTION TYPE STEP DOWN/UP <400KVA</u>		
	A) ABB	B) SIEMENS	C) VOLTAMP
	D) CROMPTON GREAVES	E) INDIAN TRANSFORMERS AND ELECTRICALS PVT LTD, GURGAON	F) ELECTRIFIED COMPANY
	G) POWER WARE		
	<u>TRANSFORMER 11KV,DISTRIBUTION TYPE STEP DOWN/UP<400KVA</u>		
	(A) ABB	(B) SIEMENS	(C) VOLTAMP
	(D) CROMPTON GREAVES	(E) INDIAN TRANSFORMERS AND ELECTRICALS PVT LTD, GURGAON	(F)ELECTRIFIED COMPANY (24 APR 2016)
	(G) POWER WARE		
	<u>TRANSFORMER 11KV,DISTRIBUTION TYPE STEP DOWN/UP>400KVA</u>		
	(A) BHEL	(B) ABB	(C) SIEMENS
	(D) SIEMENS	(D) AREVAT&D	(E) CROMPTONGREAVES
	(F) INDIAN TRANSFORMERS AND ELECTRICALS PVT LTD, GURGAON	(G) ELECTRIFIED COMPANY(24APR2016)	
	<u>PACKAGED/UNIFIEDSUB STATION</u>		
	(A) CROMPTON GREAVES	(B) BHEL	(C) ABB
	(D) SIEMENS	(E) VOLTAMP	(F) ANDREW YULE
	(G) MEGA WIN SWITCHGEAR PVT LTD (07 AUG 2016)		
	<u>VACUUMCB AND SF6(11KV&33KV)AND RING MAIN UNITS</u>		
	(A) BHEL	(B) ABB	(C) AREVA T&D
	(D) SIEMENS	(E) ANDREWYULE	(F) CROMPTONGREAVES
	(G) ITE GURGAON	(H) MEGAWIN SWITCHGEARPVTLTD(07 AUG16)	
	<u>CURRENT AND POTENTIAL TRANSFORMERS(LT&HT)</u>		
	(A) AE	(B) ENGLISH ELECTRIC	(C) CROMPTON GREAVES
	(D) AREVA T&D	(E) KAPPA	(F) PARGATI
	(G) C&S ELECTRICAL AND ELECTRONICS PVT LTD(02 MAY 16)		
	<u>ELECTRONICENERGYMETER (TEMPERPROOFWITHOPTICALPORT)</u>		
	(A) SIEMENS	(B) L&T	(C)HAVELLS INDIA LTD (11 SEP 2016)
	(D)HPL INDIA LTD (13 OCT 2017)	(E) BENTEC ELECTRICAL AND ELECTRONICS PVT LTD (02 MAY16)	(F) SECURE METERS
	(G)DELHI CONTROL DEVICES PVT LTD (17 SEP 2015)	(H) INDOASIAN	
	<u>ELECTRICAL INSTRUMENTATION/ MEASURING INSTRUMENTS DIGITAL / ANALOG/ ENERGY METERSVOLTMETER/ AMMETER</u>		
	(A) HAVELLS INDIA LTD (11 SEP2016)	(B) HPL INDIA LTD (13 OCT2017)	(C) L&T
	(D) AE	(E) MECO	(F) SECURE METERS
	<u>CAPACITOR BANK/APFC PANEL</u>		
	(A) ABB	(B) SEIMENS(ESPCO S)	(C) L&T
	(D) BCH	(E)ADHUNIK SWITCH GEARS PVT LTD(22 SEP2017).	(F) UNIVERSAL SWITCH GEAR CONTROL
	(G) RYCOENGINEERING	(H) POWER WARE	(J) ELSSPELSBERG
	<u>THERMO PLASTIC STREET LIGHT JUNCTION BOX/DB</u>		
	(A) HENSEL	(B) SINTEX INDUSTRIES LTD(31MAR2016)	(C) ELSSPELSBERG
	(D) UNIVERSALSWITCHGEAR CONTROL		

PARTICULAR SPECIFICATION (Cont....)**Contd...**

NATURE SWITCH/STREET LIGHT TIMBER			
(A) LEGRAND	(B) L&T	(C) BAJAJ	
(D) HAVELLS	(E) GE	(F) KAKTIYA ENERGY SYSTEM PVT LTD(22 JUN2016)	
LT SWITCH BOARD PANEL(INDOOR WALL MOUNTED PREWIRED)			
(A) SCHNIEDER	(B) L&T	(C) ABB	
(D) HAVELLS	(E) C&S	(F)HPL INDIA LTD(13OCT2017).	
LT SWITCH BOARDPANEL(INDOOR WALLMOUNTEDPREWIRED)			
(A) SCHNIEDER	(B) L&T	(C) ABB	
(D) HAVELLS	(E) E &S	(F) HPLINDIALTD (13OCT17)	
LT CONTROL PANEL/ FEEDER PILLAR BOX			
(A) L&T	(B) MILESTONE	(C) ADVANCE	
(D) UNILEC	(E)ADHUNIK SWITCH GEARS PVT LTD(22 SEP 2017)	(F) UNIVERSAL SWITCH GEARCONTROL	
(G) NEPTUNE	(H) RYCO ENGINEERING		
STEEL TUBULAR POLES			
(A) JINDAL STEEL	(B) NATIONALTUBIN G CO	(C) CALCUTTA POLES AND TUBES	
(D) BANSAL POLES	(E) BOMBAY TUBE &STORE		
CABLE JOINT LT AND HT HOT AND COLD SHRINKABLE			
(A) BIRLA-3M	(B) DENSON	(C) RAYCHEM	
(D) M-SEAL	(E) CAB-SEAL	(F) CAB-SEAL (G) MS-SEAL	
AIR BREAK SWITCHES/HT ISLOATORS/GANG SWITCHES			
(A) PACTIL	(B) BHEL	(C) JAIPURIA BROTHERS	
(D) ELPRO	(E) ATLAS	(F) OBLUM (F) JAYSHREE	
DSC/PIN TYPE PORCELAIN INSULATORS			
(A) BHEL	(B) JAIPURIA BROTHERS	(C) PACTIL	
(D) SOUTHERN INSULATORS	(E) JAYASHREE BORADA	(F) WS INSULATORS	
(G) RASHTRIYA ELECTRICAL			
DIESEL GENERATING SET ENGINES			
(A) KIRLOSKAR GREEN	(B) CUMMINS	(C) ASHOK LEYLAND	
(D) GREAVSCOTTON	(E) MAHINDRA	(F) EICHER	
(G) CATERPILLAR	(H) RUSTON		
ALTERNATORS			
(A) ALSTOM	(B) CROMPTON GREAVES	(C) KIRLOSKAR ELECTRIC	
(D) SIEMENS	(E) BHARAT BIJLEE	(F) STAMFORD	
(G) JOYTI	(H) MAHINDRA		
LIGHTNING ARRESTORS (STATIONCLASS)			
(A) OBLUM	(B) ELPRO	(C) BHEL	
(D) AREVA T&D	(E) JAYPURIA BROTHERS	(F) MADRAS PROCELIN	
(G) MEI			
ACSR CONDUCTOR			
(A) INDIAN ALUMINIUM LTD	(B) ALIND	(C) BHARAT CONDUCTORS	
SINGLE PHASE PREVENTOR/ CONDUCTOR /THERMAL OVERLOAD RELAY			
(A) ABB	(B) BCH	(C) L&T	
(D) SIEMENS	(D) GE	(E) HAVELLS	
(F) C&S	(G)MINILEC		
BATTERY MAINTENANCE FREE			
(A) EXIDE	(B) AMCO		
(D) AMARON			
(G) AMARA RAJA			
BATTERYCHARGERS			
(A) ESCORP	(B) SU-KAM	(C) MICROTEK	
(D) STATCON	(E) AMARA RAJA	(F) MASSTECH	

Contd...

PARTICULAR SPECIFICATION (Cont....)

	INDICATORLAMP/ SELECTORSWITCH		
	(A) L&T	(B) SIEMENS	(C) GE
	(D) RR MICRO	(E) KAYCEE	(F) HAVELLS
	(G) HPL INDIAL TD (13OCT2017)		
	DIESELENGINE		
	(A) KIRLOSKAR GREEN	(B) CUMMINS	(C) ASHOK LEYLAND
	(D) GREAVS COTTON	(E) MAHINDRA	(F) EICHER
	(G) CATERPILLAR	(H) RUSTON	
	FIREHOSEREEL		
	(A) MINIMAX	(B) FIREX	(C) SAFEX
	PRESSURESWITCH		
	(A) SIEMENS	(B) HONEYWELL	(C) DANFOSS
	(D) BARRASOMATIC	(E) RAPIDCONTROL	(F) BELIMO
	SYNTHETICENAMEL/ACRYLICPAINT		
	A) JOTUN INDIA PVT LTD	B)APCOLITE(ASIAN)	C)LUXOL (BERGER)
	D)JENSON & NICHOLSON PAINTS LTD (BOROLAC)	E) GODAVARI PAINTSPVTLTD	F)BUTTER FLY(BERGER)
	G) GOODLASS NEROLAC PAINTS	H) DELUX VELVET TOUCH (ICI)	
	TRANSFORMER OIL		
	(A) Servo	(B) Castro	(C) Shel
	(D) Gulf		

Allother materials :-Make and sample as approved by GE

Notes:	
1.	Makes specified in Schedule 'A' shall only be provided when makes are mentioned in Schedule 'A'.
2.	Makes specified in Particulars Specifications shall be provided only when no makes are specified in Schedule 'A'.
3.	Makes specified in this Appendix shall be provided only when no makes are mentioned in Schedule 'A' and Particular Specifications.
4.	Contractor will supply the material only after obtaining the written approval from GE regarding use of specific make of items and will supply the material at appropriate time as and when required by the GE.
5.	To ensure genuineness of material the contractor will order only on manufacture or authorised dealer and the Engineer-in-Charge will receive material after verifying the delivery challan of the supplier and after satisfying the genuineness of material.
6.	Delete the make whichever is not applicable.

Signature of contractor
Dated:

ACWE (Contracts)
For Accepting Officer