CHAPTER 2
TECHNICAL SPECIFICATION FOR DISTRUBUTION SYSTEM

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GENERAL OPERATING CONDITIONS

1. Ambient temperature	-5^0 C to 55^0 C
2. Altitude	up to 2000 m above MSL
3. Humidity	99% (max.)
4. System voltage	11 kV, 400/230 V
5. System frequency	50 Hz

Note: The variation of frequency and voltage for design and operation is as per actual system operation i.e. ± 5 %.

S.P. 1.0 STEEL TUBULAR POLE

1. **Scope**

1.1 This Specification covers the design, fabrication, testing and supply of tubular steel poles commonly used in overhead electric lines.

2. **General**

The steel pole shall be fabricated in several lengths and strengths as specified in Table 1 contained herein.

2.1 The steel tubular poles must be manufactured by a company approved to quality standard ISO 9001:2000. The ISO 9001 certification number, the name of the authorized approving authority with the contact address and telephone and fax numbers shall also be stated. The Bidder shall enclose a copy of the ISO 9001 certificate with the bid.

3. Description

3.1 The steel poles shall be of swagged design and shall consist of three (3) separate lengths of steel tubing swagged at two joints to fabricate the poles. However, there are some numbers of poles as mentioned in the price and delivery schedule which shall be of folding type. The quantities of such folding poles shall be intimated at the time of contract.

3.2 The steel tubing used in pole fabrication shall be of steel of any approved process possessing a minimum tensile strength of 42 kg/sq. mm and a chemical composition of not more than 0.06% sulphur and not more than 0.06% phosphorous.

3.3 The tubing diameter and tubing wall thickness shown in Table 1 for each length of pole are the minimum size to be used in fabricating each length of pole. It shall be the responsibility of the Bidder to determine the adequacy of the component tubing shown for the load to be sustained. However, in no case the tubing diameter and wall thickness for any component tube be less than the value shown in Table 1.

3.4 Tubular poles shall be made of welded tubes, swagged and joined together. The upper edge of each joint shall be chamfered at an angle of about 45-degree. The steel poles shall be composed of three sections of diminishing diameters and minimum diameter thickness and lengths of pole shall be as shown in Table 1.

3.5 All tubes forming parts of the above supports shall be made from hot insulated seamless or continuously welded steel in accordance with BS 6323 or equivalent applicable Standards.

3.6 The entire section of the poles shall be galvanized with minimum coating of weight not less than 460-gm/-sq. m internally and externally.

3.7 Each pole shall be provided with a steel top plate 3-mm minimum thickness welded to the end of the section. The top plate shall not project beyond the perimeter of the top section. Each pole shall also be provided with a welded base plate welded to the bottom of the pole.

3.8 The pole shall, be drilled in accordance with the drilling patterns as defined in the Figure. All the holes shall be of 18 mm dia. However, the manufacturer must get approval of the drilling pattern before manufacturing the poles. Each pole shall be marked with the appropriate length as shown in Figure.

3.9 The folding type of poles shall be fabricated in such a way that the section pieces can be carried to the site and fitted on the site itself. The pole section on top shall have a flange and the section under it shall overlap to a length of 25 cm as shown in the diagram. The poles shall be drilled in such a way that the section in top could be securely fixed the section under it by two bolts of 5/8" x 7" at 90 degree each other. Two such joints form a complete pole of three sections as shown in Fig 2 and 3.

3.10 The size of the base plate shall be as per governing standard.

4 Tolerance

4.1 The following tolerances shall be maintained:

a) Tolerance of diameter: Not Applicable
b) Tolerance on weight: Not Applicable
c) Tolerance on thickness: Not Applicable
e) Straightness: The finished poles shall not be out of straightness by more than 1/600 of the height.

5. Tests

5.1. The following test (s) shall be performed for the pole furnished. All testing shall be fully documented and certified test reports shall be provided to NEA.

a Tensile test and chemical analysis for sulphur and phosphorous
b. Deflection test
c. Permanent set test
d. Drop test

5.2 Number of poles selected for conducting tensile test and chemical analysis for sulphur and phosphorous shall be as given below:

Lot Size	**No. of poles**
Up to 500	1
501 to 1000	2
1001 to 2000	3
2001 to 3000	4
3001 and above	5

5.3 Number of poles selected or conducting deflection test, permanent set test and drop test shall be as given below:

Lot Size	**No. of poles**
Up to 500	5
501 to 1000	8
1001 to 2000	13
2001 to 3000	18
3001 and above	20

The deflection test, permanent set test and drop test shall be conducted in succession on each of the poles selected.

5.4 **Deflection Test**

Each pole shall be rigidly supported for a distance from the butt end equal to the depth which it is to be planted in the ground. It shall then be loaded as cantilever and the appropriate deflection load of Table applied at right angles of the axis of pole 30 cm from the top of the poles up to 9 m (overall) and 60 cm from the top for poles over 9 m (overall). For convenience in testing, the pole may be fixed horizontally and the load applied vertically. The temporary deflection due to the applied load at the point of application of load shall not exceed 157.5 mm.

5.5 **Permanent Set Test**

This test shall be carried out immediately after the deflection test. After application of proper load specified in Table 1 the permanent set measured from the zero position after the release of the appropriate applied load at the point of application of the load shall not exceed 13 mm.

5.6 **Drop Test**

The test shall be made in the case of swagged poles. The pole shall be dropped vertically with the butt end (bottom end) downwards, three times in succession from a height of 2 m on to a hardwood block 150 mm thick laid on concrete foundation. The pole shall not show any signs of telescoping or loosening of joints.

5.7 Should of any of the poles selected fail to pass any of the tests specified above two further poles shall be selected for testing from the same lot in respect of each failure. Should both these additional poles fail, the test material represented by the test samples shall be deemed as not complying with these specifications.

6.0 Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001:2000;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available with supporting documents;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. **Bid Documentations**

7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for selections of steel tubings, and any standard followed in the fabrication and testing of the poles offered.

7.2 The Bidder shall provide a description and certified dimensional drawings of each type of pole.

7.3 Two (2) clear certified copies of all type tests performed on similar type of poles and similar working loads otherwise the bid offer shall be rejected. The type test must have been carried out in recognized national or international testing laboratory or independent testing laboratory other than manufacturer.

7.4 A clause-by-clause commentary of specification, specifying compliance and deviations, if any.

7.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

Table 1
Poles specifications

IS Designation	**410SP- 52**	**410 SP-43**	**410 SP-31**	**410 SP-13**
Overall Length	11 m	10 m	9 m	8 m
Planting depth. m	1.8	1.8	1.5	1.5
Sections:				
Length, m				
Top (h1)	2.7	2.4	2	1.75
Middle (h2)	2.7	2.4	2	1.75
Bottom (h3)	5.6	5.2	5	4.50
Outside Diameter, mm				
Top (h1)	114.3	114.3	114.3	88.9
Middle (h2)	139.7	139.7	139.7	114.3
Bottom (h3)	165.1	165.1	165.1	139.7
Thickness, mm				
Top (h1)	3.65	3.65	3.65	3.25
Middle (h2)	4.5	4.5	4.5	3.65
Bottom (h3)	4.5	4.5	4.5	4.5
Approximate weight, kg	175	160	147	101
Crippling load, kgf	307	348	367	301
Application of load from top of pole, m	0.6	0.6	0.3	0.3

S.P.2.0 ACSR CONDUCTORS

1.0 Scope

This Specification covers the fabrication and supply of aluminium conductors, steel reinforced (ACSR) commonly used on overhead power line construction.

2. Description

2.1 The manufacturer of the ACSR conductor must have been accredited with ISO 9001:2000 (design included) quality certifications.

2.2 The ACSR conductor shall be a concentrically stranded right-hand lay conductor.

2.3 The ACSR conductor shall be fabricated in accordance with BS: 215 (Part 2) latest revision or any other national or international standards that ensures a substantially equal quality to the standard mentioned above, will also be acceptable.

2.4 The following types of conductors shall be supplied:

Code Name	Nominal Area (Sq. mm)	Stranding (Al/Steel)	Breaking Strength (kN)	Mass (kg/km)	Resistivity at 20°	Diameter	
						Aluminum (mm)	Steel (mm)
Dog	100	6/7	32.7	394	0.273	4.72	1.57
Rabbit	50	6/1	18.35	214	0.540	3.35	3.35

3. Packaging

3.1 All conductors shall be furnished on non-returnable treated seasoned wooden reels. All timber shall be treated to provide protection against rot and insects. Protective external lagging of sufficient thickness shall be provided and fitted closely on the reels. Binder consisting of steel straps shall be provided over the external laggings. The reel shall be new and sufficiently sturdy in construction to withstand ocean shipping, road transport, several loading and unloading, storage in tropics, hauling and field erection of conductor without distortion or disintegration.

3.2 Each reel of the conductors furnished shall contain only one (1) length of conductor.

3.3 All reels shall be legibly marked in paint with the following information:

a) Size of conductor
b) Type of conductor
c) Length in meters
d) Net weight of conductor
e) Direction of rolling

3.4 The standard length of the completed conductor in each reel shall be as per the table below:

Conductor Size (sq. mm):	50	100
Normal Length of the Conductor (m):	3000	1500

4. **Tests**

4.1 The manufactured conductor shall be tested in full compliance with the governing standard including following routine tests:

Aluminum wire

a) Tensile test
b) Wrapping test
c) Resistivity test

Steel wire

a) Determination of stress at 1% elongation
b) Tensile test
c) Torsion test or elongation test as appropriate
d) Wrapping test
e) Galvanization test

5. **Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

6. Bid Documentation

6.1 The Bidder shall provided with the Bid two (2) clear copies of the governing standards for fabrication and testing of the ACSR conductor and two (2) clear copies of all other relevant standards referenced therein.

6.2 The Bidder shall provide certified type test results of all types of ACSR conductor as required by governing standards.

6.3 The Bidder shall also furnish the Certificate of Compliance, as specified in Paragraph 4.4 of BS 215, Part 2:1970, at the time of the shipment of each lot of conductor, or as required by the appropriate section of the equivalent national standard.

6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

6.5.1 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 3.0 AAAC CONDUCTOR

1. **Scope**

This Specification covers the general requirements of design, manufacture and testing of XLPE covered all aluminum alloy conductor for 11kV overhead distribution system.

2. **Description**

2.5 The manufacturer of the covered conductor must have been accredited with ISO 9001 quality certification (*including design in the scope of registration*).

2.6 The conductor shall be of multi-strand round compacted hard drawn aluminum alloy conforming to AS 3675 latest revision thereof or any recognized international standards that ensures at least a substantially equal quality to the standard mentioned above. The Conductor wires shall not have any joints except for those made on the base wire.

2.7 The covering insulating material shall be of track resistant UV stabilized (weather resistant). The average thickness of the covering insulation shall not be less than that stipulated in the Technical Requirements. The hardness of the covering XLPE shall be such that it should not get damaged by the kite string and shall be suitable for fixing insulation piercing Arc Protectors. The covering shall be fully pressure extruded and dry cured so as to provide a uniform thickness throughout the length of the conductor.

2.8 Suitable water blocking material shall be incorporated between the conductor and the covering during the extrusion process to prevent the migration of water along the conductor. The water blocking material shall be of contrasting colour to that of the conductor. The water blocking material shall not affect the inter-strand conduction and also not affect the adhesion between the conductor and the XLPE cover. Water blocking material shall be stable at maximum operating temperature of $80^{o}C$ and full technical particulars with regard to the above shall be furnished with the offer.

2.9 The following types of covered conductors shall be supplied:

(I) A) Nominal conductor area mm^2 - 100

i) Number of strands Nos. - 7
ii) Diameter of the wire mm - 4.26
iii) Nominal conductor diameter mm – 12.78
iv) Max. linear resistance at 20^{0} C Ohms/km - 0.3390

B) Covering Insulation

i) Minimum average thickness of XLPE covering mm - 2.0
ii) Minimum thickness of XLPE covering at any point - 1.7
iii) Maximum thickness of XLPE covering at any point - 2.5

C) Covered Conductor

i) Minimum breaking strength of conductor (KN) – 29.26
ii) Short time current rating/1sec. (kA) – 11.0
iii) Conductor Operating Temperatures (Max.)
1) Continuous operation ^{0}C - 80
2) Emergency operation ^{0}C - 100
3) Short circuit operation (5 sec) ^{0}C - 210

iv) Covered conductor overall diameter range mm - 16.0 to 19.3

(II) A) Nominal conductor area mm^{2} - 55

i) Number of strands Nos. - 7
ii) Diameter of the wire mm – 3.15
iii) Nominal conductor diameter mm – 9.45
iv) Max. linear resistance at 20 ^{0}C Ohms/km - 0.6210

B) Covering Insulation

i) Minimum average thickness of XLPE covering mm - 2.0
ii) Minimum thickness of XLPE covering at any point - 1.7
iii) Maximum thickness of XLPE covering at any point - 2.5

C) Covered Conductor

i) Minimum breaking strength of conductor (KN) – 16.03
ii) Short time current rating/1sec. (kA) – 11.0
iii) Conductor Operating Temperatures (Max.)
1) Continuous operation ^{0}C - 80
2) Emergency operation ^{0}C - 100
3) Short circuit operation (5 sec) ^{0}C - 210

iv) Covered conductor overall diameter range mm – 12.67 to 16.0

3. **Packaging**

3.1 The finished covered conductors shall be delivered in continuous lengths of 500 ± 5 meters and the ends of the covered conductors shall be effectively sealed with heat shrinkable cap to prevent ingress of moisture. The conductor shall be wound to the drum with the lowest number at the inner end of the drum. They shall be supplied in wooden drums made of well-seasoned wood that is treated to prevent deterioration

by termites or fungus attack and suitable for outdoor storage of twelve (12) months or steel drums. The chemical used for treating the wood shall not be harmful to the conductor and the drum shall be lined with an impervious material to prevent direct contact of the covered conductor with the drum.

The external flange diameter shall be such that the distance between the outer edge of the flange and the packed conductor shall not be less than 75mm so that the drum could be rolled on the flanges without causing damage to the conductor. Direction of rolling shall be clearly marked.

The drum shall have spindle hole of adequate diameter and reinforced with steel plates for mounting the drum on horizontal axle for laying out the conductor.

3.2 Each reel of the conductors furnished shall contain only one (1) length of conductor.

3.3 All reels shall be legibly marked in paint with the following information:

f) Size of conductor
g) Type of conductor
h) Length in meters
i) Net weight of conductor
j) Direction of rolling

3.4 The standard length of the completed cover conductor in each reel shall be as per the table below:

Conductor Size (sq. mm):	100	55
Normal Length of the Conductor (m):	500	1000

4. **Tests**

4.1 Routine Tests

The manufactured conductor shall be tested in full compliance with the governing standard including following routine tests:

Test on wire before stranding

i) Wire diameter
ii) Ultimate tensile strength
iii) Wrapping test
iv) Resistivity test

Test on finished covered conductor

i) Inter-strand conductivity test
ii) Thickness of covering
iii) Static water blocking test
iv) Stripping test
v) Spark test

4.2 Type Tests

The Bidder shall submit the type test reports along with the Bid. The Covered Conductors shall be type tested conforming to AS 3675 of 1993, or IEC Standard or the governing standard, and certified copies of the type test certificates shall be furnished with the offer The report shall be issued by a recognized independent testing authority. The employer also reserves the right to have tests carried out at his own cost by and independent agency, whenever there is a dispute regarding the quality of supply. The cable shall be subjected to the following type tests:

a) Tests on wire before stranding
b) Tests on covering material
c) Tests on finished covered conductor

The Type Test Certificates furnished shall be from a recognized independent testing authority acceptable to the purchaser.

5. **Bid Documentation**

5.1 The Bidder shall provided with the Bid two (2) clear copies of the governing standards for fabrication and testing of the covered conductor and two (2) clear copies of all other relevant standards referenced therein.

5.2 The Bidder shall provide certified type test results of all types of covered conductor as required by governing standards.

5.3 The Bidder shall also furnish the Certificate of Compliance at the time of the shipment of each lot of conductor, or as required by the appropriate section of the equivalent international standard.

5.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

5.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 4.0 SELF SUPPORTING LV AERIAL BUNDLED CONDUCTORS (ABC) CABLE

1. SCOPE

This Specification covers the design, manufacture, factory test, supply and delivery of 0.6/1 kV four-core cross-linked polyethylene (XLPE) insulated self supporting aerial bundled conductors (ABC) for use in the construction of 230/400V, 3-phase, 4-wire, unigrounded, distribution network.

2. DESCRIPTION

2.1 The cable shall be suitable for use within Nepal: altitude range 0-2000 meters, typical temperature range -5 deg C to 45 deg. C, relative humidity 80-90%.

2.2 The conductor shall consist of compact round stranded aluminum wires. They shall be of H2 or H4 grade (complying with IEC: 60228) and per the following:

a) Upto and including 50 sq. mm. conductors = H2 grade.
b) All sizes above 50 sq. mm. conductors = H4 grade.

2.3 The conductor shall be insulated by extruded black cross-linked polyethylene (XLPE) material. The cross-linked polyethylene (XLPE) insulating shall be black in colour and to be stabilized against deterioration caused by exposure to direct sunlight and ultraviolet radiation conforming to requirement specified IEC 60502. XLPE insulation shall be pressure extruded. The nominal value of the carbon black content of the sheath (insulation) shall be 2.5 with a tolerance of + 0.5% (Table 20 of IEC : 60502-1, 2004). The XLPE material shall be of Borealis, Austria/ BASF, Germany/Du Pont, USA/Sumito Chemicals, Japan or DOW Chemicals, USA make. In case of other make, the bidder shall submit the certification from Independent Internationally Recognized Agency/ies to substantiate the equivalency to the above referred make. Failure to furnish the equivalency certification will result in the offer being rejected.

2.4 The complete cable shall consist of four equal-size insulated conductors stranded together, and the direction of lay shall be right-hand. The type of construction shall cause the tensile load to be shared equally between four conductors. The core identification and the assembly (laying up) of cores be as per IEC 60502. Ridges shall be provided over phase core and neutral core also.

2.5 The other technical specifications of the ABC are given in Table 1: Technical Data.

3. STANDARDS

3.1 The cable shall comply with the latest revision of UK ESI Standard 43-14:"Aerial Bundled Conductors XLPE Insulated for LV Overhead Distribution", or comparable internationally recognized standards with will result in the cable of equal or better quality.

4. PHASE IDENTIFICATION

4.1 The identification of the conductors shall be provided by means of ribbing on the external surface of the insulation. The neutral conductor shall preferably be marked with a minimum of 12 for 25mm^2, 16 for 50 mm^2 and 20 for 95 mm^2 ribs spaced evenly around the circumference of the core.

5. EMBOSSING ON CORES

5.1 All the cable shall have the following embossing on insulated neutral conductor for identification in interval not more than 2 meters. Font size of letters to be min. 5 mm.

a) Name or trade mark of manufacturer
b) Voltage grade
c) Type of cable, i.e LV ABC
d) LV Aerial Bunch Cable (4C X 25, 4C X 50, 4C X 95 Sq mm)
e) Size of phase conductor, i.e. 4C X 25, 4C X 50, 4C X 95 Sq mm
f) Year and month of manufacturing.
g) Type of insulation, i.e XLPE
h) Name of purchaser
i) Contract Number

6. SIZE AND QUANTITY

6.1 Sizes of cable shall be:

4x95 mm2
4x50 mm2
4x25 mm2

6.2 The required quantity of the ABC of above sizes shall be as shown in the Price Schedule(s).

7 TESTING

7.1 Type Test

All the type tests are detailed below in accordance with referenced ESI, IEC 60502, IEC 60540 or equivalent standards, amended upto date, shall be performed on cable samples drawn by the purchaser:

Construction tests

-Verification of diameters of conductor and insulated conductor, and thickness of insulation, and so on.

Test on XLPE

-Hot set tests
-Tensile strength at break
-Elongation at break
-Shrinkage

Mechanical tests

-Breaking load test
-Bending test

Electrical tests

-High voltage test
-Conductor resistance at 20 deg C.
-Insulation resistance

Type tests are required to be carried out on a sample of any one size of cable manufactured. Sample for the type test will be drawn by the purchaser's representative and the type tests will be witnessed by him. The type tests shall be carried out by the supplier at any of the following independent recognized laboratory at the cost of supplier:

a. ASTA Certification Services (UK) or National Metorological Laboratory in UK, accredited to Western European Legal Metrology Corporation.

b. CESI (Centro Electtrotecnico Sperimentale Italiano S.P.A) or National Metrological Laboratory in Italy, accredited to Western European Legal Metrology Corporation.

c. ESEF (Ensemble Des Stations D' Essais a' Grande Puissance Francaises) or National Metrological Laboratory in France, accredited to Western European Legal Metrology Corporation.

d. B.V. KEMA (KEMA) or National Metrological Laboratory in Netherlands, accredited to Western European Legal Metrology Corporation.

e. National Metrological Laboratory in Japan, accredited to National Laboratory Accreditation System in Japan.

f. National Metrological Laboratory, accredited to American Association for Laboratory Accreditation.

g. The type test from other internationally recognised independent test laboratory, such as PTB, Germany; IHP, Turkey; PTP, Austria; NMI, Holland; Falcon Test Lab, UK, Ofgem (formerly known as 'Offer"), Ireland may also be acceptable.

7.2 Acceptance Test

The following tests shall be made on the completed cable at the manufacturer's plant in accordance with referenced ESI, IEC 60502, IEC 60540 or equivalent standards during pre-dispatch inspection and testing:

Construction tests

-Verification of diameters of conductor and insulated conductor, and thickness of insulation, and so on.

Test on XLPE

-Tensile strength at break
-Elongation at break

Mechanical tests

-Breaking load test
-Bending test

Electrical tests

-High voltage test
-Conductor resistance at 20 deg C.
-Insulation resistance

8.0 QUALITY ASSURANCE

The manufacture shall posses ISO 9001 Quality Assurance Certification for the manufacture of LV ABC Cable for the plant where the manufacture of LV ABC Cable is done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacture, along with the offer.

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001:2000;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available with supporting documents;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

9. PACKAGING

9.1 The ABC Cable shall be wound on non-returnable wooden drums conforming to IS: 10418 with latest amendments thereof. All timber shall be treated to provide protection against rot and insects; the treatment process not having deleterious effect on the cable. The drums should have supporting plate with bush at central hole. The end of the cable shall be sealed by means of non-hygroscopic sealing material. The drums shall be of such construction as to assure delivery of cable in

the field free from displacement and damage and should be able to withstand all stresses due to handling and the stringing operation so that cable surface is not dented, scratched or damaged in any way during transportation and erection. The cable shall be properly lagged on the drums.

9.2 Each reel of the conductors furnished shall contain only one (1) length of conductor.

9.3 Maximum size and weight of drum (excluding lagging) shall be:

Diameter	1600 mm
Width	1000 mm
Weight	1.5 MT (including cable)

9.4 All reels shall be legibly marked in paint with the following information:

a) Size of conductor
b) Type of conductor
c) Length in meters
d) Net weight of conductor
e) Direction of rolling

10. BID DOCUMENTATION

10.1 The BIDDER shall provide with the Bid two (2) clear copies of the Standard governing fabrication of the conductor and two (2) clear copies of all other specifications referenced therein as relevant to the fabrication and testing LV ABC.

10.2 Drawings: 2 sets showing general construction, size and weight.

10.3 The BIDDER shall provide the name and the address of the manufacturers of the cable being offered and the length of the cable in the manufacturer's standard reels, including net and gross weights.

10.4 Complete type test report for all sizes of ABC Cable.

10.5 All data supplied shall be bound separately from the Bid Document.

TABLE 1

TECHNICAL DATA

SELF SUPPORTING LV ABC

Nominal cross sectional area, mm2	25	50	95
Number of Core	4	4	4
Form of conductor	Stranded compacted circular		
Number of wires in conductor	7	7	19
Min. diameter of conductor, mm	5.8	8.0	11.3
Max. dc resistance of conductor at 20 deg. C, Ohm/km	1.200	0.641	0.320
Min. breaking load of conductor, kN	3.5	7.0	13.3
Min. average thickness of insulation excluding ribs, mm	1.3	1.5	1.7
Min. thickness of insulation at any point, mm	1.07	1.25	1.43
Min. breaking load of cable, kN	14.0	28.0	53.2

SP 4.1 FITTINGS FOR SELF-SUPPORTING LV AERIAL BUNDLED CONDUCTORS (ABC)

1. **Scope**

This Specification covers the fabrication and supply of fittings and associated apparatus for with LV aerial bundled conductors (ABC).

2. **Service Condition:**

Ambient temperature	:	-5° C to 55° C
Altitude	:	up to 2000 m above MSL
Humidity	:	99% (max.)
Mains voltage	:	400/230 V
System frequency	:	50 Hz

3. **Description**

3.1 The fittings, hardware and equipment shall be fabricated in accordance with UK ESI Standard 43-14: "Conductor Fittings and Associated Apparatus for use with LV ABC" latest revision, and all referenced standards therein, or latest revision thereof or any other national or international standards that ensures at least a substantially equal quality to the standard mentioned above, will also be acceptable.

3.2 The ABC Cable hardware manufacturing company must have been accredited with ISO 9001:2000 (*including design in scope of registration*) quality certification.

3.3 The fittings shall be for use in conjunction with 4-core ABC of 95 sq. mm, 50 sq. mm and 25 sqmm nominal cross-sectional areas.

3.4 Contractor shall get approval of all drawings and hardware sample from Purchaser before starting the fabrication of all hardware.

3.5 The fittings and accessories are as follows:

3.5.1 **Anchor clamps:**

The anchor clamps shall be bolted type. The wedge of clamp shall be made of age and weather resistant insulating material with high mechanical strength. The tightening straps shall be made of hot dip galvanized steel. The clamp shall be loaded with the spring. The clamp shall have at least 2 bolts for tightening. The hooking end of the clamp shall be provided with hot dip galvanized nut and bots with safety lock. The Anchor clamps shall be suitable for use in conjunction with the support hooks stated in Sub Clauses 3.5.3.

The clamp shall be suitable for following ABC.

ABC size/type	Min. Breaking load (kN)
95 sq. mm, 4-core ABC	43
50 sq. mm, 4-core ABC	37
25 sq.mm, 4-core ABC	37

3.5.2 **Suspension clamps**

The suspension clamps shall be suitable for the installation and suspension of following ABC cables types and angle of deviations. The clamps shall be suitable for use in conjunction with the support hooks stated in Sub Clauses 3.5.3 below.

Type	ABC size/type	Max. angle of deviations (degree)
Type A1	95 sq. mm, 4-core ABC	30
Type A2	50 sq. mm, 4-core ABC	30
Type A3	25 sq. mm, 4-core ABC	30
Type B1	95 sq. mm, 4-core ABC	60
Type B2	50 sq. mm, 4-core ABC	60
Type B3	25 sq. mm, 4-core ABC	60

The ferrous part of the clamps shall be hot dip galvanized.

3.5.3 **Support hooks (Pig tail type)**

The support hooks shall be made of hot dip galvanized steel of sufficient sizes. The support hook shall be suitable for mounting in steel tubular (ST) poles.

(i) Support hooks suitable for PSC poles: The support hooks shall be bolted type and shall be of sufficient length and have sufficient threading to enable them to be used on following sizes of PSC poles.

a) Type A: Size ranging between 130 mm. to 170 mm.
b) Type B: Size ranging between 190 mm. to 240 mm.

The pig tail end of the hook shall have stopper for maintaining clearance between pole and the suspension clamp. The hook shall be provided with either 2 sets of suitable hexagonal nuts or one set of hexagonal nut and one set of eye nut. The eye of eye nut shall have minimum inner diameter of 30 mm. and shall be suitable for installing in conjunction with anchor clamp stated in clause 3.5.1 above and stay tightener. The support hook shall have diameter not less than 16 mm. and shall have enough mechanical strength to withstand load, which applies during its service period. The support hook and its accessories shall be made of hot dip galvanized steel. The conceptual drawing of support hook is given in CSLV 12.

(ii) Support hooks suitable for Steel Tubular Poles: The support hooks shall be mounted on circular two-way clamp. The hook (pig tail) shall be mounted on one of the ways of the clamp. The conceptual drawing of the hook (pig tail)

is given in CSLV 12. The clamp shall be suitable for following sizes of poles.

a) Type TC6: Two-way clamp suitable for pole diameter ranging between 190 mm. to 230 mm.
b) Type TC8: Two-way clamp suitable for pole diameter ranging between 140 mm. to 180 mm.

The remaining way of clamps shall be suitable for accommodating two numbers of double eye fitting stated in Sub Clause 2.4.5 herein, to be used along with anchor clamps stated in clause 2.4.1 above. The width and thickness of clamp shall be not less than 50 mm. and 6 mm. respectively. Nuts and bolts of the clamp shall have diameter not less than 16 mm. The conceptual drawing of semi circular clamp for Telecopic pole is give in CSLV 10

3.5.4 **Weak links**

The weak link shall be suitable for installation between support hook and the suspension or anchor clamp. The link shall be made of hot dip galvanized steel. Two ends of the link shall be twisted by 90^{o}. The weak link shall be suitable for using in conjunction with following ABC.

(i) 95 sq. mm., 4-core ABC
(ii) 50 sq. mm., 4-core ABC
(iii) 25 sq. mm., 4-core ABC

The weak links designated above shall have release force near to the highest values of maximum working tension of respective ABCs.

3.5.5 **Double-eye fitting**

The double eye fitting shall be made of hot dip galvanized steel. The diameter of the steel and inner diameter of the eye shall be not less than 16 mm. and 30 mm. respectively. The one end of the eye fitting shall be mounted on bolt of clamps stated in sub clause 3.5.3 (ii), stated above and other end shall be used along with anchor clamp, stated in sub clause 3.5.1. The conceptual drawing of the fitting is given in CSLV 11.

3.5.6 **Insulated wall fittings (cleats)**

The insulated wall fittings shall be single hole fixing type. The fixing shall be done either by the hammering of nail or by using lag screw into hole on wall. The fitting shall be made of weather, heat and age resistant black polyamide insulating material with sufficient mechanical strength. It shall have capacity to hold different sizes of ABC as stated above and other cables having overall outer diameter from 6 mm. to 50 mm. Preferably, the fitting shall be removable notched strap type. The fitting shall have wet flashover voltage not less than 6 kV.

3.5.7 Insulate removable strap

The insulated removable strap shall be made of weather, heat and age resistant insulating material having wet flashover voltage not less than 6 kV. It shall be suitable to hold ABC having overall outer diameter from 20 mm. to 50 mm. Preferabley, the fitting shall be removable notched strap type.

3.5.8 Insulated cable end caps

The insulated cable end caps shall be made of weather and age resistant insulating material and shall have wet flashover voltage not less than 6 kV. The cap shall be heat shrinkable type and shall be coated internally with a suitable sealant. The caps shall be suitable for following sizes of ABC.

(i) 95 sq. mm., 4-core ABC
(ii) 50 sq. mm., 4-core ABC
(iii) 25 sq. mm., 4-core ABC

3.5.9 Insulated insulation piercing connectors

The insulated insulation piercing connectors shall be suitable for using with aluminum ABC and concentric cables. It shall be made of high quality, weather, heat and age resistant insulating material having wet flashover voltage not less than 6 kV. It shall be watertight and suitable for making connections to the live lines. The piercing of main line and the tapping shall be done simultaneously. The design of the connectors shall be such that its removal is possible even after breaking of the shear head. The connector shall be provided with end cap for tapping end. The connector shall be suitable for following cables.

Type	Main	Tapping
Type A	25-95 sq. mm, ABC	25-95 sq. mm, ABC
Type B	25-95 sq. mm, ABC	6-25 sq. mm, Concentric Cable

3.5.10 Pre-insulated junction sleeves for Aerial Bundled Cable (ABC)

Pre-insulated Aluminum junction sleeves shall be used for connecting two separate piece of Aluminum Aerial Bundled Cable (ABC), through joint by crimping with hexagonal compression tool. The pre-insulated aluminum junction sleeves for three phases and neutral shall have grease for contact. The insulation of the sheath of sleeve shall have resistant to compression with water tightness joints and the wet flashover voltage of the insulating material shall not be less than 6 kV. The end of sleeve shall have colored joint to identify the section of the conductor to be used. The following color code shall be used.

ABC Size (mm^2)	**Colour Code**
95 sq. mm	Grey
50 sq. mm	Yellow
25 sq.mm	Blue

The sleeve shall be marked with the following information with an indelible ink:

The length of ABC to be stripped.
Number of compression to be made.
Section of conductor, die to be used.

3.5.11 **Insulated tools for with insulated insulation piercing connectors.**

The tool set shall be fully insulated, made of high quality insulating materials, having wet flashover voltage not less than 6 kV. The design of the tool set shall be suitable for use with connectors described in sub clause 3.5.10 above and shall allow the safe installation to live line.

3.5.12 **Core separators (pairs)**

The core separators shall essentially comprise two wedges to facilitate the installation of connectors on tensioned ABC cable. The two separators shall be joined together with a nylon cord. The two separators, which shall be made from wither hardwood or rigid plastic, shall be so shaped as to be capable of being positively locked in position.

3.5.13 **Anchor clamp for concentric type service drop cable**

The anchor clamp for concentric type service cable shall be of wedge type. The wedge of clamp shall be made of age and weather resistant insulating material with high mechanical strength. The tightening strap shall be made of hot dip galvanized steel. The clamp shall be suitable for the concentric cable of 6 sq. mm. The clamp shall be suitable for use in conjunction with support hooks and wall brackets for service connection stated in sub clauses 3.5.3 and 3.5.14 respectively.

3.5.14 **Wall bracket for Service connection**

The wall bracket for service connection shall be suitable for use in conjunction with anchor clamp for concentric type service drop cable stated in sub clause 3.5.13. It shall be made of hot dip galvanized steel. The fixing shall be done either by the hammering of nail or by using screw into hole on wall. Suitable number of fixing nail or the screw as appropriate shall be the part of wall bracket for service connection.

4. **Tests**

4.1 In respect of the following fittings the tests shall include, but not limited to the following:

Anchor clamps:
Static test
Dynamic test
High temperature test (thermal)
Low temperature test
Tensile (high tension) test
Voltage test (on ABC) following dynamic, high and low temperature and high

tension tests.
Suspension clamps:
Slip test
Voltage test (on cable)
Thermal test
Insulation piercing connectors:
Electrical heat cycle test

Tests for other fittings and hardware shall be conducted in accordance with the relevant national or international standards.

5. Bid Documentation

5.1 The Bidder shall furnish with the Bid two (2) clear copies of the Standard governing fabrication and testing of the fittings and accessories for LV ABC and two (2) clear copies of all other relevant standards referenced therein.

5.2 The Bidder shall furnish two (2) sets of complete description, catalogue, dimensional drawings showing general construction and size of all fittings and accessories.

5.3 The Bidder shall furnish two (2) clear certified copies of all type tests performed on all fittings and accessories offered.

5.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

5.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

SP 5.0 SILICON STEEL CORE TYPE DISTRIBUTION TRANSFORMER

1. Scope

These specifications cover the requirements of oil-immersed, naturally cooled single and three-phase distribution transformers suitable for outdoors installation on 11kV and 33 kV, 50 Hz distribution systems.

2. Service Condition

The transformers shall be designed and constructed for outdoor installation and operation under the following conditions:

Ambient temperature:	-5°C to 45°C
Relative humidity:	up to 95%
Altitude:	up to 2000 m above the mean sea level

3. Standards and Quality Certification

3.1 The equipment specified in this Section of the Contract shall conform to the latest edition of the appropriate IEC specifications and/or other recognised international standards *equivalent to IEC Standards*. In particular:

IEC 60076	Power transformers
IEC 60137	Insulating Bushings for alternating voltages above 1 kV
IEC 60156	Insulating liquids-Determination of the breakdown voltage at power frequency-test method
IEC 60296	Specification for uninhibited mineral insulating oils for transformers and switchgear
IEC 60551	Determination of transformer and reactor sound levels
IEC 60616	Terminal and tapping materials for power transformer
IEC 60722	Guide to lightning and switching impulse testing of power transformers and reactors
IEC 60733	Determination of water in insulating oils.
IEC 5493	Protective coating of iron and steel structures against corrosion.

3.2 The manufacturer of the offered transformers must have been accredited with valid ISO 9000 quality certification with design in its scope of registration.

4. Description

4.1 Technical details are given in Table 1 to Table 3. The quantity of the transformers to be supplied shall be as given in the Schedules of Rates and Prices.

4.2 *Tank*

The tank shall be of welded construction and fabricated from mild steel of adequate thickness. All seams shall be properly welded to withstand requisite impact during short circuit without distortion. All welding shall be stress relieved. The tank cover

shall be bolted on to the tank with weatherproof, hot-oil resistant, resilient gasket in between for complete oil tightness. Pressed-steel radiators shall be mounted on transformer-tanks of 100 kVA and higher rating transformers. The radiator shall be of pressed-steel of corrugated type design. Heat dissipation calculation in respect of the number, size and length of the radiators are to be satisfied by design calculation.

Each transformer shall be provided with a case of rigid construction, which shall be oil-tight and gas-tight. The thickness of all tank sides except the tank-bottom and cover shall not be less than 3.2 mm. The thickness of tank-bottom and cover shall not be less than 4.0 mm. The tank shall be capable of withstanding, without leakage or permanent deformation, a pressure 25% greater than the maximum operating pressure. The tank cover shall be bolted on to the main-tank. Each transformer shall be provided with earthing terminal with clamp type connector.

4.3 **Painting**

All sheet steel works shall be phosphated in accordance with the following procedure and in accordance with BS 2569 and BS 5493.

The tank body shall be sand/shot blasted to remove the welding scales. Oil, grease, dirt shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying. After phosphating, thorough rinsing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and even drying. The phosphate coating shall be sealed by the application of two coats of stoving type zinc chromate primer. The first coat may be "flash dried" while the second coat shall be stoved. After application of the primer, two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. Touch up shall be applied after completion of tests. The color for the finishing paint shall be light gray or as approved by Employer. The final finished thickness of paint film on steel shall not be less than *60* microns. Finished painted surface shall present aesthetically pleasing appearance free from runs and drips. A small quantity of finishing paint shall be supplied for minor touching up required at site.

4.4 **Core**

The transformer shall be of core type. The cores shall be constructed with prime core-material of interleaved grade non-aging, low loss, high permeability, grain oriented and cold rolled silicon steel laminations, properly treated after being sheared to remove any burrs and shall be re-annealed to remove any residual stresses. The steel shall be thin in lamination.

The yoke laminations shall be in single piece instead of pieces to reduce chances of introducing more air gaps in the core construction.

All steel sections used for the support of the core shall be thoroughly sand blasted after cutting, drilling and welding.

All laminations shall be properly insulated with the materials that will not deteriorate due to pressure and hot oil.

The core shall be rigidly clamped with positive locking device to ensure adequate mechanical strength. Core and coil assembly shall be capable of withstanding the vibrations and shock during transportation, installation, service and adequate provision shall be made to prevent movement of core and coil assembly relative to the tank during these conditions.

The core shall be provided with lifting lugs suitable for lifting complete core and coil assembly of transformer.

Permissible Flux Density and Over Fluxing

Flux density at rated voltage and frequency shall not exceed 1.6 T. The no-load current at rated voltage and at 112.5% voltage shall not exceed the values given below with tolerance as indicated.

At 100% rated voltage	2% of rated full load current + 30% as tolerance.
At 112.5% rated voltage	max 4% of rated full load current

The bidder shall submit the design calculation in support of flux density and no-load current at 100% and 112.5% voltage along with drawings of core-steps, limb-diameter, window-height, limb-center, etc.

4.5 **Winding**

The design, construction and treatment of winding shall give proper consideration to all service factors. The winding shall be so designed that all coil assemblies are of identical voltage ratio and shall be interchangeable. All delta leads should be clamped tightly on to the special frame/bracket making pie (π) frame. The leads leading to the bushing terminals should be clamped to the horizontal support base of the pie frame so that vibration during short circuit is not passed on to the windings. The completed assembly of core and coils shall be dried in a vacuum sufficient to ensure elimination of air and moisture within the insulating structure. After the drying process, the assembly shall be immediately impregnated with dry oil to develop full electrical strength in the windings. The windings of the transformer shall be fabricated from copper materials for 50 KVA and higher rating transformer, whereas it may be of copper or aluminum for lower rating transformers.

Current Density

Current density for any part of the winding shall not exceed the following values:

Copper winding transformers	$\leq$ 2.8 amp/mm^2
Aluminum winding transformers	$\leq$ 1.5 amp/mm^2

4.6 **Oil Preservation System**

The transformers up to 25 kVA of voltage rating 11/0.4 kV and 11/0.23 kV shall be completely oil filled type. The transformers of higher ratings shall be provided with

conservator. The conservator vessel shall have a capacity between highest and the lowest levels of not less than 7.5% of the total cold oil volume of the transformer.
Each conservator vessel shall be fitted with a sufficient-size breather in which silica-gel shall be used as the drying agent. Windows in the silica-gel breathers shall be sufficiently large enough to allow crystal color change to be easily observed from a distance of 6 m. The position of the silica gel breather shall be such that maintenance can be carried out without the need to de-energize the transformer.

4.7 **Tap Changer**

An externally - operated tap changer for transformers rated 100 kVA and above shall be furnished with each transformer, to be operated only when the transformer is de-energized. The tap changer shall include an operating handle, visible indication of tap position and means for locking the tap changer in any desired position. The locking device shall be arranged to prevent locking the tap changer in an off position. Mechanical means shall be provided for limiting the maximum and minimum travelling of the extreme tap positions to be at the maximum and minimum position of the tap changer.

4.8 **Insulating Oil**

The insulating oil shall be refined mineral oil. Necessary quantity of oil for the transformer shall be furnished by the contractor.

4.9 **Bushings**

The bushings shall be made of homogeneous and well vitrified porcelain. The color of the insulator shall be brown and the surface shall have polished glaze.

The high voltage bushings shall have clamp-type terminal lugs suitable for terminating 30-120 mm^2 stranded conductor.

The low voltage bushings shall have clamp-type terminal lugs suitable for terminating aluminum conductor compatible to the kVA rating (with 100% factor of safety) of the transformer.

The low voltage neutral bushings shall include a clamp-type terminal lug for terminating together an earth-wire and an aluminium conductor of neutral circuit of the LV system.

4.10 **Temperature rise**

Maximum oil-temperature rise and maximum winding-temperature rise above ambient-temperature of 45^oC when carrying maximum continuous rated current shall not exceed the following;

a. In oil by thermometer 50^oC

b. In winding by resistance 55°C

The temperature rise of the insulating oil shall be measured near the top of the main tank.

4.11 **Gaskets**

All sealing washers / Gaskets shall be made of oil and heat resistance nitrile / neoprene/ synthetic rubber bonded with cork gasket. Gasket made with natural rubber and cork shall not be acceptable. The thickness of the tank cover gasket shall not be less than 6 mm before compression.

4.12 **Clearances**

Minimum electrical clearances between the phases and phase to earth shall not be less than the values given below:

Voltage	Medium	Phase to phase, mm	Phase to earth, mm
33 kV	Air	330	320
11 kV	Air	255	205
400 V	Air	75	55

The clearances shall be maintained by fixing the bimetallic connectors in position.

4.13 **Accessories**

The following accessories shall be provided with each transformer.

- Lower oil filter and drain valve
- Liquid level gauge
- Lifting Lug
- Name plate
- Tank grounding terminal connector suitable for grounding cable
- Pressure relief device of explosion-vent type for 25 kVA and higher ratings

4.14 Rating and Terminal Marking Plate

Each transformer shall be provided with a non detachable rating and terminal marking plate of weather proof material, preferably of brass fitted in a visible position mentioning the following information:

- Guaranteed No Load Loss and Load loss
- Details of rating (rated output, voltage, phases, frequency etc.)
- Cooling
- Connection and vector diagram
- Weights (Total, weight of core, weight of winding and weight of oil)
- Name of manufacturer and year of manufacture
- Standards of manufacture
- Physical dimension of the transformer
- Any other relevant information

The face of the transformer body shall display the words “Property of Nepal Electricity Authority" on two sides written in indelible paint.

5. **Tests**

Tests shall be performed in accordance with these specifications in line with relevant IEC standards.

5.1 **Type Tests**

The Bidder shall submit, along with the Bid, type test reports (detail) on the following tests performed on identical units.

- Temperature rise tests
- Dielectric Type test
  - i) Impulse voltage tests
  - ii) Separate source AC withstand voltage test

If the type test report for identical unit of transformer is not available from the testing laboratory/ies below, the type test report of similar type transformer may be considered acceptable during bid evaluation, provided, the bidder shall upon award of the Contract and prior to mass production of transformer, undertake to carry out type test on identical unit of each capacity of transformer in one of the following testing laboratories in the presence of representative appointed by Nepal Electricity Authority at no extra cost to the Client/Employer: a. ASTA Certification Services (UK) or National Metorological Laboratory in UK, accredited to Western European Legal Metrology Corporation b. CESI (Centro Electtrotecnico Sperimentale Italiano S.P.A) or National Metrological Laboratory in Italy, accredited to Western European Legal Metrology Corporation, c. ESEF (Ensemble Des Stations D' Essais a' Grande Puissance Francaises) or National Metrological Laboratory in France, accredited to Western European Legal Metrology Corporation,d. B.V. KEMA (KEMA) or National Metrological Laboratory in Netherlands, accredited to Western European Legal Metrology Corporation,e. National Metrological Laboratory in Japan, accredited to National Laboratory Accreditation System in Japan, f. National Metrological Laboratory, accredited to American Association for Laboratory Accreditation, g. The type test from other internationally recognised independent meter test laboratory, such as PTB, Germany; PTP, Austria; NMI, Holland; Falcon Test Lab, UK and Ofgem (formerly known as 'Offer"), Ireland may also be acceptable. In this case, for purpose of evaluation, the values of no-load and load losses shall be considered from the values guaranteed by the bidder.

5.2 **Routine Tests**

The following tests shall be performed on each unit of transformer by the manufacturer before dispatch and submit the test-reports to the Employer.

- Applied voltage test
- Induced voltage test
- No load loss and excitation current test

- Impedance voltage and load loss tests
- Winding resistance measurement
- Ratio tests
- Polarity and phase relation tests
- Tank leakage tests
- Insulation resistance tests
- Separate source power frequency voltage withstand test
- Dielectric breakdown strength of oil

The bidders are required to furnish the details of testing facilities available at the manufacturer's premises for conducting the tests listed above in 5.2

5.3 **Tests to be witnessed by the Employer**

To ensure about the quality of transformers, the inspection shall be carried out in following three stages:

(i) In the first stage, after award of the contract and prior to mass production, the manufacturer shall design & manufacture the prototype of Distribution Transformers and carry out type test on identical unit of each capacity of transformer in one of the following testing laboratories in the presence of representative appointed by Nepal Electricity Authority at no extra cost to the Client/Employer: a. ASTA Certification Services (UK) or National Metorological Laboratory in UK, accredited to Western European Legal Metrology Corporation b. CESI (Centro Electtrotecnico Sperimentale Italiano S.P.A) or National Metrological Laboratory in Italy, accredited to Western European Legal Metrology Corporation, c. ESEF (Ensemble Des Stations D' Essais a' Grande Puissance Francaises) or National Metrological Laboratory in France, accredited to Western European Legal Metrology Corporation,d. B.V. KEMA (KEMA) or National Metrological Laboratory in Netherlands, accredited to Western European Legal Metrology Corporation,e. National Metrological Laboratory in Japan, accredited to National Laboratory Accreditation System in Japan, f. National Metrological Laboratory, accredited to American Association for Laboratory Accreditation, g. The type test from other internationally recognised independent meter test laboratory, such as PTB, Germany; PTP, Austria; NMI, Holland; Falcon Test Lab and UK, Ofgem (formerly known as 'Offer"), Ireland. All the type tests shall be concluded within 120 days after the award of Contract. The suppliers shall be allowed to mass production only after satisfactory result of Type Test.

(ii) Second stage Inspection will be done when the raw material is received, and the assembly is in progress in the shop floor. After the main raw-materials i.e. core and winding materials and tanks are arranged and transformers are taken for production on shop floor and 20-25% under each lot of assembly has been completed. The supplier shall intimate the NEA, in this regard, so that an inspecting officer for carrying out such inspection could be deputed, as far as

possible within fifteen days from the date of intimation. During the first stage inspection, a few assembled cores shall be dismantled to ensure that the CRGO laminations of M4 or Superior Grade used are of good quality. During this stage of inspection the Manufacturer shall provide the inspectors documentary evidence such as purchase order, bill of lading, delivery receipt, factory test certificate and type test report (from the independent laboratory accredited by International Accreditation Corporation (ILAC) or International Accreditation Forum (IAF) or other reputed Accreditation Agencies) of the core and winding materials to be used specifically for the manufacturing of Transformers under the subjected contract.

(iii) Pre dispatch inspection will be carried out at finished stage i.e. transformers are fully assembled and are ready for dispatch. As and when the transformers are ready for dispatch, an offer intimating about the readiness of transformers, for pre dispatch inspection for carrying out routine tests (specified in Clause 5.2) on minimum 2% quantity of offered lot shall be sent by the supplier along with Routine Test Certificates as specified in Clause 5.2. In addition to above the Purchaser's representative(s) shall also witness the (a) temperature-rise test, (b) dielectric type-test for each type (and rating) of transformer on at least 2 (two) % of each type (and rating) of transformer to be procured. The sample shall be selected by the Employer's representative(s) from the complete-lot ready for dispatch. The above mentioned tests shall be carried out in the premises of the Manufacturer.

The Contractor shall carry-out [which the Purchaser's representative(s) shall witness] the following tests in a laboratory owned or nominated by the Employer after delivery in Nepal.

a) Temperature rise test on at least one transformer of each rating.
b) No Load Loss and Load Loss test on 100 (hundred) % of transformer

The sample shall be selected by the Employer's representative(s) from the complete-lot of delivered transformers. **Cost for such tests shall be quoted in the Price Schedule and shall be paid by the Supplier.**

6. Evaluation

6.1 The transformer no-load and load losses shall not exceed the following prescribed values. If the guaranteed no load and load losses exceed the prescribed values below, the offer shall be rejected.

For 11/0.4 /0.23 kV

S.N.	*Rating*	*No Load Loss (Watts)*	*Load Loss (Watts)*
1.	25 kVA, 3-ph	75	460
2.	50 kVA, 3-ph	120	750
3	100 kVA, 3-ph	220	1210
4	200 kVA, 3-ph	365	2100

6.2 Transformers shall be evaluated for the loss values (no-load losses and load losses) during bid evaluation based on the following loss capitalization formula:

$P_E = P_b + K_L L_L + K_{NL} L_{NL}$

Where,

P_E = Evaluated Price

P_b = Bid Price

K_L = Value of Load Loss

L_L = Guaranteed load losses at rated current

K_{NL} = Value of no load Loss

L_{NL} = Guaranteed no load losses

The transformer losses shall be capitalized as follows for evaluation purpose:

K_{NL} =Value of no-load loss= USD 4,684/ kW

K_L = Value of load loss= USD 618/ kW

6.3 Penalty for Excessive losses: During testing, if it is found that the actual measured losses are more than the values guaranteed by the bidder (provided that they are within the limit specified in Clause 6.1 above), a penalty shall be recovered from the bidder at double the loss capitalization rates arrived at clause 6.2 above. For fraction of a kW, proportionate penalty will be recovered.

6.4 For the purpose of this Specification type tests are defined as tests performed on similar transformers of the same general arrangements, same ratings and same mechanical and electrical characteristics.

6.5 If at any stage it is established that the type test report submitted by the bidder is not satisfactory, discrepant or ambiguous, then NEA reserves the right to ask the bidder/supplier to conduct the type test on the rating/s of transformers chosen by the NEA in the presence of their representative at reputed national/international testing laboratory prior to its mass production *and/or* dispatch. The costs involved in organizing and conducting such tests shall be borne by the bidder/supplier.

7. Bid Documentation

7.1 The Bidder shall furnish with the Bid, the following documentation:

a) One (1) clear copy of the IEC standards governing fabrication and testing of the transformers.

b) Two (2) clear certified copies of type tests carried out for each rating as required by the governing IEC standard and the specifications.

c) Two (2) copies of certified outline drawings for each kVA rating showing dimensions, arrangements, and locations of all parts.

d) A clause-by-clause commentary on the specification, specifying compliance or deviations, if any.

S.P.5.1 RATINGS AND FEATURE FOR DISTRIBUTION TRANSFORMER TABLE 1

Type		Three-phase, 11/0.4 kV
Rated power		As specified in the Schedules of Rates and Prices
Rated voltage	- Primary	11kV
	- Secondary	400/230V
Max system voltage	- Primary	12kV
	- Secondary	440V
Rated Frequency		50Hz
Connection	- Primary	Delta
	- Secondary	Grd. Wye
Cooling System		ONAN
Vector group		Dyn 11
Rated impedance voltage		3.5 - 4.5%
BIL for windings and bushings for primary side		75kV
Withstand voltage, 50 Hz, 60 Sec.		
- Primary	28kV	
- Secondary	3kV	
No load tap changer (for 100 kVA and above)		+/- 2.5%, +/- 5% on HV side
Mounting		Platform
Insulation levels (IEC) 76		LI 75 AC 28/AC 3
Insulation temperature class (IEC 76)		A
Maximum allowable noise level at 3 metre hemispherical radius		<44 dB
Applicable standard		These Specifications and IEC

S.P. 6.0 SURGE ARRESTER AND DISTRIBUTION CUTOUT

S.P.6.1 SURGE ARRESTERS

1. Scope

This specification covers the general requirements of the design, manufacture, testing, supply and delivery of Surge Arresters of Gapless Metal-Oxide type for 11kV and 33kV Distribution System of the NEA.

2. System Parameters

(a)	Nominal voltage	11 kV	33 kV
(b)	System highest voltage	12 kV	36 kV
(c)	System frequency	50 Hz	50 Hz
(d)	No. of phases	3	3
(e)	Neutral earthing	Effective	Non effective
(f)	System fault current	20kA	

3. Service Condition

(a)	Annual average ambient temperature	30^0C
(b)	Maximum ambient temperature	47^0C
(c)	Solar radiation	1.6 kW/m^2
(d)	Maximum relative humidity	99%
(e)	Environmental condition	Humid tropical climate
(f)	Operational altitude	Up to 3000 meters above MSL
(g)	Isokeraunic (Thunder day) level	90 ays

4. Applicable Standards

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof and the NEA Specifications specified hereafter.

(a) IEC 60099-4 (1999) Part 4	Surge Arresters - Metal-oxide surge arresters without gaps for a.c. systems
(b) IEC 60099-5 (2000) Part 5	Surge Arresters - Selection and application recommendations
(c) IEC 61109 (1992)	Composite insulator for a.c. over headlines with a nominal voltage greater than 1000V - Definitions, test methods and acceptance criteria.
(d) IEC 60507 (1991)	Artificial pollution tests on high voltage insulators to be used on a.c. Systems.

5. Technical Parameters

(a) MINIMUM TECHNICAL REQUIREMENTS

			Nominal Voltage 11kV	**Nominal Voltage 33kV**
i)	Rated voltage	kV	12	>36
ii)	Continuous Operating Voltage	kV	10	30
iii)	Standard nominal discharge current (8/20 ⌊js)	kA	10	10
iv)	Line discharge Class		1	1
v)	High current impulse (4/10js) - Peak	kA	100	100
vi)	Steep current (1/20js) maximum	kV	40	1 20
	impulse residual voltage - peak			
vii)	Maximum residual voltage at 10kA for (8/20js)	kV	35	110
viii)	Switching impulse (30-100/60-200js) maximum residual voltage - peak	kV	30	100
ix)	One second TOV withstand capability	kV	>1.15x12	>1.15x 36
x)	Type of housing Insulator		Polymeric	Polymeric
	1) Insulation withstand level			
	a) Lighting impulse (1.2/50js) voltage - peak	kV	75	170
	b) Power frequency withstand voltage (wet)	kV	28	70
	2) Total creepage distance	mm	276	828
xi)	Energy absorption Capability (with 4/10 wave	kJ/kV	Not less than 3.2	

(b) Power Frequency Voltage vs Time Characteristics

The manufacturer shall provide the power frequency voltage vs time characteristics, preheated to 60°C with no prior energy and with prior energy (specified by the manufacturer) in order to verify the TOV capability of the Arrester.

If a particular manufacturer is unable to meet the TOV condition of $1.15U_r$ (rated voltage of the Arrester) for 1 sec. duration, has the option of offering of an Arrester of a higher rating.

6.0 BASIC FEATURES

6.1 Design

The Surge Arresters shall be designed for outdoor service conditions stipulated in Clause No. 3 above. They will be connected between phase and earth to protect distribution transformers and switchgear. It shall be complete with the following:-

a) Clamps suitable to receive Copper/Aluminium (Line) Conductors from 4 mm-16mm

b) The mounting clamps suitable for bracket mounting on a structure made out of 100x50x6mm Channel Iron.

6.2 Manufacture

The Surge Arrester shall be of the non-linear metal-oxide resister type without spark gaps and the non-linear metal-oxide resister shall be housed in a hermetically sealed insulator casing to prevent ingress of moisture.

6.3 Insulator Details

The housing insulator of the surge arrester shall be of polymeric type and the insulator sheds shall be designed to minimize trapping of contamination.

The complete arrester shall withstand a 1000h salt fog test at continuous voltage as described in IEC 61109 / IEC 60507. Additional cycle tests as described in IEC 61109 shall also be passed satisfactorily.

6.4 Moisture Sealing

The manufacturing procedure shall include an effective leak test and the manufacturers shall carry out the Special Thermal Stability Test as specified in IEC 60099-4.

6.5 Partial Discharge

Each surge arrester shall be tested to prove absence of partial discharge contact noise as specified in IEC 60099 - 4.

6.6 Arrester Disconnector

The Surge Arrester shall have a device for disconnecting it from the system in the event of arrester failure to prevent a persistent fault in the system and it shall give a visible indication when the arrester has failed. The arrester disconnector shall be tested as per IEC 60099-1.

6.7 Insulating Bracket

A robust insulating bracket together with suitable mounting clamps to mount the Surge Arrester to 100x50x6mm Channel Iron Cross Arms shall be supplied with the Surge Arrester. The power frequency withstand voltage of the insulating bracket shall not be less than 20kV.

7.0 Quality Assurance

1. The manufacture shall posses ISO 9001 Quality Assurance Certification for the manufacture of Surge Arrester for the plant where the manufacture of MCCB is done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacture, along with the offer.
2. Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

   i. The structure of the organization;
   ii. The duties and responsibilities assigned to staff ensuring quality of works;
   iii. The system for purchasing, taking delivery and verification of materials;
   iv. The system for ensuring quality of workmanship;
   v. The quality assurance arrangement shall conform to relevant requirements of ISO9001:2000;
   vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
   vii. List of manufacturing facilities available with supporting documents;
   viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
   ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

8.0 Manufacturing Experience

Manufacturer shall have a minimum of 5 years experience of the manufacture of 12 kV & 36 kV Metal Oxide Gapless Arresters and shall have supplied to few Electricity Utilities internationally during last 5 years. The manufacturer shall submit proof documents such as supply records, the name and particular of the purchasers, quantity sold, and the year of sale.

9.0 ADDITIONAL REQUIREMENTS

9.1 Rating Plate Markings

The following ratings and data of the arresters shall be provided and it shall be weather proof and corrosion proof. The plate shall be positioned at the bottom flange base and visible from the ground level.

(a) Number and year of the standard adopted
(b) Rated voltage / frequency
(c) Continuous operating voltage
(c) Arrester type and discharge class
(d) Nominal discharge current
(e) Manufacturer's identification (name or trade
(f) Year of manufacture
(g) Serial number
(h) Contract No.

9.2 **Packing**

Each set of Surge Arrester shall be packed in a suitable box. Number of these boxes shall be held together in a firm position and measures shall be taken to avoid damage against jerks and collision between adjacent units during transportation.

Each packing shall contain a copy of installation instruction in English Language. The voltage rating, manufacturer's name / identification, Country of Origin, and the quantity shall be clearly marked on each packing.

10.0 **INFORMATION TO BE SUPPLIED WITH THE OFFER**

10.1 The following shall be furnished with the offer.

a) Product Catalogues / Technical literature describing the constructional features, materials used for components, operational feature of the equipment, indicating the model number etc.

b) Energy withstand capability & a description of the test carried out to measure the same.

c) Power frequency withstand voltage versus time characteristic curve covering the time range from 0.1 sec. to 24 minutes.

d) Dimensional drawings of the bracket mounting base, live conductor clamps, earth lead and automatic earth disconnecting device and overall dimensional drawing.

e) Drawing of name plate to scale incorporating the particulars called for.

f)Completed Schedule of Guaranteed Technical Particulars - Annex A

g) A copy of the Manufacturer's ISO 9001 Certificate conforming to Clause 7-Quality Assurance

h) Documents to prove manufacturing experience as per Clause 8.0.

10.2 **Type Test Certificates**

Following Type Test certificates conforming to IEC 60099-4, IEC 60507 and IEC 61109 shall also be submitted with the offer.

a) Insulation withstand test.
b) Residual voltage tests,
c) Long duration current impulse
d) Operation duty test

e) Tests of arrester disconnector,
f) Partial discharge test,
g) Seal leakage test,
h) Tracking & erosion test for polymeric insulation

The Type Test Certificates shall clearly identify the equipment concerned showing the manufacturer's identity. Type Test Report shall include a complete drawings and the model/type of the offered Arrester.

Type Test Report shall be from a recognized accredited independent testing authority acceptable to the purchaser.

11.0 SAMPLE

One complete set of the offered model of the surge arrester shall accompany with the Bid to facilitate analysis and evaluation.

12.0 INSPECTION AND TESTING

12.1 Inspection

The successful Bidder shall make necessary arrangements for pre-shipment inspection and tests by the nominated NEA Inspectors to carry out in his presence the necessary Sample/Acceptance tests as per Clause 12.2, conforming to IEC 60099-4 on equipment and materials offered. Routine test report as per Clause 12.2 shall be furnished for the observation of the Inspector.

12.2 Acceptance/ Sample Test

The following acceptance test for Class 1 surge arrester, as per IEC 60099-4 shall be witnessed by the NEA Inspector.

a) Power frequency reference voltage test
b) Partial discharge test.
c) Lightning Impulse Residual voltage test.
d) Thermal Stability test

12.3 Routine Test

The following Routine Tests shall be carried out on all the arresters as per IEC 60099-4 and the test report shall be made available for the observation of the NEA Inspector at the time of inspection.

(a) Power frequency reference voltage test.
(b) Residual voltage tests.
(c) Partial discharge test.
(d) Leakage test

13.0 **TECHNICAL LITERATURE, DRAWINGS**

Technical Literature in English Language on installation, operation and maintenance shall be supplied with the Surge Arresters, and they shall be descriptive and self explanatory, complete with necessary circuit diagrams and drawings.

S.P.6.2 DISTRIBUTION CUTOUT

1.0 SCOPE

This specification covers the general requirements of the design, manufacture, testing, supply and delivery of 12 kV and 36 kV Dropout Fuse Cutouts) complete with fuse carriers and mounting brackets.

2.0 SYSTEM PARAMETERS

S.No.	Description		
(a)	Nominal Voltage	11kV	33kV
(b)	System highest Voltage	12kV	36kV
(c)	System frequency	50 Hz.	50 Hz
(d)	Number of phases	03	03
(e)	Method of earthing	Effectively earthed	Non effectively earthed
(f)	System faults level	20 kA rms	20 kA rms

3.0 SERVICE CONDITIONS

S.No.	Description	
(a)	Annual average ambient temperature	25 °C
(b)	Maximum ambient temperature	47^0C
(c)	Maximum relative humidity	99%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere.
(e)	Operational altitude	Up to 3000 meters above MSL

4.0 APPLICABLE STANDARDS

The equipment and the components supplied shall be in accordance with the latest editions of the Standards specified below and amendments thereof. However the NEA Specification shall supersede these Standards in the event there is a discrepancy

(a)	IEC 60282-2 (1995)	H.V. Fuses - Expulsion and similar fuses
(b)	IEC 60071-1 (2006)	Insulation co-ordination.- Part I Definitions, principles and rules
(c)	IEC 60071-2 (1996)	Insulation co-ordination - Part 2 - Application guide
(d)	IEC 60273 (1990)	Characteristic of indoor & outdoor post insulators for systems with nominal voltages greater than 1000V.
(e)	IEC 60694 (2002)	Common Specifications for high-voltage switchgear & control gear standards
(e)	IEC 60060-2 (1994)	High-voltage test techniques -Part 2 Measuring systems
(f)	BSEN1461 (1999)	Hot dip galvanized coatings on iron and steel articles.

5.0 MINIMUM TECHNICAL REQUIREMENTS

(a)	Rated Voltage	kV	12	36
(b)	Rated Frequency	Hz	50	50
(c)	Rated continuous current	A	100	100
(d)	Insulation level: Dry Impulse withstand (1.2kV/50^s) voltage (positive & negative polarity) (peak)			
	(i) Across the isolating distance of the fuse base	kV	85	195
	(ii) To earth and between poles	kV	75	170
	Wet 1 min. Power frequency withstand voltage (rms.)			
	i) Across the isolating distance of the fuse base	kV	32	80
	ii) To earth and between poles	kV	28	70
(e)	Total creepage distance(min)	mm	240	720
(f)	Mounting angle (to vertical plane)	deg	15 ~20	15 ~20
(g)	Interrupting rating			
	(i) Symmetrical interrupting rating (minimum) rms.	kA	8.0	6.8
	(ii) Asymmetrical interrupting rating (minimum) rms.	kA	9.6	10.0
	(iii) X/R Ratio		4.0	12.0

NOTE : The minimum values of wet power frequency 50 Hz withstand voltages for 01 minute (one) duration should be as stipulated in Table 4 of IEC 60282-2.

6.0 BASIC FEATURES

6.1. General

The Dropout Fuse Cutouts shall be of Class A as per IEC 60282-2. It shall be suitable for use in outdoor circuits under tropical conditions stipulated in Clause 3.0 above. The Dropout fuse cutout shall be complying with the minimum technical requirements stipulated in Clause 5.0 above.

6.2. Design

i) The Dropout Fuse cutout shall be designed with a solid core, bird proof, one piece Porcelain Insulator and, it should robust enough to withstand shocks due to frequent operations. The fuse carrier shall drop-out immediately following the blowing of the fuse.

ii) Dropout Fuse cutout within the same voltage class shall be so designed that fuse carrier together with mounting assembly shall be dimensionally compatible to facilitate the interchange of fuse carriers of the cutouts of corresponding rating.

iii) The Dropout fuse cutouts shall be able to mount on a single channel iron cross arm (100mm x 50mm x 6mm) at an angle of 15 to 20 degrees to the vertical. The whole unit shall be complete with long mounting bracket, bolts, nuts & washers.

iv) Fuse carrier shall be made of high strength fiberglass filament wound tube or suitable insulating material and it shall be protected from weather and environment by a ultraviolet resistant coating. Inside liner of the fuse tube shall be constructed of a synthetic arc quenching material.

v) Copper Arc Shortening rod shall be attached to the cap of the fuse tube to obtain higher interrupting rating. A removable button head type fuse link having M6x1 thread shall be able to fix to the arc shortening tube.

vi) The installation and removal of the fuse carrier shall be facilitated by inserting the operating rod into a lifting eye at the hinge end (lower) of the fuse carrier when it is in the dropped out position. An operating lever eye shall be provided at the top of the carrier to facilitate a downward pull by the operating rod to release the latch incorporated in the stationary upper contact

vii) All castings such as upper and lower moving and fixed contacts, clamp type terminals, toggle mechanism shall be of phosphor bronze, silicon bronze, aluminum bronze or Silver-plated brass.

6.3. Stationary and Movable Contacts

i) The Stationary and Movable Contact surfaces shall be silver plated to minimize the contact resistance.

ii) The upper stationary contact assembly shall be provided with a safety latch to prevent the fuse carrier from dropping due to vibration and The upper contacts shall be protected from any airborne contaminants

iii) A back up spring made out of stainless steel or phosphor bronze shall be provided to ensure constant pressure between the upper stationary contact and the upper movable contact of the fuse carrier.

iv) The lower stationary contact support and the fuse carrier shall be machined at the swiveling or axle point to enable the fuse carrier with the fuse link to be correctly guided into the latching position by an operating rod. The hinge at the stationary contact shall be so designed to prevent the dropping off of the fuse carrier in the drop-out position, due to shock and vibration.

v) A suitable guiding arrangement shall be provided in the upper contact to ensure easy engagement of the fuse carrier.

vi) The Asymmetrical breaking current ratings shall be permanently marked on the upper metal part.

6.4. Terminals

i) The upper and lower terminals shall be of Bi-metallic type, suitable to accommodate Copper/Aluminum Conductors of Sizes from 5mm to 14mm diameter.

ii) The upper terminal shall be positioned to receive the conductor from either side or upward direction while the lower terminal shall be able to receive the conductor from either side or downward direction.

iii) The maximum temperature rise for contacts (movable and stationary) shall not be more than 40°.C and, for terminals the temperature rise shall not be more than 30° C.

6.5. Galvanizing

All iron and steel parts such as mounting and support brackets, bolts and nuts, washers etc. shall be galvanized after processes such as sawing, shearing, drilling, punching, filling, bending and machining are completed. Galvanizing shall be the hot-dip process to comply with the standard BS EN 1461.

7.0 QUALITY ASSURANCE

1. The manufacture shall posses ISO 9001 Quality Assurance Certification for the manufacture of Dropout Fuse Cutout for the plant where the manufacture of MCCB is done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacture, along with the offer.
2. Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

   i. The structure of the organization;
   ii. The duties and responsibilities assigned to staff ensuring quality of works;
   iii. The system for purchasing, taking delivery and verification of materials;
   iv. The system for ensuring quality of workmanship;
   v. The quality assurance arrangement shall conform to relevant requirements of ISO9001:2000;
   vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
   vii. List of manufacturing facilities available with supporting documents;
   viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
   ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

8.0 ADDITIONAL REQUIREMENTS

8.1. Rating PlateMarkings

The ratings and data of the Dropout Cutout Fuse shall be provided in the rating plate, which shall be weather and corrosion proof.

The main rating plate near the supporting bracket of the insulator base shall carry the following information:

1.0 Number and year of the Standard adopted

1.1 Rated voltage/Rated maximum current
1.2 Class designation/Manufacturer's name or trademark,
1.3 Asymmetrical current rating / Symmetrical current rating / X/R Ratio.
1.4 Year of manufacture
1.5 Contract No.

The following information shall be marked on the fuse carrier.

2.0 Manufacturer's name or trademark
2.1 Rated Voltage / Rated frequency
2.2 Rated maximum current
2.3 Rated breaking capacity (Asymmetrical/Symmetrical current rating & X/R Ratio).

8.2. **Packing**

The pre assembled dropout fuse unit (Dropout Fuse Base, Fuse Carrier and Mounting Bracket) shall be packed in a suitable hardboard box and the rated voltage of the unit shall be clearly marked on the box. Spare fuse carrier shall be supplied in suitable hardboard boxes, the quantity and the voltage rating applicable shall be clearly marked on the boxes.

9.0 **INFORMATION TO BE SUPPLIED WITH THE OFFER**

9.1 **The following information in the English Language shall be furnished with the offer.**

1. Catalogues describing the equipment and indicating the model number.
2. Literature describing the operational and constructional features of the equipment and materials used for components
3. Overall dimensional drawings and separate dimensional drawing of the mounting arrangement, movable and stationary contacts, clamping terminals, toggle/tongue mechanism and insulator support.
4. Drawing of nameplate to scale, incorporating the particulars called for.
5. Completed schedule of guaranteed technical particulars (Annex A).
6. A list of names and addresses of the major purchasers of the Dropout Fuse Cutout during past 5 years of the same Type/Model indicating the quantities supplied, time of delivery.

9.2 **Type Test Certificates**

Thefollowing Certificates of Type Tests carried out in accordance with the IEC 60282-2 and IEC 60060 at areference frequency of 50 Hz where applicable shall be furnished with the offer.

Dielectric tests;
Temperature rise tests;
Artificial pollution tests
Mechanical Tests

Breaking tests;		36 kV	12kV
Symmetrical	current	6.8 kA	8.0 kA
Asymmetrical	current	10 kA	9.6 kA
X/R ratio		12	4.0

The Test Certificate shall indicate the name of the Manufacturer, Type, Model and the Serial Number of the equipment tested. The test certificates referred to,

shall be from an **Accredited Independent Testing Authority acceptable to the Purchaser.**

Offers of Bidders who fail to furnish the particulars requested in Clause 9.1, 9.2 and sample as per Clause 10 shall be rejected.

9.3 **SAMPLE**

One sample of the model offered of the Dropout Fuse Cutout unit complete with fuse carrier and mounting bracket shall accompany the Bid to facilitate analysis and evaluation.

One sample of spare fuse carrier shall also be provided for each voltage rating offered. While analyzing samples, the purchaser reserves the right to check dimensions, inspect workmanship, and perform tests as prescribed in relevant Standards.

10 **INSPECTION AND TESTING**

10.1 **Inspection**

The successful Bidder shall make necessary arrangements for inspection by an Engineer appointed by the Purchaser to carry out in his presence the necessary Sample / Acceptance tests on equipment and materials offered. Routine test reports as per IEC 60282-2 shall also be made available for the observation of the Inspector.

10.2 **Sample / Acceptance Tests**

The following Sample / Acceptance tests as per IEC 60282-2 shall be witnessed by the Representative of the Purchaser.

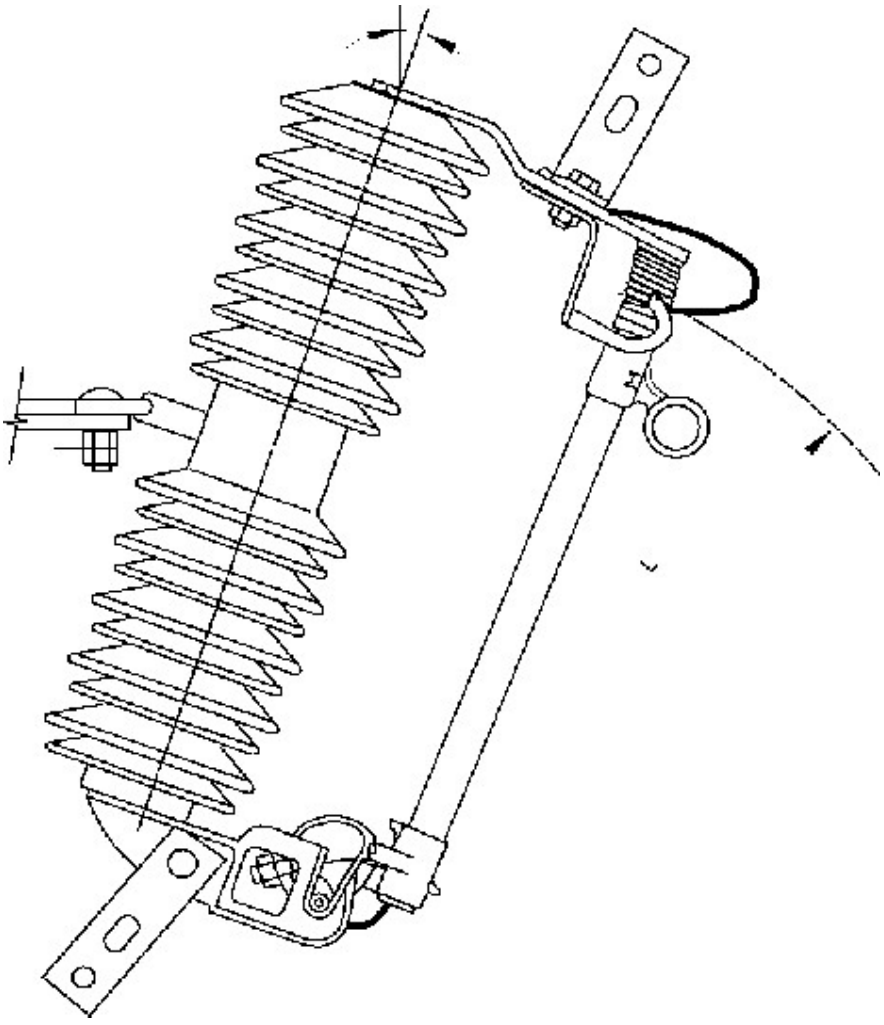
(a) Dimensional Verification
(b) Dielectric tests
(c) Mechanical Tests
(d) Measurement of resistance of fuse-links

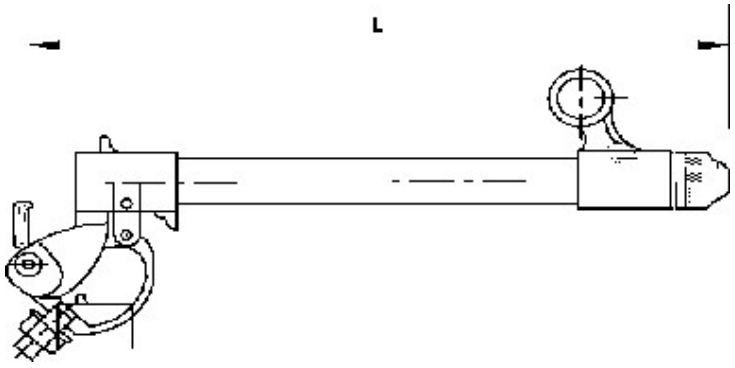
11. **TECHNICAL LITERATURE AND DRAWINGS**

All relevant drawings, technical literature, hand-books etc. required for installation, operation, and maintenance of the equipment, shall be supplied with the equipment. Routine test report shall also be supplied with the equipment.

12. **ANNEX**

Annex A - Expulsion Fuse Cut-out (Drawing: No: 1).





SP 7.0 FUSE LINK

1. Scope

This Specification covers the supply of button head fuse links commonly used in the protection of distribution transformers.

2. Description

2.1 The button-head fuse link shall be fabricated in full compliance with American National Standard specification ANSI C 37.42-1981, or latest revision thereof or other recognized international standards that ensures at least a substantially equal quality to the standard mentioned above, will also be acceptable.

2.2 The fuse link shall have fast characteristics and shall be suitable for protection of distribution transformers.

2.3 The fuse link shall be supplied in accordance with the type and ratings shown in the Bid package.

3. Tests

The distribution cutout and surge arrester shall be tested in accordance with the relevant provisions of the governing standard.

4. Bid Documentation

4.1 The Bidder shall furnish two (2) clear copies of governing standards for fabrication and testing of fuse links.

4.2 The Bidder shall furnish two (2) clear certified copies of catalogue of fuse links.

4.3 The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.

4.4 The Bidder shall also furnish with the Bid two (2) copies of the following data with respect to the fuse links furnished:

a) Time-Current (TC) characteristics curves at 30^{o}C, including minimum melting time and total clearing time.
b) Preloading adjustment factors or curves.
c) Ambient temperature adjustment factors or curves.

4.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 8.0 MOULDED CASE CIRCUIT BREAKERS (MCCB)

1.0 SCOPE

This specification covers the manufacture and testing of Moulded Case Circuit Breakers (MCCB) used in the Low Voltage Overhead Distribution system of the Nepal Electricity Authority (NEA) to provide overload and short circuit protection for Distribution lines up to Customer Distribution Panel.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	400/230 V, 3 ph & Neutral
(b)	System highest voltage	440/250 V, 3ph & Neutral
(c)	System frequency	50 Hz
(d)	Method of earthing	Solidly earthed Neutral at substations
(e)	System fault current	25 kA

3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30^0C
(b)	Maximum ambient temperature	55^0C
(c)	Minimum ambient temperature	$0\ ^0$C
(d)	Maximum relative humidity	99%
(e)	Environmental condition	Humid tropical climate with polluted atmosphere.
(f)	Operational altitude	From M.S.L. to 2500 meters above MSL

4.0 APPLICABLE STANDARD

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof. However the NEA specification shall supersede these standards in the event there is a discrepancy.

a) IEC 60947 - 1 (2004 - 03),Part 1: General rules Low -voltage switchgear and control gear
b) IEC 60947 - 2 (2006 - 05),Part 2: Circuit –Breakers-Low - voltage switchgear and control gear

5.0 TECHNICAL REQUIREMENTS

(a)	No. of Poles	3 unless otherwise specified in the Price Schedule
(b)	Rated insulation voltage	750V
(c)	Rated frequency	50 Hz
(d)	Rated operational voltage	400/230 V
(e)	Rated insulation level :-	
	i) Impulse withstand voltage (1.2/50 us peak)	8 kV
	ii) Power frequency Dielectric Test Voltage (rms)	2500V
(f)	Rated duty	uninterrupted
(g)	Rated current adjustment-I1 A	(0.8-1)In
(h)	Instant opening current adjustment-I2 A	10 x In
(i)	Highest nominal short circuit breaking capacity-Icu (400 V)	25KA
(j)	(kA rms)	75%
(k)	kA peak	52
(l)	Breaking duration (in short circuit) ms	<10
(m)	Mechanical Life Operation	>15000
(n)	Electrical Life Operation	>3000
(o)	Time current characteristics	To co-rdinate with HV fuse.
(p)	The MCCB shall not cause any nuisance tripping due to switching current of motor & capacitor load, and shall have the following Time Current Characteristics:	Multiple of normal current setting Tripping time:
		1.05, More than 2.5Hrs.
		1.1 Less than 2.5 Hrs
		1.15 More than 1Hr.& Less than 2Hrs.
		1.2 More than 0.5Hrs. & Less than 2Hrs.
		1.3 Less than 30 minutes
		1.4 Less than 10 minutes.
		2.5 Less than 1 minute.
		6.0 Less than 5 seconds.
		8.0 Less than 40 milli seconds.
		12.0 Instantaneous (less than 20 milli seconds)
(q)	Creepage distance suitable for	Pollution Degree 3 and suitable for isolation
(r)	Line load reversibility features	Yes
(s)	Interrupting Capability	(IEC category P2)

6.0 BASIC FEATURES

6.1 Design

The circuit breakers shall be of three poles unless otherwise specified in the price schedule, with moulded case design, suitable for operation at a maximum relative humidity of 99% and at maximum ambient temperature of 55 ^{0}C.

The case shall be moulded from insulated material possessing high thermal stability and good mechanical strength, able to withstand robust use without fracture or permanent distortion.

The case should be stamped with the letters “NEA” for the purpose of identification. The Moulded Case Circuit Breaker shall be of surface mounting type and shall be suitable for mounting in an enclosure for outdoor application. It shall be possible to reverse feed the breaker without any reduction in performance.

The maximum permissible temperature- rise of various components of the breaker shall not exceed the values stipulated in IEC 60947 - 1.

6.2 Construction

6.2.1 Operation Mechanism

The circuit breaker shall be provided with trip free features for manual ON-OFF operation.

The operating mechanism shall be quick make and break type, with the speed of operation independent of the operator, and mechanically trip free from the operating handle so as to prevent the contacts from being held closed against short circuit and overload conditions.

The operating mechanism shall be constructed to operate all poles of the breaker simultaneously during, opening, closing and tripping conditions.

The breaker shall be operated by a toggle, which shall clearly indicate the 3 positions ON, OFF and TRIPPED.

The breaker shall have current-limiting function which works according to the opposite magnetic force principle.

6.2.1 Contacts

The MCCB shall be of the uninterrupted duty type and the contacts shall be of Silver alloy or Silver faced Copper having high current carrying capacity with good arc resistance property.

6.2.2 Operation

a) Overload Release

Each pole of the MCCB shall be provided with bimetallic Thermal Element or Hydraulic Magnetic or Solid State (electronic) type of overload protection with the tripping time decreasing with increasing tripping current characteristic (inverse time delay).

b) Short Circuit Release

An electro magnetic element type or solid state (electronic) instantaneous short circuit protection shall be fitted in each pole assembly affecting immediate tripping of the circuit breaker if the current exceeds the breaking ratings given in table in Clause 5.0.

c) Solid state type trip unit

The solid state trip unit shall be suitable for operation in tropical climate stipulated in Clause 3 above.

It shall be a proven design to provide trouble free operation during the life span of the MCCB.

The solid state type trip unit could not be energized by internally mounted current transformers. It shall not require any external power supply to operate the tripping mechanism.

In case any problem may occur on solid state trip unit, the MCCB shall have additionally electro-mechanic protection for the short-circuit.

6.2.3 **Terminals**

The terminals of the breaker shall be suitable for front connection of cables and insulated phase barriers shall be provided for all poles.

(a) Breakers of capacities 160A and below:

Cables are to be fixed to the breaker using palm type lugs with nut and bolt. Allen key head bolts are not acceptable.

Breaker Capacity (A)	**Cable Size (mm^2)**	**No. Of Cables**
upto 30	10	1
Greater than 30 and upto 60	16	1
Greater than 60 and upto100	50	1
Greater than 100 and upto160	70	1

(b) Breakers of capacities 250A and above:

To terminate oversize and multiple cables for circuit breakers of capacities of 250A and above, suitable tinned copper extenders or spreaders and insulated phase barriers shall be provided. The standard sizes of the cables and the number of cables to be used with different capacities of circuit breakers are indicated below.

Breaker Capacity (A)	**Cable Size (mm^2)**	**No. Of Cables**
Greater than 160 and upto 250	95	2
Greater than 250 and upto 400	240	2
Greater than 400 and upto 500	240	2

6.2.4 Mounting Bolts

The circuit breakers shall be suitable for mounting in outdoor distribution panels and each breaker shall be furnished complete with one (1) set of bolt fastenings, complete with nuts and lock washers of the correct diameter for the mounting hole and of a length equal to the depth of the MCCB body plus approximately two (2) centimetres.

7. QUALITY ASSURANCE

3. The manufacture shall posses ISO 9001 Quality Assurance Certification for the manufacture of Moulded Case Circuit Breakers for the plant where the manufacture of MCCB is done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacture, along with the offer.
4. Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

   i. The structure of the organization;
   ii. The duties and responsibilities assigned to staff ensuring quality of works;
   iii. The system for purchasing, taking delivery and verification of materials;
   iv. The system for ensuring quality of workmanship;
   v. The quality assurance arrangement shall conform to relevant requirements of ISO9001:2000;
   vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
   vii. List of manufacturing facilities available with supporting documents;
   viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
   ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

8.0 MANUFACTURING EXPERIENCE

Manufacturer should have a minimum of five years experience for manufacturing of MCCB. The manufacturer should submit proof documents such as supply records, the name of the purchasers, quantity sold, and the year of sale to prove that they have supplied the MCCB to minimum of five customers internationally during last five years.

9.0 ADDITIONAL REQUIREMENT

9.1 Routine Tests

The following routine tests as per IEC 60947 shall be carried out on all the MCCB and routine test report shall be made available for the observation of the inspector at the time of inspection.

a) Mechanical operation tests
b) Dielectric Tests
c) Verification of the calibration of releases
d) Temperature rise test

9.2 Rating Plate Markings

Each Circuit Breaker shall be marked in a durable manner with the following data as stipulated in IEC 60947-2 and shall be visible and legible when the circuit breaker is installed.

a) Rated current
b) Suitability for isolation, with symbol
c) Indication of the open and closed positions

Ultimate breaking capacity (l_{cu}) for various values of the rated operational voltage (U_e) shall be recorded on the device.

The following data should be marked externally on the breaker and they need not visible when the breaker is installed.

a) Manufactures identification (Name or Trade Mark);
b) Type designation or serial number;
c) Number and Year of the standard adopted;
d) Utilisation category
e) Rated operational Voltage and Frequency;
f) Rated service short-circuit breaking capacity
g) Rated ultimate short-circuit breaking capacity
h) Rated short-time withstand current/duration

9.3 Packing

The MCCB shall be suitably packed in biodegradable material (cardboard boxes) to prevent damage during transport, handling and storing.

9.4 Storing

The moulded case circuit breakers of different current ratings shall be stored according to the serial number and rating in batches of 100 separately so as to select breakers for acceptance inspection and testing as per Clause 11 by random sampling method.

10.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be furnished with the offer.

a) Catalogues describing the equipment and indicating the model number and the literature describing the operational features of the equipment.
b) Constructional features, materials used for components and relevant technical literature and complete dimensional drawings.

c) Completed Schedule of Guaranteed Technical Particulars. (Annex-A)
d) Quality Assurance Certificate conforming to ISO 9001 as stipulated in the Clause No. 7.0.
e) A list of names and addresses of ten leading purchasers outside the country of manufacture to whom the manufacturer has supplied the MCCB of similar type and design quoted. Give dates and details of such sales made during the last 05 years.
f) The Characteristics

I) The tripping time-current characteristics curves covering both thermal and magnetic current settings for each type of circuit breaker offered.
II) If over-current and instantaneous releases are of static type, then the manufacture shall furnish evidence that the components used are tropicalised, (suitable for the climatic conditions stipulated in Clause 3.0 above) and the field tests on the equipment have been satisfactory.
III) Discriminating table indicating proper co-ordinating shall be submitted.

g) Type test certificates for each ratings of MCCB for;

I) Verification of constructional requirements
II) Verification of temperature-rise
III) Verification of dielectric-properties
IV) Verification of making and breaking capacities
V) Verification of short-circuit breaking and making capacities
VI) Verification of operating limits
VII) Verification of operational performance
VIII) Verification of degree of protection of enclosed equipment

The Type Test Certificates referred to above shall be issued from following Testing Authority:

h) ASTA Certification Services (UK) or National Metorological Laboratory in UK, accredited to Western European Legal Metrology Corporation.

i) CESI (Centro Electtrotecnico Sperimentale Italiano S.P.A) or National Metrological Laboratory in Italy, accredited to Western European Legal Metrology Corporation.

j) ESEF (Ensemble Des Stations D' Essais a' Grande Puissance Francaises) or National Metrological Laboratory in France, accredited to Western European Legal Metrology Corporation.

k) B.V. KEMA (KEMA) or National Metrological Laboratory in Netherlands, accredited to Western European Legal Metrology Corporation.

l) National Metrological Laboratory in Japan, accredited to National Laboratory Accreditation System in Japan.

m) National Metrological Laboratory, accredited to American Association for Laboratory Accreditation.

n) The type test from other internationally recognised independent meter test laboratory, such as PTB, Germany; IHP, Turkey; PTP, Austria; NMI, Holland; Falcon Test Lab, UK, Ofgem (formerly known as 'Offer"), Ireland, TUV, China, CPRI, India may also be acceptable.

Test Certificates, Performance Curves and Tables etc., of the Type Test performed shall conform to the standard specified, at a reference frequency of 50 Hz where applicable.

The Test Certificates should clearly identify the equipment concerned, showing the manufacturer's identity, Type No. and basic technical parameters.

If the type test report for each ratings of MCCB is not available, the type test report of similar rating of MCCB may be considered acceptable during bid evaluation, provided, the bidder shall upon award of the Contract and prior to mass production of MCCB, undertake to carry out type test on identical unit of each rating of MCCB in any of above specified testing laboratory or in an independent laboratory accredited by International Accreditation Corporation (ILAC) of International Accreditation Forum (IAF) in the presence of representative appointed by Nepal Electricity Authority at all the cost of Supplier.

Failure to furnish the information/particulars requested for in Clause 10.0 will result in the offer being rejected.

11. INSPECTION, SAMPLING AND TESTING

11.1 Inspection

The successful Bidder shall make necessary arrangements for pre-shipment inspection by Inspecting engineers sent by the NEA or by an authority acceptable to the NEA to carry out the necessary acceptance tests of the equipment offered.

11.2 Selection of Test Samples

The number of moulded case circuit breakers to be selected by random sampling method for acceptance inspection and testing shall be as indicated below.

S. No.	No. of units	No. of Batches	No. of samples to be selected
a)	Less than 100	1	3
b)	100-500	5	4
c)	500-1000	10	6
d)	1000-1500	15	8
e)	Above 1500	above 15	10

11.3 **Acceptance/ Sample Tests**

The following Tests as per IEC 60947 shall be witnessed by the inspecting Engineers.

a) Mechanical Operation tests
b) Calibration of releases
'c) Temperature rise tests
d) Dielectric tests.

12.0 **MAKE:**

The following makes of MCCB shall be acceptable: Seimens / L & T / ABB / GE Power, Hager, Schneider, CG, Hyundai, Havells, Mitsubishi, Federal, Mitsubishi, Legrand, Chint or equivalent. In case of other make, the bidder shall submit the certification from Independent Internationally Recognized Agency/ies to substantiate the equivalency to the above referred make. Failure to furnish the equivalency certification will result in the offer being rejected.

13.0 **TECHNICAL LITERATURE AND DRAWINGS**

All relevant drawings, technical literature, product catalogue, hand-books etc. required for installation, operation and maintenance of the equipment shall be supplied with the equipment. Routine test report shall also be supplied with the equipment.

14.0 **GUARANTEE**

The successful bidder shall be required to furnish the guarantee certificate of 5 years obtained from the MCCB Manufacturer

15.0 **ANNEX**

A- Schedule of Guaranteed Technical Particulars.

S.P. 9.0 DISTRIBUTION PANEL BOARD

1. Scope

This Specification covers the fabrication, testing and supply of distribution panel boards.

2. Description

2.1 The panel board shall be pole-mounted and used in conjunction with pole-mounted distribution transformers to house molded case circuit breaker (MCCB) (SPECIFICATION: SP 8.0 feeding 400/230 Volt circuits.

2.2 The manufacturer of panel boards must have been accredited with ISO 9001 manufacturing quality certification.

2.3 The panel board shall be rectangular in shape with an entrance door in the front of the panel board. The panel board shall be equipped with interior standoffs suitable for mounting MCCB and for supporting cables. The panel board will be fixed to the pole by exterior mounting brackets attached to the back of the panel board. Details of these components shall be as specified in the following text.

2.4 The panel board shall be fabricated to provide a degree of protection IP 22, as defined in IEC: 60529. The panel board shall be provided with means for natural ventilation.

Material

2.5 The panel board case and door shall be fabricated out of steel sheet of minimum 2 mm. in thickness and pole mounting brackets shall be fabricated out of mild steel flat of 6 mm. in thickness.

2.6 The interior standoffs shall be fabricated of steel sheet of sufficient thickness to support installed circuit breaker and cables without lateral movements.

Construction

2.7 The panel board case and all interior and exterior attachment shall be spot-welded. All welding shall be of the highest quality. The panel boards shall be formed and welded square and all attachments to the interior and exterior surfaces shall be welded square and perpendicular to the panel attached.

2.8 The panel board shall be so constructed as to be water tight from blowing of free-falling rain. There shall be no apertures in the panel board case other than those provided for the entrance door, cable fittings, or ventilation. The top extension and bottom shall be so formed to provide a drip edge and prevent water form flowing on the respective under-surfaces.

2.9 All individual pieces of metal shall be edge finished prior to assembly to provide surfaces and edges which are free from sharp points and edges. After welding in place, all welds shall be finished to smooth condition.

3. Panel board Front

3.1 The front panel shall be fabricated as a separate piece containing the panel board door and doorframe. The front shall be attached to the panel board housing by suitable bolting arrangements to provide a watertight and dust tight seal at the perimeter.

3.2 The door shall be equipped with a gasketed removable door, door-handle lock, and suitable hinges.

3.3 The door and panel frame shall be so fabricated to provide an integrated structure which is warp-resistant and which will maintain dust-tight and watertight seal.

3.4 Gasketing material shall be heat-resistant and shall retain its resilience over time to precluded degradation of dust-tight and watertight properties.

3.5 The insertable (and removable) door handle shall provide a door a locking function. The handle shall be insulated.

3.5 The door hinge may be continuous type or separate hinge units. However, the type of hinge furnished must accommodate, and not degrade, the dust-tight and watertight characteristics and must provide adequate door alignment and support over time.

4. MCCB Standoffs

4.1 The standoffs shall be shaped and dimensioned to accommodate the MCCBs as required by Bid Packages.

4.2 The standoffs shall be precisely located.

5. Cable Standoffs

5.1 The cable standoffs shall be properly shaped and dimensioned.

5.2 The standoff shall have the metal edges contoured and smoothed to prevent abrasion of applied cable serving.

5.3 The standoff shall be located within the panel board to make allowance for cable bending radii and the location of other components.

6. Bus bars

6.1 The neutral and phase bus bars shall consist of copper bus bar insulated from the panel board by 600 V porcelain insulators. The copper bus bar shall be of proper size (ampere capacity) and properly dimensioned.

6.2 The bus bars shall be located within the panel board to provide adequate clearance for the installation and correct functioning of all items.

6.3 If it is required to drill or penetrate the panel board back to install 600 V insulators, the outside of the panel board shall be permanently sealed over the attachment to retain water-tightness.

Cable Entrance Fittings and Knockouts

6.4 Knockouts for cable entrance fittings (bushings) shall be provided in the bottom of the panel board.

6.5 All necessary cable entrance fittings shall be supplied for proper connection of all circuits to fulfill the requirement of the Bid Package. The fittings shall be designed to be suitable for exposed cables entering the panel board from below and shall secure the cable with inserts to prevent lateral and longitudinal movement of the cables.

6.6 The fittings shall be threaded multi-piece construction which when installed securely locks the fittings to the panel board. The fittings may be of metal or polymer material. Metal fittings shall be galvanized or plated as appropriate. The fitting inserts may be single or multi pieces and shall be of material sufficiently elastic and resilient to securely grip the PVC cable sheath without damage. The fitting components shall enable capturing of the inserts to preclude insert creep and fallout due to clamping pressure.

7. Ventilation

7.1 The panel board shall be provided with apertures for natural draft ventilation in the panel board bottom and in the top overhang.

7.2 The ventilation apertures shall be covered with bronze screen materials of a mesh sufficiently to preclude passage of small insects. The edges of the bronze screening shall be surely fastened to the panel board by means of soldering or epoxy adhesive. The mesh shall be protected during panel board fittings to preclude clogging of mesh openings by finished materials.

Pole Mounting Bracket

7.3 The panel board shall be provided with two (2) pole mounting brackets. The size of poles will be confirmed by the Project before manufacturing.

8 Grounding Stud

8.1 The panel board shall be provided with a brass grounding stud located in an approved locations.

8.2 The grounding stud shall be fitted to the panel board to insure low resistivity and water tightness of the installation.

8.3 The grounding stud shall be complete with pressure washer, lock washer, and nuts.

9. Finish

9.1 After fabrication, the panel board shall be thoroughly cleaned of all dirt, grease, mill scale, and weld slag on all interior and exterior surfaces and all surfaces of all components. After thorough cleaning of panel board one (1) coat of red oxide metal priming paint and two (2) finish coats of paint color shall be thoroughly applied. The paint color shall be of light grey. The finish coats shall be of oil based or epoxy paint. Alternatively, powder coating of panel board may also be acceptable.

9.2 The bronzed screen ventilation holes, working surfaces of door hinge and door lock, and outside face of grounding stud shall be free from all finishing materials.

10. Bid Documentation

10.1 The Bidder shall furnish two (2) copies of certified fabrication drawings showing all views, section, and dimensions of individual components and assembled panel board.

10.2 The Bidder shall furnish complete description of all materials to be used, including cable entrance fittings and finishing materials.

10.3 The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.

10.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 10.0 PORCELAIN INSULATOR

1. **Scope**

This Specification covers the fabrication and supply of porcelain insulators, as herein specified, for use on overhead power line construction.

2. **General**

2.1 All porcelain insulators shall be fabricated and tested in accordance with the Standards referenced or other national or international standards, for each type of insulator.

2.2 Porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The glaze shall be brown in color. The glaze shall cover all exposed parts of the insulators.

2.3 The manufacturer of the insulator must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

3. **Pin Insulator**

3.1 The pin insulator shall be manufactured and tested in accordance with IS: 731-1971 or the latest version thereof or any other national or international standards that ensures the insulators of at least equal to or better quality than the standard mentioned above, will also be acceptable. The lead thread shall be compatible with the insulator pin specified in SPECIFICATION: SP-11.0 herein.

The pin insulator shall have following ratings and features:

-	Highest System Voltage	12 kV	36 kV
-	Rated Voltage	11 kV	33 kV
-	Creepage Distance (min)	230 mm	580 mm
-	Wet Power Frequency Withstand Voltage	35 kV	75 kV
-	Impulse Withstand Voltage	75 kV	170 kV
-	Puncture Power Frequency Voltage (min)	105 kV	180 kV
-	Visible Discharge Voltage (Effective)	9 kV	27 kV
-	Cantilever Strength	5 kN	10 kN
-	G.I. Pin Head IS: 2486 Part-II	Small IS Ref. S165P	Large IS Ref. L300N

4. **Disc Insulator**

4.1 The disc insulator shall be manufactured and tested in accordance with IS: 731-1971 or latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

4.2 The disc insulator shall be ball and socket fitting type. The disc insulator shall meet or exceed the following ratings and features:

-	Highest system Voltage	12 kV
-	Rate Voltage	11 kV
-	Porcelain Diameter (min)	255 mm
-	Spacing	145 mm
-	Creepage Distance (min)	280 mm
-	Power Frequency Puncture Withstand Voltage	1.3 × Actual wet flashover voltage
-	Wet Power Frequency Withstand Voltage	35 kV
-	Impulse Withstand Voltage	75 kV
-	Puncture Power Frequency Voltage (min)	105 kV
-	Visible Discharge Voltage	9 kV
-	Mechanical Strength	45 kN
-	Ball and Socket Size	16 mm B
-	Applicable Standard for Special Characteristics	IS: 3188-1980

5. Stay Insulator

5.1 The stay insulator shall be manufactured and tested in accordance with IS: 5300-1969 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable. The stay insulator shall meet or exceed following ratings and features:

		Type 1	*Type 2*
-	Highest System Voltage	36 kV	12 kV
-	Rated Voltage	33 kV	11 kV
-	Creepage Distance (min)	57 mm	41 mm
-	Minimum Failing Load	88 kN	44 kN
-	Power Frequency Withstand Voltage, 1 minute:		
	Dry	27 kV	18 kV
	Wet	13 kV	8 kV
-	IS Designation	C	A

6. Tests

6.1 Type test

The Bidders shall include with their offers type test certificates issued by an independent testing laboratory of repute comprising, among other:

- Dry lightning impulse withstand voltage test;
- Wet power frequency withstand voltage test.

6.2 Routine test

Following routine test shall be carried out on the sample in accordance with the governing standard:

- Verification of dimensions
- Temperature cycle test
- Mechanical tests
- Puncture test
- Porosity test

7. Marking

7.1 Each insulator shall be legibly and indelibly marked to show the following:

a) Name or trademark of manufacturer.
b) Year of manufacture.

c) Name of the Purchaser as follows: "NEA-GSEEP"
d) Minimum failing load in Newton (for pin and disc insulators only)

7.2 Markings on porcelain shall be printed and shall be applied before firing.

8. **Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

x. The structure of the organization;
xi. The duties and responsibilities assigned to staff ensuring quality of works;
xii. The system for purchasing, taking delivery and verification of materials;
xiii. The system for ensuring quality of workmanship;
xiv. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
xv. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
xvi. List of manufacturing facilities available;
xvii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
xviii. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

9. **Bid Documentation**

9.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of porcelain insulators and two (2) clear copies of all other relevant standards referenced therein.

9.2 The Bidder shall provide certified type test results of all types of porcelain insulators as required by governing standards.

9.3 The Bidder shall furnish two (2) sets of dimensional drawings of all types of porcelain insulators.

9.4 The Bidder shall provide complete description, catalogue and certified dimensional drawings of all types of insulators.

9.5 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

9.6 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 11.0 INSULATOR PIN

1. **Scope**

This Specification covers the fabrication and supply of bolt-type, long shank cross-arm insulator pins.

2. **Description**

2.1 The insulator pin shall be fabricated and tested in accordance with the nominated standards or any other national or international standards that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The insulator pin shall be furnished with a spring washer, stainless steel split lock and nut assembled on the insulator pin. The ratings and features of the insulator pins shall be as follows:

	For 11 kV	*For 33 kV*
Head Type	Small S165P	Large L300N
Total Length	315 mm	450 mm
Stalk Length	165 mm	300 mm
Shank Length	150 mm	150 mm
Minimum Failing Load	5 kN	10 kN
Applicable Standard	IS: 2486 (Part II)	

The insulator pins shall be compatible with the pin insulators specified in SPECIFICATION: SP-10.0

2.2 The manufacturer must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

3. **Material**

3.1 The insulator pins shall be fabricated from hot rolled steel. The pin shall be a single piece, obtained by the process of forging. It shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material. It shall be of good finish free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar and the shank is avoided.

4. **Galvanizing**

4.1 All ferrous components except or those made of stainless steel shall be hot dip galvanized. The threads of nuts and tapped holes, when cut after galvanizing shall be well oiled and greased. The galvanizing shall conform to IS: 2629-1985 or any other equivalent national of international standards.

5. **Finish**

All insulator pins shall be reasonably smooth on all surfaces and free of sharp projections.

6. **Test**

6.1 Insulator pins shall comply with the following tests as per IS: 2486 (Part I).

6.2 *Type Tests:*

- Visual examination test

- Checking of threads on head

- Galvanizing test

- Mechanical test

6.2 *Acceptance Tests:*

- Checking of threads on head

- Galvanizing test

- Mechanical test

6.3 *Routine Test:*

- Visual examination.

7**.** **Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;

ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

8. **Bid Documentation**

8.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of insulator pins and two (2) clear copies of all other relevant standards referenced therein.

8.2 The Bidder shall provide certified type test results of insulator pins as required by governing standards.

8.3 The Bidder shall provide catalogue and certified dimensional drawings of all types of insulator pins.

8.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

8.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 12.0 DISC INSULATOR FITTINGS
(TENSION SET and BRACK STRAP)

1. **Scope**

1.1 This specification covers the fabrication and supply of tension type disc insulator fittings.

2. **Description**

2.1 The disc insulator fittings shall be supplied with ball and socket couplings (socket eye, ball eye/ball clevis etc.), twisted straps, and bolted type tension clamps. Number of U-bolts in tension set shall be 3 (three).

2.2 Tension clamp shall be suitable for ACSR conductor, diameter ranging from 5 mm. to 16.5 mm.

2.3 The ultimate strength of disc insulator fittings shall be more than 45 kN.

2.4 All components of disc insulator fittings shall be such that they fulfill all requirements of this specification and compatible with disc insulator specified in SPECIFICATION :SP-11.0

2.5 All parts of different fittings, which provide for interconnection, shall be made such that sufficient clearance is provided at the connection point to ensure free movement of insulator assembly.

2.6 The twisted strap shall be suitable for 50×100×50 mm. cross arm. Size of the holes for bolt, which anchors twisted strap with cross arm shall be suitable for insulator pins specified in SPECIFICATION: SP-11.0 and width of the twisted strap shall be designed accordingly. Diameter of nuts and bolts of strap shall be equal to shank diameter of insulator pins. Nuts and bolts shall also be provided with spring washer and split pin.

2.7 Unless otherwise specified in this specifications, disc insulator fittings shall be in accordance with IS: 2486 (Part I & II) or any other equivalent national or international standards.

2.8 The manufacturer of the disc insulator fittings must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

3. **Material**

3.1 The tension clamp shall be made of the aluminium alloy type. Other accessories like ball eye/ball clevis, socket eye, nuts, and bolts shall be made of hot rolled steel and obtained preferably by process of forging. Twisted cross arm strap shall be made of MS sheet metal. Cotter bolts and U-bolts shall be of galvanized steel. Cotter pins shall be stainless steel.

3.2 All forging and castings shall be of good finish and free from flaws and other defects. The edges on the outside of fittings, such as at the eye, socket and holes, shall be rounded.

4. Galvanizing

4.1 All ferrous fittings and the parts other than those of aluminium alloy and stainless steel, shall be hot dip galvanized in accordance with IS: 2629-1985 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

5. Tests

5.1 The disc insulator fittings shall comply with the following tests as per IS: 2486 (Part I) or any other equivalent national or international standards.

1. *Type Test:*

   - Verification of Dimensions,

   - Visual Examination Test

   - Slip Strength Test

   - Mechanical Test

   - Electrical Resistance Test

   - Heating Cycle Test

   - Galvanizing Test

2. *Acceptance Tests:*

   - Verification of dimensions

   - Galvanising Test

   - Mechanical Tests

3. *Routine Tests:*

   - Visual Examination Tests

   - Routine Mechanical Test

6. Marking

6.1 The tension clamp shall be marked on it following:

a) Name or trademark of manufacturer
b) Name of the Purchaser as follows: "NEA-RSDSRP"

7. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

8. Bid Documentation

8.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of disc insulator fittings And two (2) clear copies of all other relevant standards referenced therein.

8.2 The Bidder shall provide certified type test results of insulator pins as required by governing standards.

8.3 The Bidder shall provide catalogue and certified dimensional drawings of all types of insulator pins.

8.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

8.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 13.0 STAY SET

1. Scope

This Specification covers the fabrication and supply of adjustable threaded, galvanized steel stay sets for use in overhead line construction.

2. Material

2.1 The stay set shall consist of mild steel, galvanized stay rod, stay tightener (turn buckle) or adjustable head, eyebolt for Steel Tubular pole or two-way clamp and twisted double-eye for steel tubular pole, thimbles complete with stay plate as shown in the conceptual drawings Dwg. CSG17.

2.2 The manufacturer of the Stay Set must have been accredited with ISO 9001 or ISO 9002 quality certification.

2.3 The stay rod and stay tightener shall be made of mild steel of minimum ultimate tensile strength of 4200-kg/sq. cm.

2.4 The stay plate shall be square type mild steel plate.

2.5 The thimbles shall be made of 1.219mm (18 SWG) GI sheet.

3. Description

3.1 Conceptual drawings of stay set and its associate hardware are given in Dwg. CSG17, and technical features and dimensions in Table 1.

3.2 The stay rod is either thimble-eye type or twin-eye type. The stay rod and suitable nut shall be fabricated to the shape and dimensions shown in Dwg. CSG17. The thimble-eye or twin-eye of the stay rod shall be made by drop forged processing. The thread form at the threaded end of the rod, and that of the accompanying nut, shall be optional with the supplier. However, it shall be the responsibility of the Supplier to supply the stay rod with a thread form that shall sustain the rated loads specified in Table 1 without creep or stripping over the full life of the rod material at specified diameter.

3.3 The stay tightener shall be fabricated in accordance with the conceptual drawing shown in Dwg. CSG17.

3.4 The eyebolt shall be oval-eye type. The eyebolt shall be made by drop-forged processing. The eyebolt shall be supplied with suitable nut and washer.

3.5 The two-way clamp required for mounting stay set (stay tightnener) in steel tubular pole shall be made of hot-rolled steel flat. The clamp shall be two halve type and shall be provided with two numbers of nuts and bolts, diameter not less than 19 mm.

The both ways of the clamp shall be suitable for accommodating two numbers of twisted double-eye fittings described in Clause 3.5 below. The two-way clamp shall be following types:

a) Type A: Suitable for pole diameter ranging from 180-230 mm.
b) Type B: Suitable for pole diameter ranging from 140-180 mm.

3.6 The twisted double eye shall be made by drop-forged processing. The twisted double-eye shall be twisted in 90^0. The diameter of the steel shall not be less than 16 mm., and eye of the twisted-eye shall be suitable for accommodating sty tightener.

3.7 The Stay plate shall be square and the plate shall have a matching hole at the center to fit the end of the stay rod.

3.8 The thimble shall be suitable for terminating steel stay wire with a preformed grip.

3.9 After galvanizing, the nut and rod threading shall be such that the nut may be run the full length of the thread without the use of tools.

4. Galvanizing

4.1 All ferrous parts of the stay set shall be galvanized after fabrication in accordance with IS: 2629-1985 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

5. Tests

5.1 Apart from the tests indicated in the relevant referenced standards of steel, the stay set shall undergo following type tests:

- Visual Inspection.
- Verification of Dimensions.
- Tensile test: The stay set assemblies shall withstand a minimum tensile loads specified in Table 1.
- Bend test: The stay rod shall be bend-tested over a mandrel of 19 mm through an angle of 90 degrees at any point in the un-threaded section of the rod without fracture of the steel. Temperature of the test shall be 22.5 deg Celsius.

5.2 Routine tests shall be performed on each batch of the stay sets as per the relevant governing standards.

6. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. Bid Documentation

7.1 The Bidder shall provide a complete description, catalogue and two (2) clear copies of certified dimensional drawings of all the components of the stay set.

7.2 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.3 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1

RATINGS AND FEATURES

	11m	8m
Length of stay rod, m.	2.44	1.8
Diameter of stay rod, mm.	19	16
Ultimate tensile strength of stay rod and tightner (min.), kg/sq. mm.	4200	4200
Minimum breaking load, kg.	10,454	7,272
Length of threaded portion, mm.	300	300
Thimble shape	Suitable for preformed for 7/8 SWG stay wire	Suitable for preformed for 7/12 SWG stay wire
Thimble section Min.), SWG	18	18
Stay plate section, mm.	600×600×6	300×300×6
Eyebolt length, mm./1	300	300
Galvanization	IS: 2629-1985	

Note:

1. For the steel tubular pole, two-way pole clamp and twisted double-eye shall be provided instead of eye-bolt.

S.P. 14.0 STRANDED STAY WIRE

1. **Scope**

This Specification covers the fabrication and supply of galvanized stranded steel wire for use in overhead power line as stay wire ropes for line supports.

2. **Description**

2.1 The steel strand shall be fabricated in accordance with B.S. 183 1972/(1983) or any revision thereof or other equivalent national or international standard provided that the resulting steel stock is of equal quality and strength. The minimum tensile strength of the steel shall be 4200 kg/cm^2. The wires shall be 45-ton quality.

2.2 The steel wire strand shall have a left-hand lay. The steel wires shall have no joint throughout the whole length. Strands shall be uniform and shall have no defects such as cracks, dust encapsulation or crevices. Further details are given in Table 1 herein.

2.3 The manufacturer of the Stranded Stay Wire must have been accredited with ISO 9001 or ISO 9002 quality certification.

3. **Galvanizing**

3.1 The stranded stay wire shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or any other national or international standards that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

4. **Tests**

4.1 The stranded stay wire shall undergo type and routine tests in accordance with the governing standard.

5. **Packaging**

5.1 The stranded stay wire shall be furnished in reels holding approximately 300m. Each reel shall have a weather - resistant tag securely attached showing the length, nominal diameter, number of individual wires, and grade of the strand.

6. **Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. Bid Documentation

7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of stranded stay wire and two (2) clear copies of all other relevant standards referenced therein.

7.2 The Bidder shall provide a complete description, and catalogue of stranded stay wire.

7.3 The Bidder shall provide certified type test results of insulator pins as required by governing standards.

7.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1

RATING AND FEATURES

	11m	8m
Steel Wire Size (No. of wire/SWG)	7/12	7/8
Grade	700	700
Steel quality	45 ton	45 ton
Diameter of Wires, mm.	2.64	4.06
Minimum Weight, kg/km	300	720
Applicable Standard	B.S. 183 1972/(1983)	B.S. 183 1972/(1983)
Galvanization	IS: 2629-1985	IS: 2629-1985

S.P. 15.0 GALVANISED STEEL BOLTS, NUTS AND MISCELLANEOUS FASTENING COMPONENTS

1. **Scope**

1.1 This Specification covers the fabrication and supply of galvanized steel bolts and nuts, as specified herein, for use in overhead electric line construction.

2. **Material**

2.1 The bolts and nuts shall be manufactured and tested in accordance with IS: 1363 (Part I)-1984 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

3. **General**

3.1 Bolts and nuts shall be furnished in the types, diameters and lengths specified in the Schedules of Rates and Prices. **However, the dimensions and length of threading of bolt must be confirmed with the Project prior to manufacture**.

3.2 Thread forms shall be consistent with all material/items listed herein and shall not strip or slip under sustained tensile loading equal to the design tensile strength of the threaded material item.

3.3 The manufacturer must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

4. **Machine Bolt and Nut**

4.1 Each machine bolt shall be furnished with two (2) hexagonal nuts and two (2) plain washers assembled thereon.

5. **Double-Arming Bolt and Nut**

5.1 Each double-arming bolt shall be furnished with four (4) hexagonal nuts and two (2) washers assembled thereon.

6. **Galvanizing**

6.1 The stranded stay wire shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

7. **Tests**

7.1 The bolt and nut shall undergo type and routine tests in accordance with the relevant governing standard.

8. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

9. Bid Documentation

9.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of bolt and nut and two (2) clear copies of all other relevant standards referenced therein.

9.2 The Bidder shall provide certified type test results of bolt and nut as required by governing standards.

9.3 The Bidder shall provide catalogue and certified dimensional drawings of all types of bolt and nut.

9.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

9.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 16.0 PREFORMED WIRE PRODUCTS FOR STAY SETS

1. **Scope**

This Specification covers the fabrication and supply of wire strand grips for stay set commonly used in overhead power line construction.

2. **Description**

2.1 The design of the preformed wire products specified herein shall be appropriate for the optimum combination of conductor strand diameter, inside diameter, rod diameter, pitch diameter, number of pitch lengths, direction of lay, and raw materials of the specific application.

2.2 The manufacturer of the Preformed Wire Products must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

2.3 The preformed wire product shall be so designed to grip the designated surface evenly, with evenly-spaced gaps, and shall not bridge the gripped surface due to excessive number of strands in the grip or tie.

3. **Steel Wire Strand Grip for Stay Set**

3.1 The steel wire strand grip shall be designed for use with thimble eye or double eye stay rod and tightner fabricated in accordance SPECIFICATION: S.P.13.0, stay wire fabricated in accordance with SPECIFICATION: S.P.14.0 (B.S. 183 1972/(1983)) and stay insulator fabricated in accordance with SPECIFICATION: S.P.11.0 (IS:5300-1969).

3.2 The steel wire strand grip shall be furnished for strand size and grade in accordance with Table 2.

3.3 The steel wire strand grip shall be manufactured of a galvanized steel wire in cabled loop form with long and short legs. The grip shall have a left-hand lay. Galvanizing shall be equivalent to Class C zinc coating per ASTM A-475.

3.4 The steel wire strand grip shall be color-coded for strand size and length and shall have one (1) or two (2) crossover marks for different diameter fittings. An identification tag shall be attached showing the manufacturer's catalogue number and applicable strand size.

3. Tests

The performs shall undergo type and routine tests in accordance with the relevant governing standard.

4**. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall

include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

5. Bid Documentation

5.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of preformed wire products and two (2) clear copies of all other relevant standards referenced therein.

5.2 The Bidder shall provide certified type test results of preformed wire products as required by governing standards.

5.3 The Bidder shall provide complete description, and catalogue of preformed wire products.

5.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

5.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1

STEEL WIRE STRANDED GRIPS

Tie Application for Strand Size	**Identification Tag and Color Code**	
7/8 SWG	GS-1	Red
7/12 SWG	GS-2	Blue

Note: All designations shown are used for product identification for the purpose of this IFB.

S.P. 17.0 GROUND RODS AND CLAMPS

1. Scope

This Specification covers the fabrication and supply of galvanized steel ground rods and clamps for use in overhead power line construction.

2. Description

Ground Rod

2.1 The ground rod shall be made of high carbon, open-hearth steel so as to achieve maximum strength. It shall be hot dip galvanized.

2.2 The ground rod shall be 19mm in diameter and 4,000mm in overall length.

2.3 The driven end of the ground rod shall have a truncated cone point. The cone point shall be approximately 13mm long, measured along the axis of the ground rod. The driving head of the ground rod shall have an approximate 3 mm, 45 degrees chamfer.

2.4 The manufacturing process shall assure that ground rod does not bend when driven into hard soils.

Ground Rod Clamp

2.5 The ground rod clamp shall be heavy duty forged steel clamp provided with a hex head cup point set screw of high strength steel with machine-cut threads. It shall be so manufactured that it gives low resistance connection. The ground rod clamp shall be galvanized.

2.6 The clamp shall suitably accommodate and clamp a 19 mm. ground rod and a stranded grounding conductor of 7/12 SWG size (SPECIFICATION: S.P.18.0).

3. Galvanizing

3.1 The galvanization of ground rod and clamp shall be in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

4. Tests

Grounds rods and clamps shall undergo type and routine tests in accordance with the relevant governing standard.

5. Quality Assurance Program

5.1 The manufacturer must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

5.2 Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

6. Bid Documentation

6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of grounding rod and clamp and two (2) clear copies of all other relevant standards referenced therein.

6.2 The Bidder shall provide certified type test results of ground rods and clamps as required by governing standards.

6.3 The Bidder shall provide catalogue and certified dimensional drawings of all types of ground rods and clamps.

6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 18.0 GROUNDING CONDUCTOR

1. **Scope**

This specification covers the fabrication and supply of galvanized stranded steel grounding conductor for use in the neutral grounding of distribution transformers and body grounding of electrical equipment.

2. **Description**

2.1 The conductor shall be 7-wire stranded conductor and shall conform to the characteristics as specified in Table 1 contained herein. Stranded conductor shall be galvanized.

2.2 The manufacturer of ground Conductor must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

3. **Galvanizing**

3.1 The stranded stay wire shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or any other national or international standards that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

4. Tests

The grounding conductor shall undergo type and routine tests in accordance with the relevant governing standard.

5**. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;

ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

6. **Bid Documentation**

6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of grounding conductor and two (2) clear copies of all other relevant standards referenced therein.

6.2 The Bidder shall provide a complete description, and catalogue of grounding conductor.

6.3 The Bidder shall provide certified type test results of grounding conductor as required by governing standards.

6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1

GROUNDING CONDUCTOR MINIMUM REQUIREMENTS

7-No. 12 SWG

Diameter of single strand	2.67 mm
Weight	299 kg/km
Short time fusing current	12 kA
Resistivity	15 Micro-Ohm-cm

S.P. 19.0 BANDING MATERIALS AND TOOLS

1. **Scope**

This specification covers the supply of banding strap, buckles and application tools commonly applied as a fastening and binding system.

2. **Description**

Banding Strap and Buckle

2.1 The banding strap and buckle shall be made of stainless steel, and shall be:

a) Type 1: 19 mm. in width and 0.7 mm in thickness. Minimum breaking strength of the strap shall be 1250 kg minimum. The strap shall be come on strap winder made of weather resistant plastic. The strap winder shall have handle for carrying, box for buckles and it shall be suitable for field handling. One roll shall contain 50 m. of banding strap. Buckle shall be suitable for use with banding strap.

b) Type 2: 13 mm. in width and 0.7 mm. in thickness. Minimum breaking strength of the strap shall be 850 kg minimum. The strap shall be come on strap winder made of weather resistant plastic. The strap winder shall have handle for carrying, box for buckles and it shall be suitable for field handling. One roll shall contain 50 m. of banding strap. Buckle shall be suitable for use with banding strap.

Tools for application of banding strap and buckle

2.2 Tools for application of banding strap and buckle shall be suitably designed and sized for use with stainless steel banding and buckle described in paragraph 2.1 above. The tool shall be durable and suitable for long-term outdoor use.

3. Tests

The binding materials shall undergo type and routine tests in accordance with the relevant governing standard.

4. **Quality Assurance Program**

4.1 The manufacturer of the banding materials and tools must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

4.1 Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;

ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

5. **Bid Documentation**

5.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of banding materials and tools.

5.2 The Bidder shall provide a complete description, and catalogue of banding materials and tools.

5.3 The Bidder shall provide certified type test results of banding materials and tools as required by governing standards.

5.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

5.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 20.0 COMPRESSION CONNECTORS AND COMPRESSION TOOLS

1. **Scope**

This Specification covers the design, testing, and supply of electrical compression connectors commonly used in overhead electric power line construction,

2. **Description**

2.1 Compression connectors shall be manufactured and tested in accordance with the relevant national or international standard.

2.2 The manufacturer of Compression Connectors must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

2.3 The compression connectors shall be designed and manufactured to achieve full compatibility between connectors and tools and produce uniform and electrically efficient connections between conductors for the class of connection intended. Conductor sizes are nominal and allowance shall be made for the actual conductor sizes to be supplied.

2.4 The compression connectors shall be tested in accordance with ANSI Standard C119.4, latest revision, or other equivalent national or international standard specifying the performance requirements for the electrical and mechanical characteristics of connectors under operating conditions, and shall conform to all testing requirements of that Standard for the classes of connectors concerned.

2.5 Compression Connectors

The compression connectors for AAAC conductor to AAAC Conductor and ACSR Conductor to ACSR conductor shall be made of electrical grade aluminum. The connectors shall have sufficient mass and contact area to provide the thermal capacity required for load cycling and fault current. The connector shall be designed to provide the distributed current density necessary to prevent hot spots, and conductivity shall exceed the full load current rating of the conductors for which they are designed.

Full tension sleeve connectors

The sleeve shall be dual tension (2-piece) for use with AAAC and /or ACSR conductors listed in Table 1.

The steel sleeve for the conductor core shall be heavily plated for resistance to corrosion and compatibility with aluminum and shall be abrasive lined for maximum holding strength.

The aluminum outer sleeve for 100 sq. mm. the conductors shall have a filler hole to permit entering over the steel sleeve and permit inhibitor application. An aluminum hole plug shall be furnished.

The full tension sleeve connector shall be furnished in accordance with Table 1.

The conductor shall achieve the same mechanical strength that of undamaged conductor at connecting point.

Repair Sleeve

The sleeve shall be one-piece aluminum for use with conductors.

The sleeve shall completely enclose all strands and restore full ampere capacity rating to burned or mechanically-damaged strands.

The repair sleeve shall be furnished in accordance with Table 1.

4. Tests

The compression connectors shall undergo type and routine tests in accordance with the relevant governing standard.

5. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

6. Bid Documentation

6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of compression connectors.

6.2 The Bidder shall provide a complete description, and catalogue/drawing of compression connectors.

6.3 The Bidder shall provide certified type test results of compression connectors as required by governing standards.

6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1

Connectors to be Furnished (Designation)	**Connector Type**	**AAAC Conductor sizes**
A-1T	Full Tension Sleeve	100 sq. mm.
A-2T	Full Tension Sleeve	55 sq. mm
A- 1R	Repair Tension Sleeve	100 sq. mm.
A- 2R	Repair Tension Sleeve	55 sq. mm

S.P. 21.0 CROSSARMS AND BRACING ANGLES

1. Scope

This Specification covers the fabrication and supply of galvanized steel cross-arms and bracing members commonly used in overhead power line construction.

2. Material

2.1 The steel cross-arms shall be fabricated from hot rolled channels and angles.

2.2 The steel channels and angles shall be fabricated and tested in accordance with Indian Standards IS: 226-1975 and IS-808-1964 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

3. Description

3.1 The steel cross-arms and bracing angles shall be of sizes shown in the Table 1: Cross-arms and bracing angles, contained herein.

3.2 Conceptual hole pattern and size of holes on cross-arm channels are shown in appropriate drawings herein, however, the Supplier must confirm with the Project the locations and sizes of holes prior to the manufacture.

3.3 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

3.3 The steel cross-arm and bracing angles shall be furnished reasonably smooth on all surfaces and free of burrs or sharp projections.

4. Galvanizing

4.1 The steel cross-arms and bracing angles shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable..

5. Tests

5.1 Apart from the tests indicated herein in the referenced standards, the channels and angles shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

6. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. Bid Documentation

7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of channels and angles and two (2) clear copies of all other relevant standards referenced therein.

7.2 The Bidder shall provide a complete description, catalogue and certified dimensional drawings of all channels and angles.

7.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1: STEEL CROSSARM CHANNELS AND ANGLE BRACES

S.NO.	***Description***	***Type***	*Dimension in mm.*	*Ref. DWG.*
1.	11 kV, Single Pole, Triangular: 1.1 Pole Top 1.2 Standard	 Channel Channel	 100×50×6.4×5×300 100×50×6.4×5×1200	 CA1 CA2
2.	11 kV, Double Pole: 4.1 Standard 4.2 Bracing Member 4.3 Bracing Member	 Channel Angle Angle	 100×50×6.4×5×2390 40×40×5×2071 40×40×5×2719	 CA3 CA4, CA5 CA4, CA5
3.	Transformer Platform Complete set	Channel Channel	100×50×6.4×5×2500 100×50×6.4×5×1200	CSLV-6A,6B,7
4.	Lightening Arrester and Cut-out Support (at Transformer Platform): 5.1 Support	Channel	100×50×6.4×5×2348	CA09

S.P. 22.0 FLAT CROSSARM BRACE

1. **Scope**

This Specification covers the fabrication, testing and supply of flat, galvanized steel cross-arm braces.

2. **Material**

2.1 The flat cross-arms brace shall be fabricated out of hot rolled steel flat.

2.2 The steel flat for cross-arms brace shall be fabricated and tested in accordance with Indian Standards IS: 226-1975, and IS-1731-1971 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

3. **Description**

3.1 The brace shall be furnished reasonably smooth on all surfaces and free of burrs or sharp projections.

3.2 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

3.3 The brace shall have a minimum tensile strength of 3182 kg at the bolt-hole and bolt slot.

3.4 The brace shall be capable of being bent 10 degrees at the bolt hole or slot and 140 degrees at any point between hole and slot without cracking of the base metal on the outside of bent portion.

3.5 The brace shall be drilled and dimensioned in accordance with Dwg. CA10 attached herein.

4. **Galvanizing**

4.1 The flat cross arm brace shall be hot dipped galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

5. **Tests**

5.1 Apart from the tests indicated herein in the referenced standards, the flat cross arm brace shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

6. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. Bid Documentation

7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of flat cross arm brace and two (2) clear copies of all other relevant standards referenced therein.

7.2 The Bidder shall provide a complete description, catalogue and certified dimensional drawings of flat cross arm brace.

7.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 23.0 TRANSFORMER PLATFORMS

1. Scope

1.1 This specification covers the fabrication and supply of transformer platforms used in overhead power line construction.

2. Material

2.1 The transformer platform shall be fabricated from hot rolled channels, angles and steel members.

2.2 The steel channels and angles for transformer platform shall be fabricated in accordance with Indian Standards IS: 226-1975 and IS-808-1964 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

3. Description

3.1 The platform shall be fabricated out of galvanized steel members, field assembled by bolting.

3.2 The platform will support the transformer above the ground and will be supported by two-pole structures of steel tubular or Steel Tubular (STEEL TUBULAR) poles. Transformers will be bolted to the platform at four (4) points. Provision should be made for the mounting of transformers of different physical dimensions and ratings up to 200 kVA.

3.3 The platform shall be designed by the supplier and fabricated, in general, in accordance with the conceptual configuration shown in Dwg. CA12 and CSLV7 contained herein. The design shall provide support for a transformer of a minimum of 1500 kg in weight with a minimum safety factor of 2.0. The Platform shall be stiff and shall be capable of withstanding horizontal forces and an overturning moment due to seismic effects on a transformer with centre of gravity 0.5 meter above its base and seismic horizontal acceleration of 0.4g. The platform shall be stiff and shall not visibly deflect under static loading.

3.4 The platform shall be supplied disassembled, complete with all required members and fastenings. Packing may be made by banding structural members. Fastenings shall be separately packed. Structural members shall be clearly identified for ease of assembly in accordance with the assembly drawing furnished by the supplier.

3.5 The platform shall be suitable for fixing to support poles of 150 to 250 mm diameter in the case of poles, and to STEEL TUBULAR poles of rectangular section with 250 to 350 mm in width and 140 to 180 mm depth.

4. **Galvanizing**

4.1 All ferrous parts of transformer platform shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

5. **Tests**

5.1 Apart from the tests indicated herein in the referenced standards, the transformer platform shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

6**.** **Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. **Bid Documentation**

7.1 A preliminary design of the platform shall be submitted with the Bid. Data to be supplied with the preliminary design shall be:

a) Steel classification proposed to be used and the characteristics thereof;
b) Two copies of Preliminary detail drawings of the proposed platform;
c) Data regarding:
   1) Vertical and horizontal loading on poles,
   2) Resultant safety factor,
   3) Resultant deflection,

4) Resultant percent of allowable tension, compression, and shear limits for the steel selected and associated fastening,
5) Moments on pole due to seismic effects on the platform and transformers.

7.2 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.3 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P. 24.0 POLE CLAMPS

1. **Scope**

1.1 This Specification covers the fabrication and supply of galvanized steel pole clamps with nuts, bolts and washers for use on overhead power line construction.

2. **Material**

2.1 The pole clamp shall be fabricated out of hot-rolled steel flat.

2.2 The steel flat for pole clamp shall be fabricated and tested in accordance with Indian Standards IS: 226-1975, and IS-1731-1971 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

3. **Description**

3.1 Outline details of pole clamps are shown in the drawings Dwg: CA13. Dimensions may be changed to comply with the final pole sizes selected. Therefore, the dimensions must be confirmed with the Project prior to manufacture.

3.2 Two (2) numbers of galvanized, 16 mm. (dia.) × 60mm. (length), fully threaded bolts with two (2) nuts and washers shall be provided with each pole clamp.

3.3 The fittings shall be free of burrs, splinters, splits, sharp points and edges, which may damage conductors or show evidence of poor workmanship.

3.4 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

3.5 The pole clamps shall have a minimum tensile strength of 3182 kg at the bolt-hole and bolt slot.

4. **Galvanizing**

4.1 The pole clamps and nut, bolts and washers shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

5. **Tests**

5.1 Apart from the tests indicated herein in the referenced standards, the pole clamps shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

6. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9001;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

7. Bid Documentation

7.2 The Bidder shall provide a complete description, catalogue and two (2) copies of certified dimensional drawings of pole clamps.

7.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

S.P.25.0 TECHNICAL SPECIFICATIONS FITTINGS FOR HV OVERHEAD, XLPE COVERED CONDUCTOR

1. **Scope**

This Specification covers the fabrication and supply of fittings and associated apparatus for HV AAAC XLPE covered conductors.

2. **Description**

2.1 The fittings, hardware andequipment shall be fabricated in accordance with International recognized standards such as IEC,NFC forFittings and Associated Apparatus for use with HV ABC latest revision, and all referenced standards therein, or latest revision thereof or other recognized international standards that ensures at least a substantially equal quality to the standard mentioned above, will also be acceptable. The fitting and accessories shall be suitable for 11 kV nominal voltage applications.

2.2 The Covered Conductor hardware manufacturing company shall have been accredited with ISO 9001 quality certification (including design).

2.3 The fittings shall be for use in conjunction with XLPE covered conductor of 100 sq. mm nominal cross-sectional areas.

2.4 Contractor shall get approval of all drawings and hardware sample from Purchaser before starting the fabrication of all hardware.

2.5 The fittings and accessories are as follows:

3. **Dead End Clamps/ Anchor Clamps**

The covered conductors shall be suitable to be tensioned using the tension insulator string with bolted/wedge type tension clamp. The bolted type covered conductor tension clamps are made of aluminum alloy and suitable for fixing to the 16mm type ”A” pin of the ball and socket type disc insulators conforming to IEC 60120/ IEC 383. The purpose of terminating covered conductors over the covering fitting shall include, but are not limited to the cone, bolted or wedge type clamp and preformed helical fittings. The fittings shall be able to withstand the specific minimum failure load (SMFL) and shall not damage the covering and shall be designed to prevent the ingress of moisture during service.

4. **Preformed Ties/ Composite Ties**

Preformed ties/ Composite ties shall be used for attaching 100 sq mm AAAC XLPE covered conductors to pin insulators either for straight line position or angle position. The ties for HV covered conductor shall be composite prefabricated type with a white rigid PVC rod covered by a black resistive conductive layer, no metal parts are allowed. Ties shall be used without removing the sheath of covered conductors. They shall combine the necessary mechanical holding function with protection of the conductor sheath from long term deterioration caused by electrical stress. The electrical integrity of covered conductor/ insulator system shall be maintained.

5. **Mid Span Full Tension Joints**

Mid span full tension joints are intended to ensure mechanical and electrical connection between two lengths of same cross section of bare conductors.

Each mid-span full tension joint comprises one aluminum alloy sleeve and a galvanized steel sleeve allowing the hexagonal compression on conductor core and one water tightened system heat shrinkable cover to prevent the penetration of water into the covered conductor.

Mid-span full tension joints shall be used for 100 mm2 XLPE AAAC covered conductor. The Mid-span full tension joints shall be hexagonal compression type. These joints guarantee mechanical and electrical features at least equivalent to those of the conductor on which they are installed.

When in use, no conductor failure shall appear next to the mid-span full tension joints and no conductor slip shall appear at tensile load below the nominal breaking load value of the conductor.

6. **Heat Shrinkable Cable End Cap**

The insulated end cable cap shall be suitable for effectively sealing the end terminal of the covered conductors and shall have wet flashover voltage not less than 11 kV. The cap shall be heat shrinkable type and the inner diameter of the cap shall be such that it shall tightly fit to the covered conductors to prevent entry of moisture.

7. **Insulation piercing connectors**

These insulation-piercing connectors are intended to connect two covered conductors with the same or different cross section between them. The main conductor should be stretched or not. The tap connector shall be a bridge constituted by a not stretched linking covered conductor. The insulation piercing connector shall not have losable components that are liable to be lost during installation. The housing shall be made entirely of mechanical and resistant plastic insulation material and no metallic part outside the housing is acceptable except for the tightening system. The housing shall be an integral part of the connector.

The number and the length of the teeth shall be adequate enough to penetrate the relevant covered conductor insulation to establish proper contact without any contract resistance and without the need to strip the covered conductor insulation. To achieve the required water tightness a special rubber seal be provided around the teeth of the present connector. The bolts and washers shall be of corrosion resistant type. The piercing of insulation shall be simultaneous on main and tap conductor when tightening the bolts. Two different types of piercing connectors are used in covered conductor which shall be supplied with two bolts.

Main covered conductor to tap covered conductor with capacity from 50 to 120 sq mm both side

Main bare aluminum conductor to tap covered conductor with capacity main capacity 50 to 120 sq mm bare aluminum and tap covered conductor 50 to 120 sq mm.

8. Tests

8.1 Type tests

The bidder shall submit the type test report along with the Bid. The report shall be issued by a recognized independent testing authority. The tests shall comply with relevant IEC/NFC Standard or the governing standard. The Employer also reserves the right to have tests carried out at his own cost by an independent agency, whenever there is a dispute regarding the quality of supply. In respect of the following fittings, the test shall include, but not limited to the following:

Dead End clamps:

- Tensile (high tension) test
- Aging test
- High temperature test (thermal)
- Low temperature test

Insulation piercing connectors:

- Dielectric strength
- Current carrying capacity of the connector
- Temperature rise at the connector
- Aging tests
- Low temperature test
- Mechanical test
- Electrical heat cycle test

Insulated cable end caps:

- Verification of water tightness
- Aging test

Mid Span Full Tension Joint:

- Dielectric strength
- Aging tests
- Mechanical test

Tests for other fittings and hardware shall be conducted in accordance with the relevant national or international standards.

8.2 Routine tests

Each batch of fittings shall be subjected to routine tests while manufacturing to confirm to the specified standard.

9. Quality Assurance Program

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
iii. The system for purchasing, taking delivery and verification of materials;
iv. The system for ensuring quality of workmanship;
v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
vii. List of manufacturing facilities available;
viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-a-vis the type, special, acceptance and routine tests specified in the relevant standards.

10. Bid Documentation

10.1 The Bidder shall furnish with the Bid two (2) clear copies of the Standard governing fabrication and testing of the fittings and accessories for LV ABC and two (2) clear copies of all other relevant standards referenced therein.

10.2 The Bidder shall furnish two (2) sets of complete description, catalogue, dimensional drawings showing general construction and size of all fittings and accessories.

10.3 The Bidder shall furnish two (2) clear certified copies of type test report for Dead end clamp/Anchor clamp, Mid span full tension joints, IPC and Cable end caps.

10.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

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CHAPTER 3
1. INSPECTION, TESTING AND COMMISSIONING

1.1 SCOPE OF WORK

The whole of the Works supplied under the Contract shall be subject to inspections and tests by the Employer or their Representatives and/or third party inspectors during manufacture, erection and after completion. The inspections and tests shall include, but not be limited to, the requirements of this section of the Specifications.

The Contractor shall provide all costs, appliances, apparatus, supervision, labor and services necessary to carry out all tests, unless specifically stated otherwise.

The Contractor shall furnish the detailed schedule of his commissioning plan at least one month prior to the scheduled date. The schedule shall include the commissioning procedures, testing sequences and details of special testing equipment, tests and commissioning record formats, information about relevant standards etc.

The scope of the commissioning program includes the site testing and putting into successful operation of all the equipment supplied under the Contract, for 1kV, AC plants and all secondary voltages systems. Testing of energy meters and certification of their accuracy shall also be included (if applicable)

1.2 OBJECTIVES

The objectives of commissioning work, prior to the successful energization of Plant at full voltage and connection to the system, are the following:

- Confirm the integrity (correctness) of installation.
- Confirm the integrity of insulation, connections and phasing.
- Ensure proof of equipment characteristics.
- Review workmanship.
- Confirm the correct implementation of the design.
- Check equipment ratings.
- Check and measure resistivity of earthing system.

1.3 QUALITY ASSURANCE, INSPECTION AND TESTING

To assure that the supply and services under the scope of this Contract whether manufactured or performed within the Contractor’s works or at his subcontractor’s premises or at the Site or at any other place of work, are in accordance with the Specifications, the Contractor shall adopt suitable quality assurance program to control such activities at all points necessary. Such program shall be outlined by the Contractor and shall be finally accepted by the Employer after discussions before the award of the Contract. A quality assurance program of the Contractor shall generally cover, but not be limited to the following:

(a) His organization structure for the management and implementation of the proposed quality assurance program.

(b) Documentation control system.
(c) Qualification data for bidder's key personnel.
(d) The procedure for purchases of materials, parts, components, and selection of subcontractors' services including vendor analysis, source inspection, incoming raw materials inspection, and verification of materials purchases.
(e) System for shop manufacturing including process controls and fabrication and assembly controls.
(f) Control of non-conforming items and system for corrective actions.
(g) Control of calibration and testing of measuring and testing equipment.
(h) Inspection and test procedure for manufacture.
(i) System for indication and appraisal of inspection status.
(j) System for quality audits.
(k) System for authorizing release of manufactured products to the Employer.
(l) System for maintenance of records.
(m) System for handling storage and delivery.
(n) A quality plan detailing out the specific quality control procedure adopting for controlling the quality characteristics relevant to each item of supply.

The quality plan shall be mutually discussed and approved by the Employer after incorporating necessary corrections by the Contractor as may be required.

1.4 Quality Assurance Documents

The Contractor shall be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of Employer's inspection of material/equipment.

The Employer, through his duly authorized representatives, reserves the right to carry out Quality Audit and Quality Surveillance of the systems and the procedures of the Contractor's and the subcontractor's Quality Management and Control Activities.

1.5 Inspection, Testing and Inspection Certificates

The provisions of the clauses on Test and Inspection of the General Conditions of Contract and Special Conditions of Contract shall be applicable to the supply and erection portions of the Works. The Employer shall have the right to re-inspect at his expenses, any material though it would have been previously inspected and approved by him at the Contractor's works before, and if, after the same are inspected at Site following the latter, material is found defective, then the Contractor shall bear the cost of this inspection and reinstatement according to specification.

1.4 TESTS AT MANUFACTURERS WORKS

1.4.1 General

Where no specific test is specified, then the various items of materials and equipment shall be tested in accordance with the relevant British, IEC, or American Standards. Where no appropriate standard is available, tests shall be

carried out in accordance with the maker's standard practice, which shall be subject to the Employer's approval.

At least fourteen days' prior notice, in writing or by tele-fax, shall be given to the Employer of the readiness of the plant for test or inspection and every facility shall be provided by the Contractor and sub-Contractor (s) to enable the Employer or their Representative and/or third party inspectors to carry out the inspections and witness the tests. This includes progress, test rig and packing inspections also.

Inspection of equipment will not be carried out unless the Employer has approved copies of the relevant sub-orders, drawings and test procedures. No equipment shall be packed, prepared for shipment, or dismantled for the purpose of packing for shipment, unless it has been satisfactorily inspected, or inspection has been waived by the Employer.

The extent and method of recording the results shall be agreed by the Employer in sufficient time to enable the tests to be satisfactorily witnessed or to make any changes to the proposed program of tests. All instruments and apparatus used in the performance of the tests shall be subject to the approval of the Employer and, if required by the Employer, shall be calibrated to an agreed standard at a laboratory of national standing to be nominated by the Contractor and approved by the Employer. The costs of carrying out such calibration shall be borne by the Contractor in all cases.

The costs of making/performing any test shall be borne by the Contractor. This shall apply to tests performed at the site or elsewhere.

After receiving the prior information about the completion of manufacturing at the factory, the Employer will depute his personnel to the Contractor's factory to witness the fabrication, assembly and testing of any or all parts of major equipment. The number of the Employer's personnel and equipment to be witnessed will be as listed below. The duration of such visits shall be as per inspection/testing requirements.

- Steel Tubular Poles and accessories
- ACSR Conductor
- AAAC Conductors
- Distribution transformers
- Disc and Pin Insulators
- LV ABC cable and accessories
- Lightning arresters
- DO Fuse Set, Fuse Element
- MCCB and Panel Board

1.4.2 Test Certificates

Within 30 days of the completion of any test, triplicate sets of all principal test records, test certificates and performance curves shall be supplied to the Employer.

These test records, certificates and performance curves shall be supplied for all tests, whether or not they have been witnessed by the Employer or his

representative. The information given on such test certificates and curves shall be sufficient to identify the material or equipment to which the certificate refers and should also bear the Contract reference title. Specified requirements shall be shown on each certificate for comparison with actual test results.

When all equipment has been tested, test certificates of all factory and site tests shall be compiled by the Contractor into volumes and bound in an approved form complete with index. Three copies of each volume shall be supplied to the Employer.

1.4.3 Type Tests

Type tests are required to prove the general design of the equipment and the Contractor may submit certificates of such design tests, which have been carried out on identical equipment. Notwithstanding any provision in BS, IEC or ANSI Standards, the Employer shall have the right to accept such certificates in lieu of the specified type tests or to reject them.

The type tests prescribed shall be carried out at the Contractor's cost in all cases, where either such certificates are not available or are rejected by the Employer.

1.5 RESPONSIBILITIES

To ensure that the test jurisdiction and transfer of responsibilities is regulated by strict safety and handover procedures, the Contractor agrees the interface with the Employer to establish and implement handover procedures consistent with the terms of these Specifications.

The Employer shall retain full jurisdiction over all commissioning activities, which may affect the operation of the existing system. In these circumstances and when so requested, shall provide technical advices and assistances.

The Contractor shall be responsible for technical guidance and assistance in establishing the scope and method of tests, witnessing of the testing, assessment of results, and re-negotiation of the changes in test schedules which may be necessary as a result of other circumstances, such as delays in the delivery, possible equipment failures.

1.6 SAFETY PROCEDURES

The Contractor shall share the responsibility for safety procedures with the Employer. The Contractor shall establish and implement a work permit and tagging system and associated safety procedures (subject to the review of Employer) for all equipment, systems and areas not covered by the Employer’s safety procedures.

The Employer will assume responsibility for the establishment and implementation of tagging, safety and work permit procedures for the protection of personnel and equipment, as soon as equipment and systems are connected to or are energizeable from the existing system.

1.7 COMMISSIONING STAFF

The Contractor shall provide commissioning personnel including skilled and unskilled labor as required. Submit a list with names, experience and proposed duration of the stay of key personnel on site, consistent with the construction schedule, along with the commissioning program.

Ensure that only staffs assigned to commissioning fulfills that duty for the duration of the assignment.

Ensure that commissioning staffs have authorization, and the competence, to undertake minor repairs or to make temporary redesigns and to reconnect systems to meet the specified system performance to preclude delays in energization and putting into commercial service of any part of the works.

1.8 TEST EQUIPMENT

The Contractor shall ensure that all instruments, tools and other equipment required for testing and commissioning are available on site, ensure that the test equipment is of satisfactory quality and condition and, where necessary, is calibrated by an approved authority or standard.

Make arrangements for the provision of power supplies for testing with necessary vector configuration, voltage and current rating.

1.9 COMMISSIONING PROGRAM

Prepare a commissioning program for approval by the Employer and for incorporation into the Project master construction program. Allocate adequate time in this program to permit full commissioning of all components.

Carry out all testing during normal working hours as far as practicable. Tests, which involve existing apparatus and system outages, may be carried out outside normal working hours. Give the Employer sufficient notice to allow for the necessary outage arrangements to be made in conformity with the testing program. Note that no tests listed in the agreed program will be waived except upon the instructions or consent of the Employer in writing.

1.9.1 Test Procedures

The following basic tests, in addition to others, shall be carried out:

- Measurement of insulation resistance.
- AC withstand voltage test

1.9.2 Requirements for Field Tests

The field tests shall be carried out in presence of Employer under the following conditions:

AC withstand test voltages for conductors and outdoor equipment shall be normal operation voltage of the transmission line and, withstand voltage test shall be carried out for ten (10) minutes by the normal voltage mentioned above. The field tests shall be carried out by the Contractor after adjustment of all the equipment have been completed.

Expandable and lead wires and other materials required for the field tests shall be arranged by the Contractor. The Contractor shall be responsible for providing all measuring instruments, test equipment and tools required for the tests.

Preparation of the test record sheets and test reports shall be the responsibility of the Contractor and the results of the field tests shall be submitted by the Contractor for Employer's approval.

Measurement of insulation resistance of the equipment shall be performed by at least 1000 V megger.

After completion of the measurement of insulation resistance mentioned above, ac withstand voltage test shall be performed by the normal operation voltage of the existing power system.

Submit test procedures, consisting of detailed test methods and samples of the related test record forms, for all equipment to be tested, to the Employer for approval along with the commissioning program. Strictly adhere to these procedures for the commissioning tests.

1.9.3 Records

Maintain an up-to-date record of all commissioning activities on site.

Record the results of the tests clearly on forms and formats approved by the Employer and with clear references to the equipment and items tested, so that the record can be used as the basis for maintenance tests, in future. Submit the required number of site test records to the Employer as soon as possible after completion of the tests.

Record the details of the test equipment and instruments used in the test sheets, in those cases where the instrument or equipment characteristics can have a bearing on the test results.

1.9.4 "As-Built" Drawings

Keep an ongoing record of all changes on a master set of drawings. Produce and supply a minimum of three complete sets of marked-up "As Constructed/As-Built" drawings before leaving the Site. Correct and re-issue the original drawings as soon as possible as per this specification.

Chapter 4

TECHNICAL DATA SHEET

(Guaranteed Technical Particulars)

Item No. 1: Steel Tubular Poles

(To be completed by Bidder)

Tubular Steel Poles

S.No.	*Description*	*Unit*	*10m.*	*8m.*
a)	Manufacturer			
b)	Governing Standards for tubing Manufacturing and Testing			
c)	Governing Standard for Galvanization			
d)	Copies of Standards Attached?	**Yes/No**		
e)	Overall Length (m)			
f)	Sections details:			
	(i) Length, m			
	Top (h1)			
	Middle (h2)			
	Bottom (h3)			
	ii) Outside Diameter, mm			
	Top (h1)			
	Middle (h2)			
	Bottom (h3)			
	iii) Thickness, mm			
	Top (h1)			
	Middle (h2)			
	Bottom (h3)			
	Approximate weight, Kg			
	Criplling load, kgf			
	Application of load from top of pole, m			

Item No.2: Pre-stressed Concrete Pole

(To be completed by Bidder)

Item No. 2. : ACSR

(To be completed by bidder)

Item	*Description*	ACSR Conductor	*Unit*
1.	Manufacturer		
2.	Governing Standards		
3.	Copies of Standards Attached:	Yes/No	
4.	Copies of type test attached?	Yes/No	
5.	If standards is not BS:215(Part II) are conductor specifications same as the BS:215 requirements in respect of the following?:		
	Diameter	Yes/No	
	Strand size	Yes/No	
	Direction of lay	Yes/No	
	Lay ratio	Yes/No	
	Materials	Yes/No	
6.	Technical data:		
		Dog	
	Nominal diameter (mm)		
	Stranding (Al/Steel)		
	Breaking strength (kN)		
	Mass (kg/km)		
	Resistance at 20^{o} C		

Item No. 3. : AAAC

(To be completed by bidder)

Item	*Description*	AAAC Conductor	*Unit*
1.	Manufacturer		
2.	Governing Standards		
3.	Copies of Standards Attached:	Yes/No	
4.	Copies of type test attached?	Yes/No	
5.	If standards is not BS:215(Part II) are conductor specifications same as the BS:215 requirements in respect of the following?:		
	Diameter	Yes/No	
	Strand size	Yes/No	
	Direction of lay	Yes/No	
	Lay ratio	Yes/No	
	Materials	Yes/No	
6.	Technical data:		
		100 sqmm	55 sqmm
	Nominal diameter (mm)		
	Stranding (Al/Steel)		
	Breaking strength (kN)		
	Mass (kg/km)		
	Resistance at 20^{o} C		

Item No. 3. : AAAC Conductor Assessories

(Clause by Clause Compliance be submitted by the bidder)

Item No. 4 : Distribution Transformer

(To be completed by bidder)

Item	Description	(11/0.4 kV, 25, 50, 100 & 200 KVA)
1.	Manufacturer	
2.	Copies of IEC standards attached?	Yes/No
3.	Copies of type test for each rating attached?	Yes/No
4.	Copies of outline drawings for each size attached?	Yes/No
5.	Winding material:	_____
6.	Primary Winding BIL	_____kV
7.	Primary Bushing BIL	_____kV
8.	Accessories listed below furnished?	
	a) Lower oil filter valve	Yes/No
	b) Liquid level guage	Yes/No
	c) Lifting lugs	Yes/No
	d) Hand hole	Yes/No
	e) Tank earthing terminal	Yes/No
	f) Overload protection If yes, details attached?	Yes/No Yes/No

9. Testing facilities available

Description	Name of the test equipment/facility
a) Applied voltage test	
b) Induced voltage test	
c) No load loss and excitation current test	

d) Impedance voltage and load loss tests

e) Resistance measurement

f) Ratio tests

g) Polarity and phase relation tests

h) Leakage tests

i) Insulation resistance tests

10. Design information

Rated kVA (IEC rating), kVA……..
Number of phases ….....……..
Frequency, Hz .....
Voltage ratio at no-load , kV.....
Winding connections.....

Type of core sheet……

Magnetising current at normal ratio:
hv, Amp …….
lv, Amp ……..

Maximum flux density in core iron at normal
voltage and frequency based on the net section of iron:
Cores, T ……
Yokes, T ……..

Type of winding:
hv .. ……..
lv …….

Maximum current density in winding at rated power:
hv, Amp/mm^2 …….
lv, Amp/mm^2 ……..

Type of insulation used for:
hv winding …….
lv winding ……..

No-load loss at normal voltage ratio and 75^{o}C, Watt .....
Load loss at rated current and at 75^{o}C, Watt .....

Regulation at 75°C and rated power as a percentage of normal voltage:
at 1 p.f, % ……

qt 0.8 p.f, % …….

Impedance voltage at 75°C and rated power:
at normal tapping,% ……..
at -5% tapping % ……
at +5% tapping % ……

Efficiency at 1 p.f 125% and rated current, % .....
Efficiency at 1 p.f 100% and rated current, % .....
Efficiency at 1 p.f 75% and rated current, % .....
Efficiency at 1 p.f 50% and rated current, % .....
Efficiency at 1 p.f 25% and rated current, % .....
Temperature rise at rated kVA by
Thermometer in oil .....
Temperature rise at rated kVA by
resistance of windings .....
Permissible overload .....
Transformer insulating oil specification ……...
Total volume of insulating oil at 20°C, litre ……..…
Effective expansion capacity of conservator, litre …….

11 Approximate weight and dimensions

Transformer core and windings, kg.....
Tank and fittings, kg.....
Oil , kg.....
Total weight, kg.....
Thickness of tank sides, mm ……
Thickness of tank bottom, mm ……
Thickness of radiator, mm……
Approximate dimensions including fittings:

Overall length, mm.....
Overall width, mm.....
Overall height, mm.....

Item No. 5. : Pin Insulator

(To be completed by bidder)

Item		Pin Insulator	
Description		*Unit*	
1.	Manufacturer		
2.	Catalogue/ Dimensional drawings		Yes/No
3.	Governing Standards		
4.	Copies of Standards Attached:		Yes/No
5.	Copies of type test attached ?		Yes/No
6.	Marking as per specifications		Yes/No
7.	Ratings:		
	Highest System Voltage	kV	
	Rated Voltage	kV	
	Creepage Distance (min)	mm	
	Wet Power Frequency Withstand Voltage	kV	
	Impulse Withstand Voltage	kV	
	Puncture Power Frequency Voltage (min)	kV	
	Visible Discharge Voltage (Effective)	kV	
	Cantilever Strength	kN	
	G.I. Pin Head		

Item No. 6. : Disc Insulator

(To be completed by bidder)

	Item *Description*	Disc Insulator *Unit*	
1.	Manufacturer		
2.	Catalog/Dimensional drawings		Yes/No
3.	Governing Standards		
4.	Copies of Standards Attached:		Yes/No
5.	Copies of type test attached?		Yes/No
6.	Marking as per specifications		Yes/No
7.	Ratings:		
	Highest system Voltage	kV	
	Rated Voltage	kV	
	Porcelain Diameter (min)	kV	
	Spacing	mm	
	Creepage Distance (min)	mm	
	Power Frequency Puncture Withstand Voltage	kV	
	Wet Power Frequency Withstand Voltage	kV	
	Impulse Withstand Voltage	kV	
	Puncture Power Frequency Voltage (min)	kV	
	Visible Discharge Voltage	kV	
	Mechanical Strength	kN	
	Ball and Socket Size Applicable Standard	mm	

Item No. 7. : Stay Insulator

(To be completed by bidder)

	Item	Stay Insulator
	Description	*Unit*
1.	Manufacturer	
2.	Catalog/Dimensional drawings	Yes/No
3.	Governing Standards	
4.	Copies of Standards Attached:	Yes/No
5.	Copies of type test attached?	Yes/No
6.	Marking as per specifications	Yes/No
7.	Ratings:	
	Highest System Voltage	kV
	Rated Voltage	kV
	Creepage Distance (min)	mm
	Minimum Failing Load	kN
	Power Frequency Withstand Voltage, 1 minute:	
	Dry	kV
	Wet	kV
	IS Designation	

Item No. 8. : Insulator Pins

(To be completed by bidder)

	Item	Insulator Pins		
	Description	*Unit*		
1.	Manufacturer			
2.	Type of Steel Used			
3.	Dimensional drawings attached?	Yes/No		
4	Governing Standard			
5.	Copies of Standards Attached:	Yes/No		
6.	Copies of type test attached?	Yes/No		
7.	Ratings and Features:			
		For 11 kV	*For 33 kV*	
	Head Type			
	Total Length (mm)			
	Stalk Length (mm)			
	Shank Length (mm)			
	Minimum Failing Load (kN)			
	Applicable Standard			
	Catalogue Number			
	IS reference			

Item No. 9. : Disc Insulator Fittings

(To be completed by bidder)

	Item	Disc Insulator Fittings
	Description	*Unit*
1.	Manufacturer/Catalogue No.	
2.	Dimensional drawings attached?	Yes/No
3.	Governing Standard	
4.	Copies of Standards Attached:	Yes/No
5.	Copies of type test attached?	Yes/No
6.	Steel Classification	
7.	Aluminum Alloy Tension Clamp	Yes/No
8.	Ferrous parts are galvanized?	Yes/No
9.	Cotter Pins are Stainless Steel?	Yes/No
10.	Ultimate Strength of Clamps	Kn

Item No. 10: Ground (Earth Rods and Clamps)

(To be completed by bidder)

	Item	Ground (Earth Rods and Clamps)	
	Description		*Unit*
1.	Manufacturer		
2.	Material Description furnished?		Yes/No
3.	Governing Standard for manufacturing and testing		
4.	Governing Standard for galvanization		
5.	Standards attached?		Yes/No
6.	Catalogue/ dimensional drawings attached for all items?		Yes/No
7.	Dimensions (Ground Rod):		
	Length	mm.	
	Diameter	mm.	
8.	Catalogue number		
	Rod		
	Clamp		
9.	Copies of type test results attached?		Yes/No

Item No. 11 : Grounding Conductor

(To be completed by bidder)

	Item	Grounding Conductor
	Description	*Unit*
1.	Manufacturer	
2.	Governing Standard for manufacturing and testing	
3.	Governing Standard for galvanization	
4.	Standards attached?	Yes/No
5.	Diameter	mm
6.	Cross Section	sq. mm
7.	Short time fusing 30 cycles	Amps
8.	Weight (Approx.)	kg/km
9.	Resistance 20 degree C (Approx.)	ohms/km

Item No. 12 : Compression Connectors

(To be completed by bidder)

	Item	Compression Connectors	
	Description	*Unit*	
1.	Manufacturer		
2.	Material Description furnished?		Yes/No
3.	Governing Standard for manufacturing and testing		
4.	Standards attached?		Yes/No
5.	Catalogue/ dimensional drawings attached?		Yes/No

Item No. 13 : LV ABC Cable

(To be completed by Bidder)

	Item	LV ABC			
	Description	*Unit*			
1.	Manufacturer				
2.	Catalogue/ drawings		Yes/No		
3.	Governing Standards				
4.	Copies of Standards Attached:		Yes/No		
5.	Copies of type test attached?		Yes/No		
6.	Rated Voltage		kV		
7.	No. of Cores				
8.	Conductor				
9.	Nominal cross-sectional area	mm2	95	50	25
10.	Diameter of conductor				
	-minimum	mm			
	-maximum	mm			
11.	Minimum breaking load of conductor	kN			
12.	Minimum breaking load of cable	kN			
13.	Min. thickness of XLPE insulation at any point (excluding ribs)	mm			
14.	Max. thickness of XLPE insulation at any point (excluding ribs)	mm			
15.	Maximum overall diameter of the core (excluding ribs)	mm			
16.	Approximate net weight per meter	kg			
17.	Max. continuous current carrying capacity per phase	A			
18.	**Maximum conductor dc resistance at 20 deg. C**	**MΩ/km**			
19.	**Maximum conductor ac resistance at 80 deg. C**	**MΩ/km**			
20.	**Positive sequence reactance of cable at 50 Hz**	**M Ω/km**			
21.	**Minimum insulation resistance**	MΩ-km			

Item No. 14 : Stay Set

(To be completed by Bidder)

Item Stay Set

	Description	*Unit*	*Stay Set (19 mm.)*	*Stay Set (16 mm.)*
1.	Manufacturer			
2.	Catalog Numbers			
3.	Steel Classification			
4.	Governing Standard for galvanization			
5.	Load rating, kg.			
6.	Type tests-tensile load data attached?		Yes/No	Yes/No
7.	Type test-bend test data attached ?		Yes/No	Yes/No
8.	Dimensional drawing attached?		Yes/No	Yes/No

Item No. 15 : Steel Wire Strand

(To be completed by Bidder)

	Item		Steel Wire Strand	
	Description	*Unit*	*7/8 SWG*	*7/12 SWG*
1.	Manufacturer			
2.	Strand diameter (overall)	mm		
3.	No. of Strands			
4.	Minimum Breaking load	kg		
5.	Nominal diameter of coated wire in strand	mm		
6.	Left hand lay	Yes/No		
7.	Governing Standard for manufacturing and testing	Yes/No		
8.	Governing Standard for galvanization			
9.	Standards attached?	Yes/No		

Item No. 16 : Galvanized Steel Nuts and Bolts

(To be completed by Bidder)

Item Galvanized Steel Nuts and Bolts

	Description	*Unit*
1.	Manufacturer	
2.	Material Description furnished?	Yes/No
3.	Governing Standard for manufacturing and testing	
4.	Governing Standard for galvanization	
5.	Standards attached?	Yes/No
6.	Catalog numbers attached for all items?	Yes/No

Item No. 17 : Performed Wire Products

(To be completed by Bidder)

	Item	Preformed Wire Products	
	Description		*Unit*
a)	Pin Insulator Tie		
1.	Manufacturer		
2.	Material Description furnished?		Yes/No
3.	Aluminum-clad steel wire		Yes/No
4.	Governing Standard for manufacturing and testing		
5.	Standards attached?		Yes/No
6.	Catalog numbers attached for all items?		Yes/No
7.	Bidder certifies that all items offered are suitable for use with 100, 55 & 30 sq. mm. AAAC		Yes/No
8.	Bidder certifies that all items offered are suitable for use with insulators specified SPECIFICATION- SP3.1.1		Yes/No
9.	Holding strength:		Kilograms
	sizes	*100 sq.mm*	*55 sq.mm*
	Top Tie		
	Double Support Top Tie		
	Side Tie		

Double Side Tie

b) Steel Wire Strand Grip

1.	Manufacturer	
2.	Material Description furnished?	Yes/No
3.	Governing Standard for manufacturing and testing	
4.	Governing Standard for galvanization	
5.	Standards attached?	Yes/No
6.	Catalogue numbers attached for all items?	Yes/No
7.	Bidder certifies that steel strand grip offered is suitable for use with insulator, stay set and stay wire specified in SPECIFICATIONS: SP3.1.1, SP3.2.1 and SP3.2.2 respectively	Yes/No
8.	Holding rating of grip	kg
	a) 7/8 SWG	
	b) 7/12 SWG	

Item No. 18 : Compression Connectors

(To be completed by Bidder)

Item Compression Connectors

	Description	*Unit*
1.	Manufacturer	
2.	Material Description furnished?	Yes/No
3.	Governing Standard for manufacturing and testing	
4.	Standards attached?	Yes/No
5.	Catalog/ dimensional drawings attached?	Yes/No

Item No. 19 : Cross-arm and angle

(To be completed by Bidder)

Item Cross-arm and angle

	Description	*Unit*
1.	Manufacturer	
2.	Steel Classification	
3.	Minimum tensile strength of steel	
4.	Is the cross arm and angles fabricated from hot-rolled steel sections?	Yes/No
5.	Governing Standard	
6.	Standard attached?	Yes/No
6.	Governing Standard for galvanizing	
7.	Drawings of cross arm and bracing?	Yes/No

Item No. 20 : Flat cross-arm brace

(To be completed by Bidder)

	Item	Flat cross-arm brace
	Description	*Unit*
1.	Manufacturer	
2.	Steel Classification	
3.	Minimum tensile strength of steel	
4.	Is the flat cross arm brace fabricated from hot-rolled steel sections?	Yes/No
5.	Governing Standard for manufacturing and testing	
6.	Governing Standard for galvanizing	
7.	Standards attached?	Yes/No
8.	Drawings of flat cross arm brace?	Yes/No

Item No. 21: Transformer Platform

(To be completed by the Bidder)

	Item	Transformer Platform
	Description	*Unit*
1.	Manufacturer	
2.	Preliminary details dwg. furnished?	Yes/No
3.	Steel Classification/ Characteristics furnished?	Yes/No
4.	Governing Standard for galvanization	
5.	Vertical Load on pole	
6.	Resultant Safety Factor	
7.	Resultant Deflection at design load	mm
8.	% of allowable tension	
9.	% of allowable compression	
10.	% of allowable shear limits	

Item No. 22: Pole Clamps

(To be completed by Bidder)

Item Pole Clamps

	Description	*Unit*
1.	Manufacturer	
2.	Steel Classification	
3.	Governing Standard for galvanization	
4.	Drawings of Pole Clamp furnished?	Yes/No

Schedule of Guaranteed Technical Particulars for Lightining Arrester

(To be filled by the Bidder for the offered Arrester)

1)	Name of manufacturer and country of origin		
2)	Rated voltage	(kV)	
3)	Maximum continuous operating voltage (MCOV)	(kV)	
4)	Whether Type Test Reports as per cl. 10.2 is furnished	(Yes/No)	
5)	Classification of arrester As per IEC 60099-4		
6)	Arrester housing;		
	a) Material		
	b) Insulation withstand level		
	i) Lighting impulse (1.2/50js) withstand voltage	(kV peak)	
	ii) Power frequency wet withstand voltage	(kV)	
	c) Total creepage distance	mm	
7)	High current impulse (4/10|js) withstand level	(kA peak)	
8)	Standard nominal discharge current (8/20js)	kA	
9)	Energy absorption Capability (with 4/10 wave shape) at U_c	kJ/kV	
10)	Steep current (1/20js) maximum impulse residual voltage	(kV peak)	
11)	Maximum residual voltage at 10kA for (8/20js)	(kV peak)	
12)	Switching impulse (30-100/60-200js) maximum residual voltage	(kV peak)	
13)	Pressure relief class (Minimum prospective symmetrical fault current)	kA	
14)	Arrester terminals		
	a) Type of material		
	b) Applicable conductor size.	mm^2	
15)	Dimensions/ Approximate weight of LA	(mm x mm), kg	
16)	Insulating Bracket		
	a) Power frequency withstand voltage	(kV)	
	b) Cantilever strength	(Nm)	
17)	Whether the arrester earth lead for disconnector provided;	Yes/No	
18)	Whether the power frequency withstand voltage versus time characteristics curve as per class 10.1(c)	Yes/No	
19)	Whether the ISO 9001 Certificate as per Clause 7.0 is furnished	Yes/No	
20)	Whether the acceptance tests as per Clause 12.2 will be carried out at the time of inspection Place of testing	(Yes/No)	
	Whether the rating plate marking as per Clause 9.1 provided.	Yes/No	

Seal and Signature of the Manufacturer:

Date:

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR DROPOUT FUSE CUTOUTS

(To be filled by the Bidder for each type)

			12 kV	36 kV
A	Name of Manufacturer & Country of Origin			
B	Class Designation			
C	Model/Catalogue No			
D	Rated Voltage	kV		
E	Rated continuous current	A		
F	Rated frequency	Hz		
G	Mounting Angle to the vertical	deg		
H	Type, Size and Material of			
	i) Upper Terminal Clamps			
	ii) Lower Terminal Clamps			
	iii) Moving Contacts			
	iv) Fixed Contacts			
I	Temperature rise for Contacts			
	1) Upper	°C		
	2) Lower	°C		
	Temperature rise for Terminals	°C		
	1) Upper	°C		
	2) Lower	°C		
J	Symmetrical / Asymmetrical (rms) interrupting rating at specified X/R ratio	kA		
K	Insulation level Dry Impulse withstand voltage 1.2/50 ^s peak (positive & negative polarity)			
	i) Across the isolating distance of the fuse base	+kV		
		-kV		
	ii) To earth and between poles	+kV		
		-kV		
	Dry and wet 1 min. Power frequency (50 Hz) withstand voltage kV rms.			
	i) Across the isolating distance of the Fuse base - Dry	kV		
	Across the isolating distance of the Fuse base -Wet	kV		
	ii) To earth and between poles -Dry	kV		
	To earth and between poles -Wet	kV		
L	Total creepage distance	mm		
M	Type of Mounting Bracket			
N	Galvanizing thickness	mm		
O	Type Test Certificates conforming to Clause 9.2 furnished	Yes/		
P	Fuse Carrier Length " L" as per Drawing 1	mm		

Seal & Signature of the Manufacturer/Bidder

Date