TECHNICAL SPECIFICATION

FOR

11 KV AIR BREAK SWITCH WITH EARTH BLADE (11KV ABEB Switch)

With FRP base Channel:

:: TECHNICAL SPECIFICATION NO::

Sr.No	Technical Specification No./Revision	Date of revision
1.	**GUVNL/GPRD/TS/RP-014/ABEB/R1**	18/07/2018
2.		
3.		

Signature of Tenderer Company's Round Seal Date: Place:

1. SCOPE :

This specification covers design, manufacturing, testing at manufacturer's works, inspection, packing & delivery of single pole mounted 11 KV Air Break Switch with the Earth Blade; with accessories mounted on FRP base Channel for out-door installation for use on, various 11 KV feeders in Gujarat State.

1.1 It is not the intent to specify completely herein all the details of design and construction of Air Break Switches with the Earth Blade. However, ABEB Switches will confirm in all respects to high standards of engineering design and workmanship and shall be capable of performing in continuous Commercial operation. In a manner acceptable to the purchaser, who will interpret the meanings of drawings and specifications and shall have the power to reject any material, which in his judgment, is not in accordance with the specifications/drawings.

The ABEB Switches offered shall be complete with all components necessary for its effective and trouble-free operation during its service period, along with associated equipment etc. Such components shall be deemed to be within the supplier's scope, irrespective of whether those are specifically brought out in the specification and/or in order or not. Also, similar parts, particularly removable ones, shall be inter-changeable.

2. SCHEDULE OF REQUIREMENT :

The detailed requirement of 11 KV ABEB Switches to be supplied against the specification are given in Schedule 'A'.

3. APPLICABLE STANDARDS:-

1. IS 9920 (Part 1 to 4)/1981 with latest Amendment if any.
2. IS 9921 (Parts 1 to 5) Specification for AC disconnector and earthing switches for voltages above 1000 V.
3. IS 2633/1986 with latest amendment if any and other relevant IS number mentioned in the specification
4. IS 2544/1973 with latest amendment, if any
5. IEC: 61109 with latest amendment if any.
6. IEC60129/IEC62271-103/IS 9921 - Alternating current disconnector (Load break isolators) and earthing switch
7. IEC 60265-1/IS 9920:1988- High voltage switches.
8. IS 6746 – Unsaturated polyester Resin System
9. ASTM D792. "Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement."

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10. ASTM D4475. “Standard Test Method for Apparent Horizontal Shear Strength of Pultruded Reinforced Plastic Rods by the Short Beam Method.”
11. ASTM D5028. “Standard Test Methods for Curing Properties of Pultrusion Resin by Thermal Analysis.”
12. ASTM D4476. “Standard Test Method for Flexural Properties of Fiber Reinforced Pultruded Plastic Rods.”
13. ASTM D570. “Water Absorption of Plastics.”
14. ASTM D3171. “Standard Test Methods for Constituent Content of Composite Materials.”
15. ASTM D7205. “Standard Test Methods for Tensile Properties of Fiber-Reinforced Polymer Matrix Composite Bars.”
16. ASTM D7617. “Standard Test Method for Transverse Shear Strength of Fiber-Reinforced Polymer Matrix Composite Bars.”
17. ASTM E831. “Standard Test Methods for Linear Thermal Expansion of Solids Materials by Thermo-Mechanical Analysis.”
18. ASTM D3418. “Standard Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry.”
19. ASTM D7705. “Standard Test Method for Alkali Resistance of Fiber Reinforced Polymer (FRP) Matrix Composite Bars used in Concrete Construction.”
20. ASTM D2344. “Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates.”
21. ASTM D3039. “Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials.”
22. BS – 476- Various parts for FRP

4. NORMAL SERVICE CONDITIONS :

TheABEB Switches to be supplied against this specification shall be suitable for satisfactory continuous operations under following tropical conditions.

1. Ambient Air Temperature : 40° C
2. Maximum ambient air temperature : 50° C
3. Maximum air temp. in shade : 45° C
4. Minimum air temp. in shade : 0° C
5. Relative humidity in percentage : 10 to 100
6. Maximum annual rainfall : 1500 mm
7. Wind Pressure (Max.) : 100 Kg/n2

8.	Maximum altitude above sea level	: 1000 Meters
9.	Normal climate	: Moderate hot and humid and polluted by dust & smoke.

As the Gujarat state is having large area,with a long seashore having saline atmosphere. The ABEB Switches, if installed in such area, shall be able to function satisfactorily.

5. GUARANTEED TECHNICAL PARTICULARS (G.T.P):

The 11 KV ABEB Switches covered in this specification shall meet the guaranteed technical particulars mentioned in Annexure 'A'.

6. Distribution Network Electrical Parameters

The main parameters of the distribution network are as follows:

Rated Voltage	12 KV
Nominal system voltage:	11 kV (rms)
Highest system voltage:	12 kV (rms)
Number of phases:	3
Frequency:	50 Hz
Variation in frequency:	48.5 Hz to 51.5 Hz
Type of earthing:	Solid
Power frequency withstand voltage:	28 kV
Basic impulse withstand voltage	75 kV

7. CURRENT DENSITY:

Current density to be adopted for all parts of ABEB Switches, terminal connectors and Earthing Blade shall not exceed the following limits.

Copper	:	2.00 Amp. / sq.mm.
Aluminum Alloy	:	1.25 Amp. / sq.mm.
Gun Metal Base	:	1.63 Amp/mm2

8. CONSTRUCTIONAL FEATURES:

The ABEB Switches shall have triple pole construction and shall be suitable for vertical mounting.For 11 KV ABEB Switch, there shall be two 11 KV Polymeric Insulator having minimum 320 CD, mounted on 75 X 40 X 6 mm FRP Channels per phase.

The aforesaid channel with the AB switch shall be mounted on an FRP frame, made of two channel supports. The switch pole shall be operable individually,

i.e. phase wise. The main blade is fixed with an operating hook, where the flower head of the operating rod can be inserted and connect or detach the moving blade, as per the requirement.

The Earth Part shall constitute of a female contact mounted on a moving metallic arm, which can travel 180^0. A construction is made for making alignment with the main blade, so that, when the main blade is in 'OFF' mode, the earth blade female part contactor fixes on it, manually. The metallic base of the earth blade component is solidly earthed in common using a 50X6mm GI strip as per the drawing.

The rating of ABEB shall be suitable for operation on three phase, three wire, 11 KV, 50 cycles, A.C. System with short-time current rating of 20KA for 3 seconds.

8.1 11 KV Polymeric Insulators to be used in manufacturing of ABEB Switches should be confirming to IEC:61109, and as mentioned therein, with the latest amendment.

For 11 KV Polymeric INSULATORS: The Bidder shall submit type test reports as per IEC: 61109 from NABL Approved Laboratory along with the bid.

The supplier will have to offer inspection of Polymeric insulators at works of manufacturer, before offering prototype and lot of the ABEBS witches, at their own cost.

8.2 The AB part Male and female contacts shall be prepared from hard drawn copper strip as per 1897/1983 (with latest amendment, if any).The chemical composition of copper shall be as under :

Element		Percent
1.	Copper (Min.) including silver & oxygen	: 99.90
2.	Bismuth (Max.)	: 00.001
3.	Lead Max.	: 00.005
4.	Total of all impurities excluding silver and Oxygen (Max.)	: 00.003

Further, the ABEB part contacts must be silver plated, with thickness of a coating not less than 2.5 Micron. The male and female contacts from electrolytic copper will have to be mounted on the Gunmetal base.

Gun Metal chemical composition should be as per IS-10472/1983, Grade-II of Table-I and current density of Gun Metal Base should be 1.63 Amp/mm2.

8.3 The spacing between the phases shall be adjustable between 600mm to 700mm (Minimum) for 11 KV switch.

8.4 For the fixing components :

Bolts, Nuts, Washers etc. below 5/8" shall be of electro galvanized or nickel plated and for sizes 5/8" and above shall be of hot dip galvanized in accordance with the IS: 2633 with latest amendment, if any.

8.5 The Switch shall be provided with aluminum lug type terminal connector made of Aluminum material, with the long barrel, long palm with two hole @ 30 mm and bimetallic Plate, suitable as per the requirement of site conductor size.

8.6 **AB Switch with Earth Switch:**

The switch shall consist of 600 Amp rating switches, each with integral earth switches. The switch shall be designed with a specific design, separating the both the mechanism: normal operation and the Earth section; to prevent the main and earth switch being switched "ON" at the same time.

The isolating distance between the OFF and the ON position in the switch should be sufficient to withstand dielectric test as per IS/IEC, so as to have enough isolating distance for ensuring safety during testing and operation.

- Manually Operated 12 KV, 600A switch and Earthing Switch with continuous current rating capacity.
- Termination shall be suitable for the size, up to the size of the dog conductor.

Necessary arrangements are provided on the switch for selecting 'Earth' position. The systems shall prevent the ABEB switch functioning from being operated from the "ON" to "Earth On" position without going through the "OFF" position.

8.7 **Earthing**

The ABEB outdoor switch shall be equipped with an earth bus, securely fixed along the ABEB base.

The size of the earth bus shall be made of IEC/IS standards, with GI Strip. Necessary terminal clamps, and connectors shall be included in the scope of the supply.

All metal parts of the switch, which do not belong to the main circuit and which can collect electric charges causing hazard, shall be connected to the earthing conductor. Each end of the conductor shall be terminated by M 10/equivalent quality and type of terminal, for connection to earth system installation.

One no. of earthing with connecting G.I Stripwith minimum size (size=38mm x 3mm min.) is to be provided as per the ref IS: 3043-1987(2006).

8.8 **Accessories and Spare:**

Spares and accessories shall be supplied along with the main equipment at free of costs.

8.9 **FRP Channel**

FRP Channel shall be manufactured in accordance with NEMA FG-1 and ASTM –E84 /IS-6746 standards and others relevant standards.

Channel shall be made of Glass reinforced Flame retardant vinylester (minimum Glass content 55%) and should be corrosion resistant and Fire retardant (Class 1, Fire rating) in accordance with the latest ASTM E-84/IS-6746. It shall have flame spread rating of 25 or less (class 1 rating) when tested in accordance with ASTM E 84/ASTM D635.

All FRP channels shall be manufactured using the PULTRUSION technology

Glass content shall be maintained between 55% to 60% by weight in all pultruded components.

Composite material shall have ultraviolet light inhibiting chemical additive to resist UV degradation. All pultruded material shall be Nexus (or equivalent) surfacing veil to provide maximum chemical and UV protection.

The Composite FRP channel shall be supplied with Drilling / Perforation as per mention in drawing.

The channel shall be supplied in standard lengths mention as per attached drawings.

The Channel construction shall have high degree of finish and shall be such as to facilitate easy handling as also to ensure easy installation of ABEB without causing damage.

The inside surface shall be perfectly smooth and free from sharp edges, burrs or projections, etc. Only machine Molding is acceptable in both the sides.

The hardware shall conform to NEMA FG-1 and shall be able to withstand the loading.

Tolerance on width and length shall be +/- 6mm and height +/- 2mm for channel.

The Color of channel and its accessories shall be yellow.

8.10 **Technical Specification of ABEB**

1. Nos. of Phases - 3
2. Nos. of Poles - 3
3. Rated Voltage - 12 KV
4. Operating Voltage - 11 KV
5. Rated lightning impulse withstand voltage - 75 KV
6. Rated power frequency withstand voltage - 28 KV
7. Current Carrying Capacity - 600 Amps
8. Short time rating current for 3 Seconds - 20 KA
9. Rated peak withstand current - 50 KA
10. Design adequate separation between 11 KV Side Switch “ON”&Earthing

9. QUALITY CONTROL :

The manufacturers shall assure proper quality control for the manufacture of ABEB Switch, a tolerance of±5% in dimensions is allowed except for current carrying parts. +5% in dimensions is allowed for current carrying parts.

The successful bidder shall invariably furnish following information along with offer/offer of inspection and testing of proto type sample.

I. Statement giving list of important raw materials including but not limited to
   a) Contact material
   b) Insulation
   c) Sealing material

d) Contactor
e) FRP

Name of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.

II. Information and copies of test certificates as in (I) above, in respect of bought out accessories& raw materials.

III. List of areas in manufacturing process, where stage inspections are to be carried out.

IV. Normally carried out for quality control and details of such tests and inspections.

V. Special features provided in the equipment to make it maintenance free.

VI. List of testing equipment available with the Bidder for final testing of ABEB and associated combinations vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in the relevant schedule i.e. schedule of deviations from specified test requirements. The supplier shall, within 15days from the date of receipt of Purchase Order, submit following information to the DISCOM.

a) List of raw materials as well bought out accessories and the names of sub-suppliers selected from those, be furnished along with offer.

b) Necessary test certificates of the raw material and bought out accessories.

c) Quality Assurance Plan (QAP) with the hold points for DISCOM's inspection. The quality assurance plan and hold points shall be discussed between the DISCOM and supplier before the QAP is finalized.

The supplier shall submit the routine test certificates of bought out items and raw material, at the time of routine testing of the fully assembled Switches.

10. TESTING & INSPECTION:-

10.1 TYPE TEST:-

The ABEB switches shall be subjected to the following type tests in accordance with the clause No. 3 of IS-9920 (Part-IV)/1985. (As this being a new item, the bidder may submit type test of 11 KV AB Switch as per the technical specification of any DISCOM of GUVNL)

(i) Tests to prove that the temperature rise of any parts does not exceed the values specified in part-2 of this standard.

(ii) Tests to prove the capability of the switch to carry the rated peak withstand current and the rated short time current.

(iii) Tests to verify the insulation level including withstand tests at power frequency voltages on auxiliary equipment.

(iv) Tests to prove satisfactory operation and Mechanical endurance.

(v) The type test certificate should not be more than 7years old as on due date of opening of tender.

The FRP Pultruded Sections used shall be fully type tested for Mechanical Properties, Electrical Properties, Fire Propagation, low flammability Fire Rating & Specific Optical Density of Smoke as mention above standards. Test certificate confirming the same shall have to be submitted along with the offer.

(vi) Fire Retardancy – Class 1 as per BS – 476 Part- 7

(vii) Flame Spread - <25 as per ASTM E84

(viii) Self-Extinguishing – UL 94 V0

(ix) Oxygen Index Test – Min 29 as per ASTM D 2863

(x) UV Resistance – For 1000 Hours accelerated weather test, with reduction of tensile strength of not more than 7 % exposure to UV as per ASTM G 154.

(xi) Antistatic Property – Resistivity < 10^6 As per ASTM D 257

(xii) Glow Wire Test - As per IEC 60695-2-12-2000 for 960 deg C

(xiii) Moisture absorption - Max. 0.6% - 24 hrs test as per ASTM D 570/ IS 6746 Annexure K

All the Type Tests shall be carried out from Laboratories which are accredited by the National Board of Testing and Calibration Laboratories (NABL) of Govt. of India such as CPRI, ERDA, ERTL, CIPET to prove that the FRP Pultruded Sections meets the requirements of specification.

Type Test Reports conducted in manufacturers own laboratory and certified by testing institute, shall not be acceptable.

10.2 **ROUTINE TEST:**

The following routine test as outlined in clause No.4 of IS: 9920 (Part-4/1985) shall be carried out by the manufacturer on each unit to check certain essential requirements.

i) Power frequency voltage dry tests.
ii) Measurement of the resistance of the main circuit.
iii) Test to prove satisfactory operation.
iv) Loading Test – Minimum 300 KG Uni directional Load withstand Capacity for FRP and additional conc. Load of 70 Kg with a safety factor of 2 should be placed at mid span of channel and the channel should not break or crack.
v) Deflection – Not occurs after loading given
vi) Glass Content - Min 55 %
vii) Oxygen Index Test – As per ASTM D 2863
viii) Fire Retardancy – As per Standards

10.3 **ACCEPTANCE TESTS :**

The following acceptance test shall be carried out as per IS: 9920 (P4/1985) on number of samples selected from the offered lot.

(i) Visual Inspection.
(ii) Checking of Dimensions (of all parts as per the approved drawing).
(iii) Power frequency voltage dry test in accordance with Cl. No.4.1 of IS9920 (p-4).
(iv) Measurement of the resistance of the main circuit in accordance with Cl.4.2 of IS: 9920 (P-4).
(v) Test to prove satisfactory operation in accordance with Cl. No.4.3 of IS 9920 (Part-4).
(vi) Galvanizing test as per IS: 2633.
(vii) Temperature rise test in accordance with Cl.3.2 of IS: 9920 (Part-4) (only on one set of sample for each lot).

The temperature rise shall not exceed the maximum limit specified. The Switch shall be mounted approximately under the usual service conditions and shall be protected against undue heating or cooling. The test shall be made with the rated normal current of 600 Amps for the switch and the rated frequency of 50 cycles. The test shall be made for a period of time sufficient

for temperature rise to reach a constant value (variation not to exceed 1^0 C(per hour).

The temperature shall be measured by means of thermocouples only.

The temperature rise measured with the above test shall not exceed, maximum, limits specified as under:-

Sr. No.	Name of part	Temperature rise limit at an ambient temperature Not exceeding in ^{0}C
1.	Silver faced copper contacts	65^0 C
2.	Terminals of switches intended to be connected by external Conductors by screw or bolt.	65^0C

FRP:FRP Manufacturer should have a facility to test channels as per load test, IS 10661 for glass content and IS 6746 for flammability test at their work.

Raw material test certificates for vinylester resin, glass fiber and additives used for production shall be furnished during inspection.

Acceptance test shall be conducted on FRP manufacturer premises end.

Following tests shall be carried out in presence of DISCOM representative.

(viii) Tensile Strength- as per GTP
(ix) Flexural Test - as per GTP
(x) Compressive Test - as per GTP
(xi) Visual and Dimension Test – As per Approved Drawing
(xii) Glass Content Test – Minimum 55%
(xiii) Burn and Flammability Test

10.4 **SAMPLE PROCEDURE FOR ACCEPTANCE TESTS:**

One sample (i.e. one set) from each 50 sets or part of it to be selected at random from offered lot for carrying out all acceptance tests mentioned above, except for temperature rise test, which is to be carried out only on 1 sample (i.e. on one set) from the offered lot.

For the offered lot, the supplier will have to submit acceptance & routine test certificate received from the original manufacturers for the Polymeric insulators and FRP channel used in the manufacture of ABEB Switches. It is preferred that insulators/FRP Channel of same make are used in one lot, However, if insulators/FRP Channel of different makes are used in one lot of ABEB Switch, then the supplier will have to submit acceptance & routine test certificates received from the respective original manufacturers for the insulators/FRP Channel used in ABEB Switches.

The supplier will have to submit chemical composition certificate from the original manufacturer for the contacts used in ABEB Switches for every lot.

All test and inspection shall be made at the place and cost of manufacturer in presence of Company's Engineer.

Although the samples selected at random by the Company at the supplier's works, have passed the specified tests and accepted; The Company reserves the right to test, the materials after receipt at the destination by arranging the testing in any of the Government approved/DISCOM laboratory. However, in the event of the samples failing in the test or the materials otherwise found defective, the supplier shall replace such materials at the destination concerned on receipt of intimation from the Company.

11. APPROVAL OF PROTOTYPE SAMPLE:

On receipt of firm order, the supplier has to submit drawing for the ordered material for approval and after drawing approval, the supply shall prepare and offer a prototype sample within fifteen days for carrying out all the acceptance tests as mentioned in the clause No.10.3 at the supplier's works, at the cost of supplier in the presence of inspectors of purchaser. Only after specific written approval of the prototype sample from the purchaser, the supplier shall make further arrangement to manufacture and offer the first lot. If, the offered design is in accordance to the type tests, the supplier shall be exempted to carry out them again.

12. DETAILED DRAWINGS :

The tenderer shall submit along with his tender dimensional general arrangement drawings of the equipment's, illustrative and descriptive literature in triplicate for various items in the ABEB.

I. Schematic diagram of the ABEB Switch
II. Schematic diagram of the FRP Channel
III. Instruction manuals
III. Catalogues of spares recommended with drawing to indicate each items of spares
IV. List of spares and special tools recommended by the supplier.
V. Copies of Type Test Certificates as per latest IS/IEC.
VI. DP structure foundation drawings of ABEB so that Utility will plan and carry out civil works etc.
VII. Dimensional drawings of each material used for item VI.
VIII. Actual diagram of ABEB with shall be made to display on the front portion of the ABEB with all operation (Mention in Drawing attached here with), so as to carry out the operations easily.

The following should be supplied to each consignee circle/town along with the initial supply of the equipment ordered.

a. Copies of printed and bound volumes of operation, maintenance and erection manuals in English/Gujarati along with the copies of approved drawings and type test reports etc.
b. Sets of the manuals as above shall be supplied to the SE(R&D). A soft copy of the all Technical and Drawing furnished in a CD

13. NAME PLATE:

Each Switch and its associated accessories shall be provided with a nameplate legible and indelibly marked with at least the following information.

a. Name of manufacturer.
b. Type of Supply: Pilot Project supply
c. Serial number: (GPRD-RP014/DISCOM name/Supplier name/0001)
d. Rated voltage:
e. Rated current:
f. Rated frequency:
g. Rated symmetrical breaking capacity:
h. Rated making capacity:
i. Rated short time current and its duration:
j. Purchase Order number and date:
k. Month and Year of supply:
l. Last date of completion of Guarantee period:
m. Rated lightening impulse withstand voltage:
n. Name of DISCOM:

Manufacturer's Name:
And Address:

Annexure 'A'

GTP for supply of 11 KV Air Break Switch with Earth Blade and FRP suitable for outdoor installation.

PART-A.

GTP for 11 KV Air break switch with Earth Blade

Sr. No.	Particulars	Confirmation
1	11 KV Outdoor type Single pole Mounted Air Break with Earth Blade Switch shall confirming IS: 9920/1981 (part-I to IV), IS: 2633 & IS: 2544/1973 with latest amendment and others, if any and as per drawing.	Yes
2	Rated system voltage – 12 KV	Yes
3	Rated frequency - 50 Hz	Yes
4	Rated Normal current - 600 Amp.	Yes
5	No. of Poles - 3	Yes
6	Rated lighting impulse withstand voltage KV (Peak): i) To switch connector and earth - 75 KV switch being in closed position. ii) Across the terminals of open switch – 85 KV disconnector	Yes
7	Rated one minute power frequency withstand voltage: i) To switch connector and earth 28 KV ii) Across the terminals of open 32 KV Switch disconnector.	Yes Yes Yes
8	Rated short time withstand current three second 20 KA	Yes
9	Rated peak withstand - 50 KA current	Yes
10	Resistance of switch at 20 degree C as per cl.4.2 of IS 9920 P-4/1985 with latest amendment if any.	Yes
11	Type of mounting- vertical	Yes

Signature of Tenderer Company's Round Seal Date: Place:

12	Fixed and moving main contacts: a) Female type of contacts with spring actions on either side or male type moving contacts. b) Material of contacts shall be of hard drawn copper grade and chemical composition of copper shall be as mentioned in col.no.8.2 of specification. c) Contact shall be silver plated d) Thickness of silver coating (min.) on contacts - 2.5 micron. e) Current density of contact - 2 Amp. sq. mm f) Current carrying capacity - 600 Amps g) Nos. of Spring – 4 nos. per female contacts	Yes Yes Yes Yes Yes Yes
13	Terminal connection of : a)Type - Lug Type , long barrel, long palm with two hole @ 30 mm b) Material –AL. c) Current density - 1.25 Amp./sq.mm d) Current carrying capacity –Conductor Carrying Capacity.	Yes Yes Yes Yes
14	Bus Polymeric insulator: a) No. of Bus Polymeric insulators per phase – 2 Nos. each of 12 KV with creepage distance of each insulator - 320 mm. b) Name of material to be used for manufacturing of insulator with class/grade-silicon 43%	Yes Yes
15	Method of galvanizing for bolts, Nuts, washers etc. i) Size below 5/8” – Electro galvanized or nickel plated. ii) Size 5/8” and above hot dip galvanized as per IS: 2633.	Yes Yes

Signature of Tenderer Company’s Round Seal Date: Place:

PART-B

GTP for FRP Base Channel–Mechanical and Electrical Properties

Sr. no	Parameter	Standard	Unit	Values for FRP Pultruded Section	Confirmation
1	Ultimate Tensile Strength	ASTM D 638	Psi	30000	Yes
2	Tensile Modules	ASTM D 638	Psi(10^6)	2.5	Yes
3	Flexural Strength	ASTM D 790	Psi	30000	Yes
4	Flexural Modulus	ASTM D 790	Psi(10^6)	1.6	Yes
5	Compressive Strength	ASTM D 695	PSi	30000	Yes
6	Compressive Modulus	ASTM D 695	PSi(10^6)	2.5	Yes
7	Barcol Hardness	ASTM D 2583	scale	50-65	Yes
8	Water Absorption	ASTM D 570	% max by weight	<=0.6	Yes
9	Glass Content	ASTM D 2584	%	Min 55	Yes
10	FSI (Flame Spread Index)	ASTM E- 84	**(Class-A)**	**Less than 25**	Yes
11	Dielectric Strength Radial	ASTM D 149	kv/25mm	30-45	Yes
12	Dielectric Strength Axial	ASTM D 149	kv/25mm	10 ~ 15	Yes
13	Arc Resistance	ASTM D 495	Sec	> 120	Yes
13	Oxygen Index	ASTM D 2863-2000	Sec	> 120	Yes
14	UV	ASTM G 154			Visual Appearance after 1000 Hrs. Exposure
15	Flammability	IS 6746			Low Flammability
16	Tolerance of section				75 X 40 X 6mm +/- 2mm and for thickness +/- 0.7 mm.

Signature of Tenderer Company's Round Seal Date: Place:

Annexure- 'B'

Bidder has to enclose following documents.

Sr. No.	Particulars	Confirmation
1	List of Plant and machinery	Yes
2	list of testing facilities	Yes
3	List of orders executed/pending at least for past two years for the items offered a) With GUVNL (Formerly …..VCL) b) With purchaser other than GUVNL (Formerly …..VCL)	 Yes Yes
4	Drawing No.	Yes
5	Type test details as per cl.10.1 of tender specifications	Yes
6	Chemical composition as per cl.8.2 of tender specification for copper	Yes
7	One (1) set of sample is to be submitted with tender	Yes

Signature of Tenderer Company's Round Seal Date: Place:

Annexures 'C'

Bidder has to mention below deviation if any, quoting relative clause of specification

Signature and Seal of Tenderer.

Signature of Tenderer	Company's Round Seal	Date:	Place: