

ADDENDUM-1

Sl. No.	Section / Clause Ref.	Existing	Addendum
1	Section-8-B-Technical Specifications	New chapter Section-16 added under Section-8-B-Technical specification.	Gang operated switch 200 Amps Single break and 400A double break
2	Section-8-B-Technical Specifications	New chapter Section-17 added under Section-8-B-Technical specification.	11 kV Pin Insulator
3	Section-8-B- Technical Specifications	New chapter Section-18 added under Section-8-B-Technical specification.	ACSR Rabbit Conductor
4	Section-8-B- Technical Specifications	New chapter Section-19 added under Section-8-B-Technical specification.	HG Fuse unit
5	Section-8-B- Technical Specifications	New chapter Section-20 added under Section-8-B-Technical specification.	Lightening Arrestor
6	Section-8-B- Technical Specifications	New chapter Section-21 added under Section-8-B-Technical specification.	LT Distribution boxes and HT metering cubicle
7	Section-8-B- Technical Specifications	New chapter Section-22 added under Section-8-B-Technical specification.	LT Protection kit

SECTION - 8B

TECHNICAL SPECIFICATIONS

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SECTION - 16

**GOS 200AMPS Single Break &
400AMPS Double Break**

TECHNICAL SPECIFICATION FOR 11KV 200AMPS SINGLE BREAK GROUP**OPERATION SWITCHES**

1.0 **Scope:** This specification covers the manufacture, testing and supply of 11KV Group operating switches of single break 200 Amps. Capacity complete with accessories, such as operating pipe, connecting pipe guides, supporting insulators, link work and locking arrangement, etc., complete conforming to IS-9921(Part 1 to 5) and the enclosed typical drawings.

2.0 **Weather Conditions:** The switches are to be installed at places with the following weather conditions.

Temperature : Maximum ambient - 45°C

Daily average : Average - 35°C

: Minimum - 5°C

: Altitude - Not to exceed 1000 Mtrs.above sea level

3.0 The equipment offered shall conform to IS-9921 and latest amendments thereof. The switches shall be suitable for horizontal upright mounting.

4.0 **Construction:**

4.1 The base shall be made of robust rolled M.S. channel section of size 75 x 40x6 mm. All ferrous parts shall be hot dip galvanized and all copper parts shall be tinned. The rotating parts shall be fitted with suitable bearing.

4.2 The blades and contacts shall be made of best quality electrolytic copper and shall be capable of carrying the rated current without exceeding the temperature limits specified in table-4 of IS-9921 (part-II).

4.3 The insulators shall be of post type, brown glazed porcelain pedestal post type design E.22 as per ISS:5350 (Part-III)/1971 with cap screws and spring washers and to technical specification enclosed conforming to IS:2544-1973 with amendments thereof.

4.4 The operating pipe shall consist of Tandem pipe (spindle rod) of length 2000 mm and the vertical pipe of length 5400 mm. The pipe shall be seamless 25mm diameter "B" type class (i.e., medium class) G.I. Pipe. The G.I. Pipe used shall conform to IS-1239-Part-I-1979 and amendments thereof. A guide shall be provided to the vertical operating pipe an intermediate position to arrest its lateral movement. Necessary fixing arrangements of the guide to the pole should also be supplied.

- 4.5 The Tenderer shall clearly indicate in the tender, the Brand name of the insulators used in manufacture of 200 Amps Single Break GOS along with relevant type test reports. The successful bidder should get the insulator make approved by BESCOM/ KRIDE, before making supplies.
- 4.6 95 Sq. mm heavy duty long barrel tinned copper lugs-6 Nos., suitable for terminating Weasel/Rabbit ACSR Conductor shall be provided for connecting conductor to the copper flats in the GOS.
- 4.7 All the iron parts shall be hot dip galvanized and shall conform to the relevant IS specifications with latest amendments those of.
- 4.8 **Arcing Horns**: The switches shall be supplied with hot dip galvanized arcing horns so that while closing or opening the switches, arcing takes place between the arcing horns and not between the main contacts.
- 4.9 **Locking Arrangements**: Suitable locking arrangements shall be provided for the operating handle.
- 4.10 The switches shall be designed to withstand the test voltage as per IS: 9921 or its latest revision thereof. The switches shall be designed to have the following current ratings.

Continuous current carrying capacity

Without over heating : 200A

Short Time Current for 1Second rating : 8 kA

Rated peak dynamic withstand current : 20kA

5.0 **Test and Test Certificate:**

- 5.1 **Routine Tests**: The Routine test as per IS:9921 shall be conducted on each G.O.S in the presence of KRIDE representative and certificate shall be submitted duly signed by a responsible officer of the tenderers/organization before dispatch of consignment.
- 5.2 BESCOM/ KRIDE reserves the right to get the type test conducted as per IS:9921 on a selected G.O.S in the presence of BESCOM/ KRIDE's testing staff at the cost of the supplier.
- 1) Impulse Voltage dry test
 - 2) Power frequency voltage dry test
 - 3) Power frequency voltage wet test
 - 4) Temperature rise test
 - 5) Measurement of resistance
 - 6) Test for rated peak short circuit current
 - 7) Operation test
 - 8) Mechanical endurance test

- 5.3 **Packing:** The group operating switches shall be securely packed to withstand rough handling during the transit and storage.
- 5.4 **Name Plate:** The group operating switch shall be provided with the name plate legibly and indelibly marked with the following information:
- 1) Name of materials
 - 2) Name of the manufacturer/Trade mark
 - 3) Letters (BESCOM)
 - 4) Purchase order No. and Date
 - 5) Type-designation and Sl. No.
 - 6) Rated voltage
 - 7) Rated current
 - 8) IS specification

TECHNICAL SPECIFICATION FOR 11KV PEDESTAL POST INSULATORS

- 1.0 **General Requirements:** The tenderer shall clearly indicate in the tender, the brand name of the insulator used in manufacture of GOS along with relevant type test reports failing which, the offer will not be considered. The successful bidder should get the insulator make approved by BESCOM/ KRIDE, before making supplies.
- 2.0 The porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed, the glaze on insulators shall be brown in colour and should cover all exposed porcelain parts except those areas which serve as supports during fixing are required to be left unglazed as detailed in IS:2544-1963.
- 3.0 Precaution shall be taken during design and manufacture to avoid the following:
- a) Stress due to expansion and contraction which may lead to deterioration.
 - b) Stress concentration due to direct engagement of the porcelain with the metal fittings.
 - c) Retention of water in recesses of metal fittings and shape which do not facilitate easy cleaning by normal methods.
- 4.0 All metal parts except those of stainless steel shall be hot dip galvanized after machining zinc coating shall satisfy the requirement of relevant IS specification. The finished galvanized surface shall be smooth.
- 5.0 The threads of the tapped holes on the post insulator metal fittings shall be cut after galvanizing and shall be protected against rust by greasing or other similar means. All other threads shall be cut before galvanizing.
- 6.0 The post insulator unit shall be assembled in a suitable jig to ensure the correct positioning of the top and bottom metal fittings relative to one another. The faces of the metal fittings shall be parallel and at right angles to the axis of the insulator and the corresponding holes in the top and bottom metal fitting shall be in vertical plane containing the axis of the insulator.

7.0 **Technical Particulars:**

Individual Units	: 11kV stacking units.
1) Rating	: 11kV
2) a) Unit description (as per ISS:5350/Part-III/1971)	: E-22 (Except torsion strength : as specified)
b) Mechanical strength as per Clause 3.2 of IS:5350/ Prt-III/1971.	: Strength class 'C' 7.5 to 12KN
3) Highest system voltage	: 12 kV (rms)
4) Impulse withstand voltage	: 75 KV (peak)
5) One minute Power frequency withstand Voltage	
	Dry : 35 kV (rms)
	Wet : 35 kV (rms)
6) Power Frequency Puncture withstand voltage (rms)	: 1.3 times the actual dry flash cover voltage of the unit.
7) Visible Discharge test voltage	: 9 KV (rms)
8) Creepage distance	: 230 mm
9) Failing load (as per IS:5350 Part-III/1971)	
(a) to (d) in Newtons and (e) in Newton meters	
a) Upright	: 9000 N
b) Under hung	: 4500 N
c) Tension	: 20000 N
d) Compression	: 40000 N

- e) Torsion : 340 Nm
- 10) Height of insulator (Min) : 254mm (Tolerance ± 1 mm)
- 11) Insulating part dia (Max) : 152 mm
- 12) Top metal fitting pitch circle dia : 57 mm
- 13) Bottom metal fitting pitch circle dia : 57 mm
- 14) a) No. of bolts : 4 Nos.
 b) Bolts holes dia : 10 mm tapped holes at the top and 12 mm plain holes at the bottom.
 c) Nominal dia of mounting : 85 mm
 face not to exceed

8.0 **Marking:** Each insulator shall be legibly and indelibly marked with the following.

- a) Name or trade mark of the manufacture
 b) Month and year of manufacture
 c) ISI certificate mark if any

Marking shall be durable and shall be printed by the transfer process before firing.

NOTE: Manufacturer's Test Certificate and type test certificate conducted on similar sample insulator shall be submitted for approval before commencement of supplies.

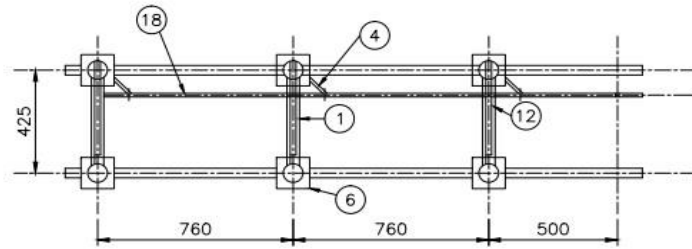
9.0 **Marking:** Bill of Materials as per Drawing.

**GUARANTEED TECHNICAL PARTICULARS FOR 11 KV 200 AMPS SINGLE
BREAK GOS**

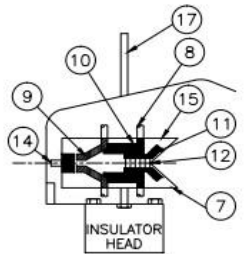
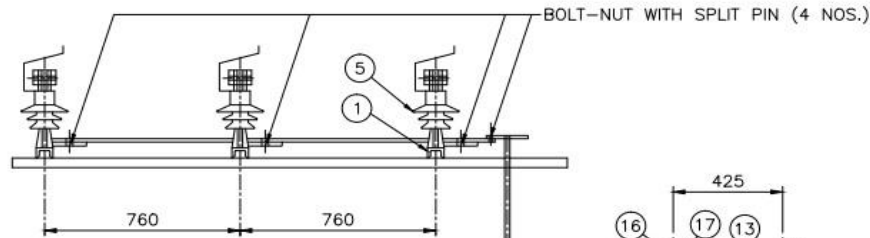
Sl. No.	Details	Results
I	Material	
1	Name of the manufacturer	
2	Type	
3	No. of poles	
4	Frequency	
5	Voltage Rating	

6	Current Rating in Amps a) Normal b) Maximum	
7	Temperature rise of the following at full rated current in O.C over ambient temperature	
8	Whether contacts are silver coated or tin coated along with thickness of coating in mm.	
9	Voltage drop across terminals of poles	
10	Short time current and duration	
11	Material of <u>fixed contact</u>	
12	Material of moving blade	
13	Material of terminal connector	
14	Type Diameter and length of operating handle	
15	Materials of arcing horns	
16	Size and length of base mounting channel	
17	Whether the Air break switch is complete with all accessories	
18	Whether Dimensional drawing is enclosed with the tender	
19	Minimum clearance between phase (The center distance between the insulators of adjacent phase in the assembled position of switch)	
20	Center to center distance between insulators of the consecutive poles of the same phase in the assembled position of switch (in mm)	
21	Whether mechanical interlock has been provided for arcing switches	
22	Type of bearings use in: 1. Rotating insulator stack. 2. To earth and between poles	
23	Impulse withstand voltage with 1/50 M.S wave positive and negative polarity.	
24	One minute power frequency withstand voltage across isolating distance ³ to earth and between poles.	
II	PARTICULARS OF INSULATORS	
1	Type of insulators	

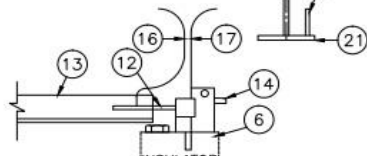
2	Name of manufacturer of insulators	
3	Height of the insulators	
4	Diameter of the largest shell	
5	Number of units per stack	
III	ELECTRICAL CHARACTERISTICS	
1	Flash over voltage	
2	Dry power frequency	
3	Wet power frequency	
4	Impulse voltage of 1/50 micro-sec(+ve)	
5	Impulse voltage of 1/5-micro-sec(-ve)	
6	Power frequency puncture withstand voltage of unit	
IV	Mechanical characteristics:	
	<ul style="list-style-type: none"> a. Cantilever strength under upright b. Cantilever strength under torsional c. Torsional strength d. Tensile Strength 	
V	General Characteristics <ul style="list-style-type: none"> a) Minimum Creepage conforms b) Weight of complete unit 	
VI	Standard to which insulator conforms	
VII	Number of Insulators per set	



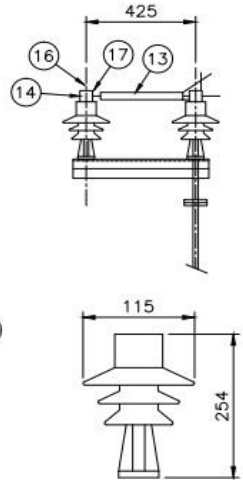
11KV 200A GOS (SINGLE BREAK)



TOP DETAILS IN SECTIONAL ELEVATION



REAR SIDE VIEW



INSULATOR DETAILS

SL. NO.	DESCRIPTION	SIZE	SECTION IN mm	QUANTITY
1.	M.S CHANNEL	500mm	75x40x6	3 NOS.
2.	GUN METAL BUSH (TOP) FOR SPINDLE (STANDARD PARTS NOT SHOWN IN THE DRG.)	10mm HT.	25mm ϕ	3 NOS.
4.	SPINDLE PLATE WITH SPINDLE	290mm	75x6mm	3 NOS.
5.	11KV POST INSULATOR	-	-	6 NOS.
6.	TOP PLATE	100mm	50x6mm	6 NOS.
7.	CONTACT BOX (BOTTOM)	110x16mm L.3mm Th	42mm W	3 NOS.
8.	COPPER CONTACT PIN (TINNED)	8mm ROD	50mm L	12 NOS.
9.	PHOSPHUR BRONZE COPPER STRIPS (TINNED)	100 (0.5Th.)	25mm W	12 NOS.
10.	SPRING(STAINLESS STEEL)	25mm Long	14G	12 NOS.
11.	COPPER CONTACT (TINNED)	90mm	25x6	6 NOS.
12.	COPPER KNIFE (TINNED)	460mm	32x6	3 NOS.
13.	MOVABLE ANGLE	400mm	45x45x5	3 NOS.
14.	LEADING FLAT, COPPER (TINNED)	190mm	25x6	3 NOS.
15.	CONTACT BOX (TOP)	110x16mm	3mm Th, 32mm W	3 NOS.
16.	MOVABLE ARCING HORN	300mm	8mm ϕ	3 NOS.
17.	FIXED ARCING HORN	300mm	8mm ϕ	3 NOS.
18.	HORIZONTAL G.I PIPE	2000mm	25mm ϕ B-CLASS	1 NO.
19.	VERTICAL G.I PIPE	5400mm	25mm ϕ B-CLASS	1 NO.
20.	HANDLE PIPE	500mm	25mm ϕ B-CLASS	1 NO.
21.	LOCKING ARRANGEMENT	PLATES 6mm	210x90, 100x90, 360x90, 300x50	4 NO.
22.	NUT & BOLTS	80 x 10mm - 24 NO, 25mm LONG- 5 NO, 30mm - 18 NO, 32mm LONG - 60 NO. ABOVE MENTIONED NUT & BOLTS ARE 10mm ϕ		
23.		64 x 12mm - 4 NO. ABOVE MENTIONED NUT & BOLTS ARE 10mm ϕ		

NOTES:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
2. THE INSULATORS USED IN GOS SHALL BE GOT APPROVED BEFORE PLACING THE PURCHASE ORDER.
3. ALL COPPER PARTS ARE TO BE TIN PLATED.
4. ALL BOLT NUTS USE FOR OPERATING ANGLE SHALL BE WITH SPLIT PIN.
5. THE CONNECTING END OF BOTH MOVING AND FIXED CONTACT SHOULD BE FITTED WITH WEDGE CONNECTORS (RABBIT TO RABBIT)
6. CREEPAGE DISTANCE OF POST INSULATOR SHALL BE 320mm(Min.)
7. ALL FERROUS PARTS SHALL BE HOT DIP GALVANIZED.

	Signatures	All dimensions are in mm unless otherwise stated.	 Approved: General Manager, (Elec.) QS&S
Chd	 AGM (QS&S)	11 KV, 200A SINGLE BREAK ISOLATOR	
Sub	 DGM (QS&S)		
		SCALE: N.T.S	DRG.NO.BESCOM/GM/QS&S/23 REV-004 DATED:24-01-2022

Technical Specification for 11 KV Class 400 Amps Double Break Group Operating Switches

1.0 SCOPE:

This specification covers the manufacture, testing at works and supply/erection of 11 KV Isolators of 400 Amps capacity, double break, complete with accessories such as operating pipe, connecting pipe, supporting insulators, link work, terminal connectors and locking arrangements as per IS 9921 of 1981 and to the owner's drawings.

2.0 The equipment offered shall conform to IS 9921 of 1981 and latest amendments thereof. The switches shall be suitable for horizontal upright mounting.

3.0 CONSTRUCTION:

3.1 The base shall be made of robust rolled M.S. Channel Section of size 75 x 40 mm. All ferrous parts shall be hot dip galvanized and all copper parts shall be tinned. The rotating shall be fitted with suitable bearings.

3.2 The blades and contacts shall be of best quality electrolytic copper and shall be capable of carrying rated current continuously without exceeding the temperature limits specified in Table 41 IS:9921 (part-II)

3.3 The insulators shall be of post type, brown glazed porcelain pedestal part type design E22 as per IS 5350 (Part-III)/1971 with cap screws and spring washers and to technical specifications enclosed conforming to IS 2544 of 1973 with amendments thereof. The insulators baked in temperature-controlled kilns only shall be used. The insulator used shall be as per relevant IS and BESCO approved.

3.4 The operating pipe shall consist of Terminal pipe (spindle rod) of length 2450mm and vertical pipe of length 5400 mm. The pipes shall be 25 mm diameter class 'B' (Medium Class). The G.I pipe used shall conform to IS 1239 part-1 1979 and amendments thereof. A guide to the vertical pipe of the operating pipe shall be provided to arrest its lateral movement. Necessary fixtures for fixing the guide to the pole shall also be supplied.

3.5 The Tenderer shall clearly indicate in the tender, the Brand name of the insulators used in manufacture of 400 Amps Double Break GOS along with relevant type test reports. The successful bidder should get the insulator make approved by BESCO/ KRIDE, before making supplies.

3.6 185sq mm Copper tinned Heavy duty long barrel lugs suitable for terminating Rabbit / Coyote ACSR conductor shall be provided for connecting conductor to the copper flats in the GOS.

3.7 All the Iron parts shall be hot dipped Galvanized and shall conform to the relevant IS specifications with latest amendments thereof.

3.8 **ARCING HORNS:**

The switches shall be supplied with hot dip galvanized arcing horns so that while opening/closing the G.O.S and arcing takes place between arcing horns not between the contacts.

3.9 **LOCKING ARRANGEMENTS:**

Suitable locking arrangement shall be provided for arresting the operating handle.

4.0 **CHARACTERISTICS:**

- a) System voltage – 11 KV
- b) Rated Voltage – 12 KV
- c) Rated Insulation Level:
 - 1. To earth and between poles 75 KV (Peak)
 - 2. Across Isolating Distance 85 KV
- d) Rated one minute power frequency withstand test Voltage
 - 1. To earth and between poles 28 KV
 - 2. Across Isolating distance 85 KV
- e) Rated normal current – 400 Amps
- f) Rated duration of short circuit – 3 Secs.
- g) Rated short time withstand current – 10 KA
- h) Type of break – horizontal, double break.

5.0 **TYPE TEST CERTIFICATE:**

The following shall constitute type tests.

- a) Impulse voltage dry test
- b) Power frequency voltage dry test.
- c) Power frequency voltage wet test
- d) Temperature rise test
- e) Measurement of Resistance
- f) Test for rated peak short circuit current
- g) Operation tests
- h) Mechanical endurance tests.

6.0 **ROUTINE TESTS:**

The routine tests as per IS 9921 shall be conducted on each G.O.S

7.0 **NAME PLATE:**

The group operating switch shall be provided with the name plate legibly and indelibly marked with the following information:

- 1. Name of materials
- 2. Name of the manufacturer/Trade Mark
- 3. Name of the Purchaser i.e., the Letters (BESCOM).

4. Purchase order No. and Date
5. Type-designation and Sl. No
6. Rated Voltage
7. Rated Current
8. IS Specification

TECHNICAL SPECIFICATION FOR 11KV PEDESTAL POST INSULATORS

- 1.0 **General Requirements:** The Tenderer shall clearly indicate in the tender, the Brand name of the insulators used in manufacture GOS along with relevant type test reports. The successful bidder should get the insulator make approved by BESCOM/ KRIDE, before making supplies.
- 2.0 The porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed, the glaze on insulators shall be brown in colour and should cover all exposed porcelain parts except those areas which serve as supports during fixing are required to be left unglazed as detailed in IS:2544-1963.
- 3.0 Precaution shall be taken during design and manufacture to avoid the following:
 - a) Stress due to expansion and contraction which may lead to deterioration.
 - b) Stress concentration due to direct engagement of the porcelain with the metal fittings.
 - c) Retention of water in recesses of metal fittings and shape which do not facilitate easy cleaning by normal methods.
- 4.0 All metal parts except those of stainless steel shall be hot dip galvanized after machining zinc coating shall satisfy the requirement of relevant IS specification. The finished galvanized surface shall be smooth.
- 5.0 The threads of the tapped holes on the post insulator metal fittings shall be cut after galvanizing and shall be protected against rust by greasing or other similar means. All other threads shall be cut before galvanizing.
- 6.0 The post insulator unit shall be assembled in a suitable jig to ensure the correct positioning of the top and bottom metal fittings relative to one another. The faces of the metal fittings shall be parallel and at right angles to the axis of the insulator and the corresponding holes in the top and bottom metal fitting shall be in vertical plane containing the axis of the insulator.

7.0 **Technical Particulars:**

Individual Units		: 11kV stacking units.
1) Rating		: 11kV
2) a) Unit description (as per ISS:5350/Part-III/1971)		E-22 (Except torsion strength : as specified)
b) Mechanical strength as per Clause 3.2 of IS:5350/ Prt-III/1971.		: Strength class 'C' 7.5 to 12KN
3) Highest system voltage		: 12 kV (rms)
4) Impulse withstand voltage		: 75 KV (peak)
5) One minute Power frequency withstand		
Voltage	Dry	: 55 kV (rms)
	Wet	: 35 kV (rms)
6) Power Frequency Puncture withstand voltage (rms)		: 1.3 times the actual dry flash cover voltage of the unit.
7) Visible Discharge test voltage		: 9 KV (rms)
8) Creepage distance		: 230 mm
9) Failing load (as per IS:5350 Part-III/1971)		
(a) to (d) in Newtons and		
(e) in Newton meters		
a) Upright		: 9000 N
b) Underhung		: 4500 N
c) Tension		: 20000 N

- d) Compression : 40000 N
- e) Torsion : 680 Nm
- 10) Height of insulator (Min) : 254mm (Tolerance ± 1 mm)
- 11) Insulating part dia (Max) : 152 mm
- 12) Top metal fitting pitch circle dia : 57 mm
- 13) Bottom metal fitting pitch circle dia: 57 mm
- 14) a) No. of bolts : 4 Nos.
 b) Bolts holes dia : 10 mm tapped holes at the top and 12 mm plain holes at the bottom.
 c) Nominal dia of mounting : 85 mm face not to exceed

8.0 **Marking:** Each insulator shall be legibly and indelibly marked with the following.

- d) Name or trade mark of the manufacture
 e) Month and year of manufacture
 f) ISI certificate mark if any
 Marking shall be durable and shall be printed by the transfer process before firing.

NOTE: Manufacturer's Test Certificate and type test certificate conducted on similar sample insulator shall be submitted for approval before commencement of supplies.

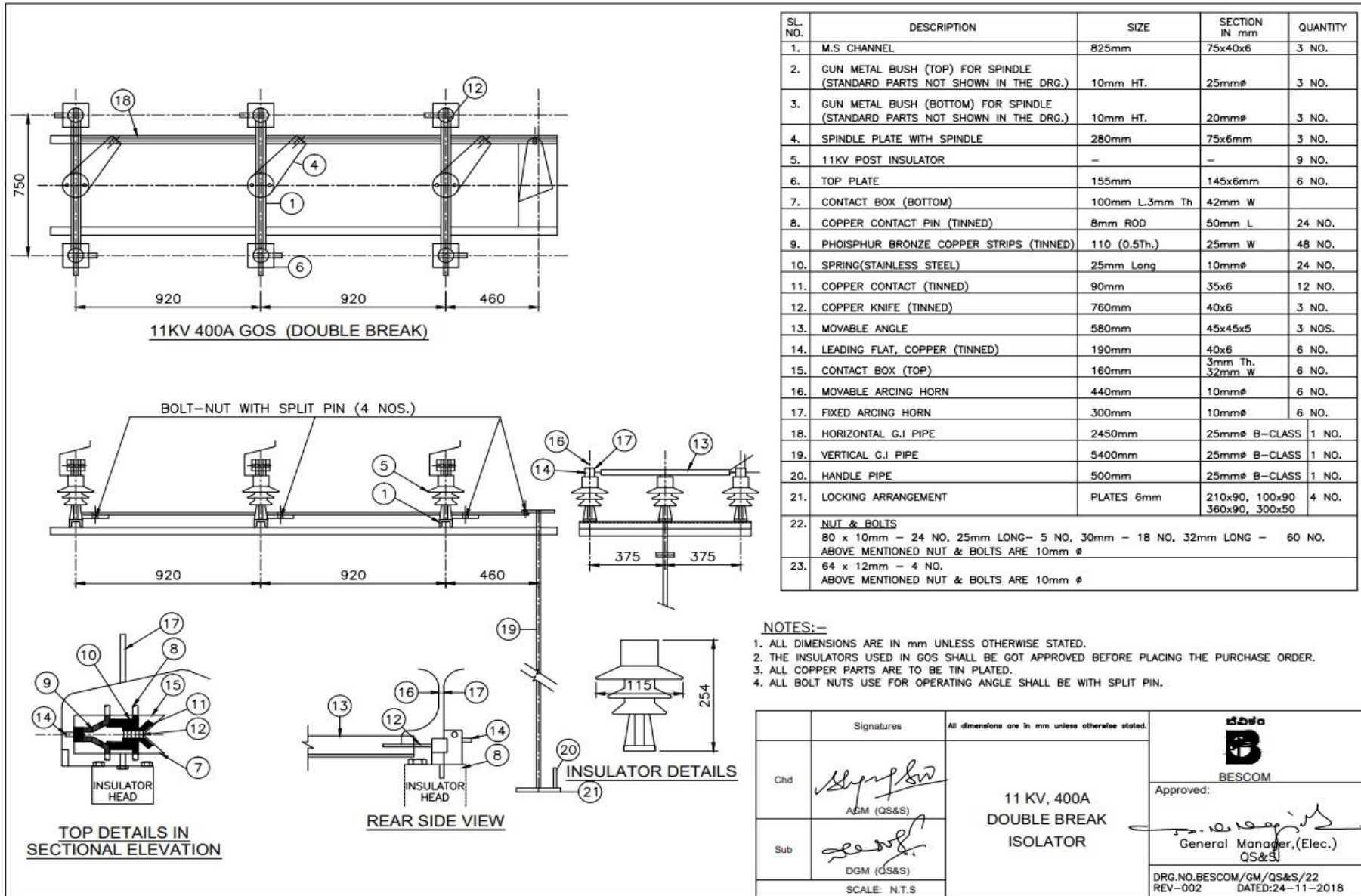
1.0 **BOM:** Bill of Materials as per Drawing.

GUARANTEED TECHNICAL PARTICULARS FOR 11 KV 400 AMPS DOUBLE BREAK GOS

Sl. No.	Details	Results
1	Material	
1	Name of the manufacturer	
2	Type	
3	No. of poles	
4	Frequency	
5	Voltage Rating	

6	Current Rating in Amps c) Normal d) Maximum	
7	Temperature rise of the following at full rated current in O.C over ambient temperature	
8	Whether contacts are silver coated or tin coated along with thickness of coating in mm.	
9	Voltage drop across terminals of poles	
10	Short time current and duration	
11	Material of fixed contact	
12	Material of moving blade	
13	Material of terminal connector	
14	Type Diameter and length of operating handle	
15	Materials of arcing horns	
16	Size and length of base mounting channel	
17	Whether the Air break switch is complete with all accessories	
18	Whether Dimensional drawing is enclosed with the tender	
19	Minimum clearance between phase (The center distance between the insulators of adjacent phase in the assembled position of switch)	
20	Center to center distance between insulators of the consecutive poles of the same phase in the assembled position of switch (in mm)	
21	Whether mechanical interlock has been provided for arcing switches	
22	Type of bearings use in: 3. Rotating insulator stack. 4. To earth and between poles	
23	Impulse withstand voltage with 1/50 M.S wave positive and negative polarity.	
24	One minute power frequency withstand voltage across isolating distance ³ to earth and between poles.	
II	PARTICULARS OF INSULATORS	
1	Type of insulators	

2	Name of manufacturer of insulators	
3	Height of the insulators	
4	Diameter of the largest shell	
5	Number of units per stack	
III	ELECTRICAL CHARACTERISTICS	
1	Flash over voltage	
2	Dry power frequency	
3	Wet power frequency	
4	Impulse voltage of 1/50 micro-sec(+ve)	
5	Impulse voltage of 1/5-micro-sec(-ve)	
6	Power frequency puncture withstand voltage of unit	
IV	Mechanical characteristics:	
	e. Cantilever strength under upright f. Cantilever strength under torsional g. Torsional strength h. Tensile Strength	
V	General Characteristics c) Minimum Creepage conforms d) Weight of complete unit	
VI	Standard to which insulator conforms	
VII	Number of Insulators per set	



SECTION -17

11K.V PIN INSULATOR

K-RIDE

TECHNICAL SPECIFICATION FOR 11 KV COMPOSITE PIN INSULATORS

1. SCOPE:

This specification covers the design, manufacture, testing and supply of 11KV Composite Insulators. The composite insulators shall be pin insulators for straight line locations.

2. SYSTEM PARTICULARS:

- Nominal System Voltage 11 kV
- Corresponding highest system Voltage 12 kV
- Frequency 50 Hz with 3% tolerance
- Number of phase 3
- Neutral earthing: effectively grounded.

3. STANDARDS:

Unless otherwise specified elsewhere in the specification's insulators shall conform to the latest revisions of all relevant standards available at the time of placement of the order. The standards are listed in Annexure 'A'.

4. GENERAL REQUIREMENTS

- 4.1 The composite insulators shall generally conform to latest Standards as listed in Annexure 'A'
- 4.2 The Composite Insulators will be used on lines on which the conductors will be ACSR of any size up to Coyote. The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
- 4.3 Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS: 13134.
- 4.4 The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

Type of Composite insulator	Nominal System Voltage kV(rms)	Highest System Voltage kV(rms)	Visible discharge test voltage kV(rms)	Wet power frequency withstand voltage kV (rms)	Impulse withstand voltage kV(peak)	Minimum creepage distance in mm	Min. failing load kN
Pin Insulator	11	12	9	35	75	320	5

Dimensional Tolerance of Composite Insulators

The tolerances on all dimensions e.g., diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109:

$\pm (0.04d+1.5)$ mm when $d \leq 300$ mm

$\pm (0.025d+6)$ mm when $d > 300$ mm.

Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be. However no negative tolerance shall be applicable to creepage distance.

4.5 Corona and RI Performance

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

5. TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS

Polymeric Insulators shall be designed to meet the high quality, safety and reliability and should be capable of withstanding a wide range of environmental conditions: Polymeric Insulators shall consist of THREE parts, at least two of which are insulating Parts: - (a) Core- the internal insulating part (b) Housing- the external insulating part (c) Metal end fittings.

5.1 CORE

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free as proven through die penetration test. The FRP rod must pass electric leakage current test of 175V/mm. The leakage current shall not exceed 0.05mA.

5.2 HOUSING:

The FRP rod shall be covered by a seamless sheath of a silicone elastomeric compound or silicone alloy or EVA compound of a thickness of 3mm minimum. It shall be one-piece housing using Injection Molding Principle to extrude directly onto the core and cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and protection against environmental influences. Housing shall conform to the requirements of IEC 61109/92-93 with latest amendments. The bonding of the elastomeric compound to the fiber glass rod

shall be perfect and shall be proved by a peel off test as described elsewhere in this specification.

5.3 WEATHERSHEDS

The composite polymer weather sheds made of a silicone elastomeric compound or silicone alloy or EVA compound shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections. It should protect the FRP rod against environmental influences, external pollution and humidity. The weather sheds should either be of EVA or have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids. Housing and weather shed materials shall have tensile strength of 10MPa with 300% elongation minimum and tear strength of 20N/mm.

5.4 METAL END FITTINGS (Pins):

End fitting transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. Metal end fittings shall be hot dip galvanized after all fittings have been completed. The material used in fittings shall be corrosion resistant. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be properly attached to the core by a coaxial or hexagonal compression process & should not damage the individual fibers or crack the core. The gap between fitting and sheath shall be sealed by a flexible EVA or silicone elastomeric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e., seamless sheath and metal connection. The sealing must be moisture proof. The dimensions of end fittings of Insulators shall be in accordance with the standard dimensions stated in IEC: 60120/ IS: 2486 - Part-II /1989.

6. WORKMANSHIP

- 6.1 All the materials shall be of latest design and conform to the best engineering Practices adopted in the high voltage field. Bidders shall offer only such insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission/distribution lines.
- 6.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 6.3 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 6.4 The core shall be sound and free of cracks and voids that may adversely affect the insulators.

- 6.5 Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.
- 6.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 6.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87-micron thickness and shall be in accordance with the requirement of IS:4759. The zinc used for galvanizing shall be of purity 99.5% as per IS:4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one (1) minute duration under the standard prece test. The galvanizing shall be carried out only after any machining.

7. TESTS AND STANDARDS

Insulators offered shall be manufactured with the same configuration & raw materials as used in the insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. **The design & type test reports submitted should have been carried out within five years prior to the date of opening of this tender.**

7.1 DESIGN TESTS:

For polymeric insulators it is essential to carry out design test as per clause 4.1 of IEC 61109/92-93 with latest amendments. The design tests are intended to verify the suitability of the design, materials and method of manufacture (technology). When a composite insulator is submitted to the design tests, the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics:

- Same materials for the core, and sheds and same manufacturing method;
- Same material of the fittings, the same design, the same method of attachment;
- Same or greater layer thickness of the shed material over the core (including a sheath where used);
- Same or smaller ratio of the highest system voltage to insulation length;
- Same or smaller ratio of all mechanical loads to the smallest core diameter between fittings
- Same or greater diameter of the core.

The tested composite insulators shall be identified by a drawing giving all the dimensions with the manufacturing tolerances.

Manufacturer should submit test reports for Design Tests as per IEC – 61109 (clause – 5) prior to supply. Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract:

UV test: the test shall be carried out in line with clause 7.2 of ANSI C29.13.

7.2 TYPE TESTS:

The type tests are intended to verify the main characteristics of a composite insulator. The type tests shall be applied to composite insulators, the class of which has passed the design tests.

7.2.1 Following Type test shall be conducted on a suitable number of individual insulator units, components, materials:

Sl. No	Description of type test	Test procedure/standard
1	Dry lightning impulse withstand voltage test	As per IEC 61109 (clause 6.1)
2	Wet power frequency test	As per IEC 611 09 (clause 6.2)
3	Mechanical load-time test	As per IEC 611 09 (clause 6.4)
4	Radio interference test	As per IEC 61109 (clause 6.5) revised
5	Recovery of Hydrophobicity test	Annexure - B This test may be repeated every 3yrs by the manufacturer
6	Chemical composition test for silicon content	Annexure - B Or any other test method acceptable to the owner.
7	Brittle fracture resistance test	Annexure – B

The bidder shall submit type test reports as per IEC 61109 along with the bid. Additional type tests required if any shall be carried out by the manufacturer, after award of contract for which no additional charges shall be payable. In case, the tests have already been carried out, the manufacturer shall submit reports for the same.

7.2.2 UV Resistance as per ASTM G 53: 5000 Hours- UV Light for 8 hours and condensation for 4 hours in a continuous cycle. Elongation to be limited to 20% (% of elongation to break before and after the test)

7.2.3 Salt Fog Test: On Insulator for 1000hours as per IEC.

7.3 Acceptance (sample) Tests

The test samples after having withstood the routine test shall be subject to the following acceptance tests in order indicated below:

(a)	Verification of dimensions	Clause 7.2 IEC: 61109,
(b)	Verification of the locking system: (if applicable)	Clause 7.3 IEC : 61109,
©	Galvanizing test	IS:2633/15: 6745
(d)	Verification of the specified mechanical load	Clause 7.4 IEC: 61109,
(e)	Verification of tightness of the interface between end fitting & insulator housing	Clause 7.4 IEC: 61109, amendment 1 of 1995

7.4 Routine Tests

SI No	Description	Standard
1	Identification of marking	As per IEC: 61109
2	Visual Inspection	As per IEC:61109
3	Mechanical Routine test	As per IEC:61106

Every Polymeric Insulator shall withstand Mechanical Routine test at ambient temperature, Tensile Load at RTL corresponding to at least 50% of the SML for at least 10 seconds.

7.5 Tests during manufacture:

Following tests shall also be carried out on all components as applicable

a)	Chemical analysis of zinc used for galvanizing
b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
c)	Chemical analysis, hardness tests and magnetic particle inspection for forgings.
d)	Peel off test to confirm adhesion of EVA/ Silicon /Silicon alloy to the core of the insulator.

7.6 Tests on the material used in manufacture of the insulator:

The bidder shall furnish following test reports conducted on the raw materials (i.e., silicon rubber or EVA) for confirming following properties prior to supply.

Sl. No	Property	Standard
1	Tensile Strength (MPa)	ISO37/ASTM D 638
2	Elongation (%)	ISO37/ASTM D 638
3	Tear Strength (N/mm)	ASTM D624B
4	TERT (4.5KV 360min)	ASTM D2303/IEC507
5	Volume Resistivity (Ohm –cm)	ASTM D257/IEC93
6	Dielectric constant	IEC 250/ ASTM D150
7	Dielectric Strength (kV/mm)	ASTM D149/IEC93
8	Density	ISO 1183A
9	Hardness (shore A)	ISO868
10	Accelerated aging	ISO188/ ASTM G53
11	Flammability test	UL-94 V0/IEC60707
12	Arc Resistance	IEC61621

7.7 The following characteristics shall be met by FRP rods used in manufacture of the insulator:

- 1 Tensile strength: 760 N/mm² Min
- 2 Glass content (%) : 75% min
- 3 Tg by DSC – 110 Deg C min
- 4 Dye penetration – No dye rise on 10 sample of 10 mm thick > 15 mins
- 5 Water diffusion & Voltage tests – 100 hours – 12kv for 1 min, no puncture or flashover on the FRP & current shall not exceed 1 mA
- 6 Hardness > 51 Barcol No
- 7 ECR glass – Boron/alkali content not more than 0.8%.

7.8 Additional Tests

7.8.1 The Owner reserves the right at his own expenses, for carrying out any other test(s) of reasonable nature carried out at Supplier's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material complies with the Specifications.

7.8.2 The Owner also reserves the right to conduct all the tests mentioned in this specification on the samples drawn from the site at Supplier's premises or at any other test center. In case of evidence

of noncompliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner.

7.9 Co-ordination for Testing

- 7.9.1 The bidder shall intimate the Owner about carrying out of the type tests along with detailed testing programme at least 3 weeks in advance of the scheduled date of testing during which the Owner will arrange to depute his representative to be present at the time of carrying out the tests.

8. QUALITY ASSURANCE PLAN:

- 8.1 The successful bidder shall submit the following information before procuring:
- 8.1.1 Test certificates of the raw materials and bought out accessories.
 - 8.1.2 Statement giving list of important raw material, their grades along with names of Sub suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in the presence of bidder's representative.
 - 8.1.3 List of manufacturing facilities available.
 - 8.1.4 Level of automation achieved and lists of areas where manual processing exists.
 - 8.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
 - 8.1.6 List of testing equipment's available with the bidder for final testing of equipment along with valid calibration reports.
 - 8.1.7 The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) followed during manufacture and testing.
- 8.2 The successful bidder shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.
- 8.3 The Purchaser representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
- 8.4 The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain insulators manufactured in 3-4 consecutive weeks.
- 8.5 The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.

8.6 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the owner in writing waives off the inspection. In the later case also, the material shall be dispatched only after satisfactory testing specified herein has been completed.

8.7 The acceptance of any quantity of material shall in no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

9. TEST CERTIFICATE:

The tenderer shall furnish detailed type test reports of the offered composite Insulators as per clause 8.2 of the Technical Specifications at the NABL approved laboratories to prove that the composite Insulators offered meet the requirements of the specification. These Type Tests should have been carried out within five years prior to the date of opening of this tender.

10. TESTING FACILITIES:

The tenderer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to Purchasers Engineers if deputed to carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer's work, the reasons should be clearly stated in the tender. The insulators shall be tested in accordance with the procedure detailed in IEC 61109 / 92-93 with latest amendments.

11. DRAWINGS:

The insulator shall be as per the Drawing enclosed.

12. RETEST AND REJECTION:

12.1 Sample Procedure for testing of insulators shall be as per clause 7.1 to 7.6 of IEC 61109 for Acceptance & Routine Tests. For the sampling tests, two samples are used, E1 and E2. The sizes of these samples are indicated in the table below.

Lot Size(N)	Sample size	
	E1	E2
N<300	Subject to agreement	
300<N<2000	4	3
2000<N<5000	8	4
5000<N<10000	12	6

If more than 10000 insulators are concerned, they shall be divided into an optimum number of lots comprising between 2000 and 10000 insulators. The results of the tests shall be evaluated

separately for each lot. The insulators shall be selected by the purchaser's representative from the lot at random. The samples shall be subjected to the applicable sampling tests.

The sampling tests are:

Verification of dimensions	- (E1 + E2)
Verification of the locking system	- (E2)
Verification of tightness of the interface between end fittings & Insulator housing	- (E2)
Verification of the specified mechanical load SML	- (E1)
Galvanizing test	- (E2)

In the event of a failure of the sample to satisfy a test, the retesting procedure shall be as follows:

- If only one insulator or metal part fails to comply with the sampling tests, a new sample equal to twice the quantity originally submitted to the tests shall be subjected to retesting. The retesting shall comprise the test in which failure occurs.
- If two or more insulator or metal parts fail to comply with any of the sampling tests or if any failure occurs during the retesting, the complete lot is considered as not complying with this standard and shall be withdrawn by the manufacturer.
- Provided the cause of the failure can be clearly identified, the manufacturer may sort the lot to eliminate all the insulators with these defects. The sorted lot then be resubmitted for testing. The number then selected shall be three times the first chosen quantity for tests. If any insulators fail during this retesting, the complete lot is considered as not complying with this standard and shall be withdrawn by the manufacturer.

12.2 Verification of dimensions (E1 + E2)

The dimensions given in the drawings shall be verified. The tolerances given in the drawing are valid. If no tolerances are given in the drawings the values mentioned in this specification shall hold good.

12.3 Verification of the locking system (E2)

This test applies only to the insulators equipped with socket coupling as specified by IEC 120 and is performed according to IEC 383.

12.4 Verification of tightness of the interface between end fittings & Insulator housing (E2)

One insulator selected randomly from the sample E2, shall be subjected to crack indication by dye penetration, in accordance with ISO 3452, on the housing in the zone embracing the complete length of the interface between the housing and metal fitting and including an

additional area, sufficiently extended beyond the end of the metal part. The indication shall be performed in the following way.

- The surface shall be properly pre-cleaned with the cleaner;
- The penetrant, which shall act during 20 minutes, shall be applied on the cleaned surface;
- Within 5 minutes after the application of the penetrant, the insulator shall be subjected, at the ambient temperature, to a tensile load of 70 % of the SML, applied between the metal fittings; the tensile load shall be increased rapidly but smoothly from zero up to 70 % of the SML, and then maintained at this value for 1 minute
- The surface shall be cleaned with the excess penetrant removed, and dried;
- The developer shall be applied if necessary;
- The surface shall be inspected.

Some housing materials may be penetrated by the penetrant. In such cases evidence shall be provided to validate the interpretation of the results. After the 1 min. test at 70 % of the SML, if any cracks occur, the housing and, if necessary, the metal fittings and the core shall be cut, perpendicularly to the crack in the middle of the widest of the indicated cracks, into two halves. The surface of the two halves shall then be investigated for the depth of the cracks.

12.5 Verification of the specified mechanical load SML

The insulators of the sample E1 shall be subjected at ambient temperature to a tensile load, applied between the couplings. The tensile load shall be increased rapidly but smoothly from zero to approximately 75 % of the SML, and then be gradually increased to the SML in a time between 30 sec. to 90 sec. If 100 % of the SML is reached in less than 90 s, the load (100 % of the SML) shall be maintained for the remainder of the 90 s. (This test is considered to be equivalent to a 1 min withstand test at the SML). The insulators have passed the test at 13.4 & 13.5 above if:

- No failure (breakage or complete pull out of the core, or fracture of the metal fitting) occurs either during the 1 min. 70 % withstand test (a) or during the 1 min. 100 % withstand test (b).
- No cracks are indicated after the dye penetration method described in 13.4 above.
- The investigation of the halves described in 13.4 above shows clearly that the cracks do not reach the core.

12.6 Galvanizing test

This test shall be performed according to IS: 2633/IS: 6745 on galvanized parts.

13. MARKINGS:

Each insulator shall be legibly and indelibly marked with the following details as per IEC- 61109:

- a) Name or trademark of the manufacturer.
- b) Voltage & Type
- c) Month and year of manufacturing.

- d) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
- e) Country of Manufacturer.

14. PACKING:

- 14.1 All insulators shall be packed in strong corrugated box of min. 7 ply duly palletted or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 Kg to avoid hackling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 14.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 14.3 Suitable cushioning, protective padding, or Dunn age or spacers shall be provided to prevent damage or deformation during transit and handling.
- 14.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case /crate /corrugated box shall have all the markings stenciled on it in indelible ink.
- 14.5 The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

Annexure-A

STANDARDS TO BE ADOPTED FOR COMPLETE INSULATORS

SI No	IS Standard	Title	International Standard
1		Definition, test methods and acceptance criteria for composite insulators for a.c. overhead lines above 1000 V	IEC: 61109
2	IS: 731	Porcelain insulators for overhead Power lines with a nominal voltage greater than 1000 V	IEC: 60383
3	IS: 2071	Methods of High Voltage Testing	IEC: 60060-1
4	IS: 2486	Specification for Insulator fittings for Overhead Power Lines with a nominal Voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	IEC: 60120 IEC: 60372
5		Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
6	IS: 13134	Guide for the selection of insulators in respect of polluted Conditions	IEC: 60815
7		Characteristics of string insulator units of the long rod type	IEC: 60433
8		Hydrophobicity Classification Guide	STRI Guide 1.92/1
9		Radio interference characteristics of overhead power lines and high-voltage equipment.	CISPR:18-2 Part-2
10	IS: 8263	Methods of RI Test of HV insulators	IEC: 60437
11		Standard for Insulators Composite-Distribution Dead-end Type	ANSI C29. 13-2000
12	IS: 4759	Hot dip zinc coatings on structural steel & other allied products	ISO:1459 ISO:1461
13	IS:2629	Recommended Practice for Hot. Dip . Galvanisation for iron and steel	ISO:1461(E)
14	IS: 6745	Determination of Weight of Zinc Coating on Zinc coated iron and steel articles	ISO:1460
15	IS:3203	Methods of testing of local thickness of electroplated coatings	ISO:2173
16	IS:2633	Testing of Uniformity of Coating of zinc coated articles	
17		Standard specification for glass fiber strands	ASTM D 578-05
18		Standard test method for compositional analysis by Thermogravimetry	ASTM E 1131-03
19	IS: 4699	Specification for refined secondary Zinc	

Annexure-B

Tests on Insulator units

1. RIV Test (Dry)

The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz AC voltage of 10 kV & 30 kV for 11 kV insulators under dry condition. The test procedure shall be in accordance with 15:8263 IEC: 437/CISPR 18-2.

2. Brittle Fracture Resistance Test

Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1 n HN03 acid" (63 gm conc. HN03 added to 937 gm water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96-hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

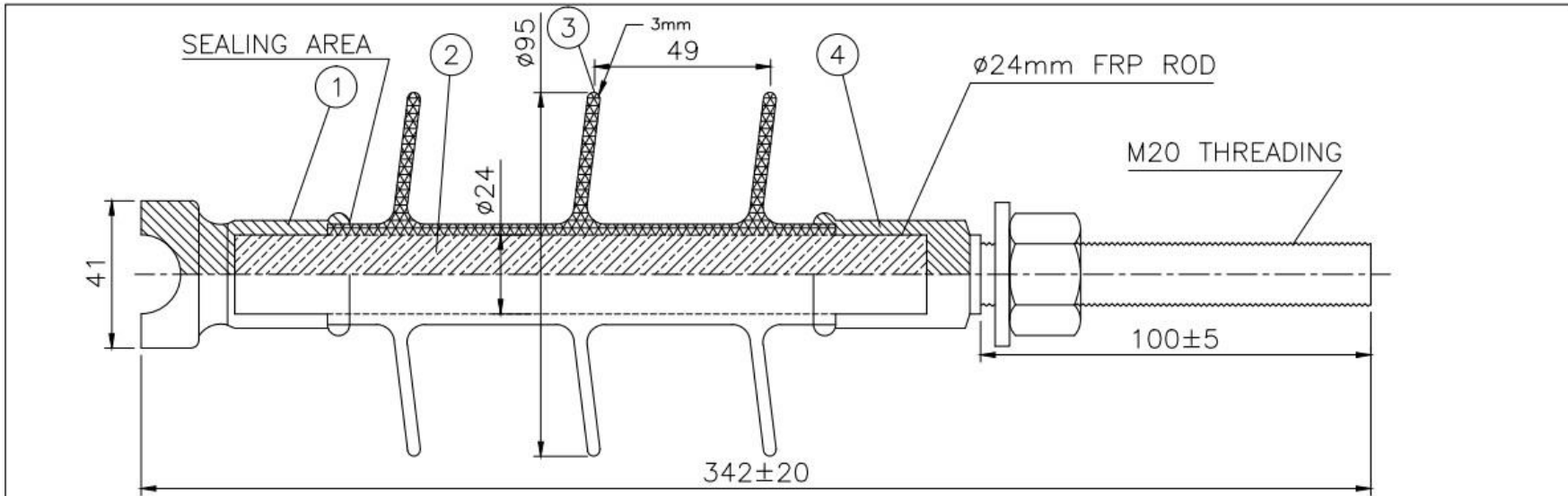
3. Recovery of Hydrophobicity & Corona test

The test shall be carried out on 4mm thick samples of 5cm x 7cm.

- i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRJ guide for Hydrophobicity classification (Extract enclosed at Annexure - D). Dry the sample surface.
- ii) The sample shall subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1 mm above the sample surface. The test shall be done for 100 hrs.
- iii) Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 2 above. Note HC classification. Repeat the cycle for 1000 hrs. or until an HC of 6 or 7 is obtained. Dry the sample surface.
- iv) Allow the sample to recover and repeat hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 - HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

4. Chemical composition test for Silicon content

The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI/ERDA or any other NABL accredited govt laboratory



TECHNICAL CHARACTERISTICS:


DIMENSIONS:	
1. CREEPAGE DISTANCE(MINIMUM)	320mm
2. ARCING(MINIMUM)	167mm
3. No OF ø95mm SHEDS	3

MECHANICAL CHARACTERISTICS:	
1. MIN FAILING LOAD	5kN

ELECTRICAL CHARACTERISTICS:	
1. NOMINAL SYSTEM VOLTAGE	11KV
2. HIGHEST SYSTEM VOLTAGE	12KV
3. SYSTEM FREQUENCY	50HZ
4. WET 1 MINUTE POWER FREQUENCY WITHSTAND VOLTAGE	35kV(rms)
5. DRY 1 MINUTE POWER FREQUENCY WITHSTAND VOLTAGE	40kV(rms)
6. DRY LIGHTNING IMPULSE WITHSTAND VOLTAGE	75kVp
7. VISIBLE DISCHARGE TEST VOLTAGE	9kV(rms)

NOTES:	
1. INSULATOR CONFORMS TO IEC: 61109-2008	IS: 2488-1974
2. GALVANISATION CONFORMS TO IS: 2679-1985	

ITEM	DESCRIPTION	MATERIAL	QTY	REMARKS
1	TOP METAL FITTING	SGCI/FORGED	1 NO	HDG
2	CORE ROD	FIBERGLASS	1 NO	24mmø
3	POLYMER HOUSING	SILICONE RUBBER	-	
4	BOTTOM METAL FITTING	SGCI/FORGED	1 NO	HDG

Signatures		All dimensions are in mm unless otherwise stated.	 BESCOM
Chd	<i>[Signature]</i> AGM (QS&S)		
Sub	<i>[Signature]</i> DGM (QS&S)	Approved: <i>[Signature]</i> General Manager, (Elec.) QS&S	
SCALE: N.T.S		DRG.NO.BESCOM/GM/QS&S/28 REV-002 DATED:24-11-2018	

SECTION -18

ACSR- RABBIT CONDUCTOR

TECHNICAL SPECIFICATION FOR RABBIT ACSR CONDUCTOR

1 SCOPE:

This specification covers manufacture, testing at manufacture's works and supply of Rabbit ACSR conductor.

- 2 The basic technical and other particulars of the equipment and the various components are specified in the following sections and tender schedule.

3 CONSTRUCTION:

- 3.1 **ACSR Conductor:** The conductor shall comply in all respects with the latest edition of IS-398 (Part-II) 1996 with its latest amendment. The Aluminium wires used in the manufacture of the conductor shall be of the highest electrical quality and free from scratches, die marks and other surface imperfections. They shall be reinforced with a central core of galvanized high tensile steel wire having negligible sulphur and phosphorous contents.
- 3.2 The steel wire shall not be subject to any heat treatment after being galvanized. The zinc coating of steel wires shall be smooth and of uniform thickness. There shall be no bare spots owing to adherence of scales or other causes.
- 3.3 **Joints in wires:** Joints in the individual Aluminium, wires are permitted but no two such joints shall be within 15 meters apart in the complete stranded conductors. There should be no joints in the galvanized steel wire except those made in the base rod or wire before final drawing forming the core of steel reinforced Aluminium.
- 3.4 The resistance of the individual Aluminium wire shall be determined separately before stranding by means of standard tests on sample wires. The test samples shall be of sufficient length to give an accuracy of at least one part in a thousand.
- 3.5 The ACSR conductor size and standard lengths shall be as per IS 398 (Part-II) 1996 with its latest amendments and as indicated below.

Code Name of Conductor	Nominal Aluminium Area	Dia of wires in mm		Sectional Area of Aluminium (mm ²)	Total Sectional Area (mm ²)	Extended Calculated Resistance at 20° C (max)	Appx. Calculated breaking load in KN	Appx. Over all dia (mm ²)	Std. Length in Mtrs	Appx. Mass Kg./Km.
		Aluminium	Steel							
Rabbit	50 Sq.mm	6/3.35	1/3.35	52.88	61.70	0.5524	18.25	10.05	1400	214

- 4 **STANDARD SIZES OF WIRES:** The Aluminium wire and galvanized steel wire for the standard construction of conductors have diameter specified as shown below, as per Tables 1&2 Section of IS 398 (Part-II).

TABLE-1: Aluminium Wire used in the construction of Aluminium Conductors Galvanized Steel Reinforced.

Diameter in mm			Cross Sectional area of nominal dia wire	Mass	Resistance at 20° C ohm/Km	Breaking load	
Nominal	Minimum	Maximum				Before Stranding	After Stranding
3.35	3.32	3.38	8.814 mm ²	23.82 Kgs/Km	3.265	1.43 KN	1.36 KN

TABLE-2: Steel wire used in the construction of Aluminium conductors galvanized steel reinforced.

Diameter in mm			Cross Sectional area of nominal dia wire	Mass	Breaking load	
Nominal	Minimum	Maximum			Before Stranding	After Stranding
3.35	3.28	3.42	8.814 mm ²	68.75 Kg/Km	11.58 KN	11.0 KN

- 5 **LAY RATIO:** Ratio of the axial length of a complete turn of the helix formed by the individual wire in a standard conductor to the external diameter of the helix.

The lay ratio shall be as shown below.

TABLE-3: Lay Ratios of Aluminium Conductor, Galvanized Steel Reinforced.

Number of Wires		Ratio of Aluminium wire dia to Steel wire dia	Lay Ratio for Steel Core		Lay Ratio for Aluminium Outside Layer	
Aluminium	Steel		Minimum	Maximum	Minimum	Maximum
6	1	1.00	-	-	10	14

Note: For the purpose of calculation, the mean lay ratio shall be taken as the arithmetic mean of the relevant minimum and maximum values given in this table.

6 TESTS & INSPECTION OF RAW MATERIAL AT SUPPLIER'S WORKS:

6.1 Within two weeks of receipt of each consignment of raw materials viz., steel, Electrolytic Aluminium rods, etc., at the manufacturers works, the contractor shall furnish to the purchaser in triplicate the raw material manufacturers certificates.

6.2 The test certificates shall cover all tests on required number of samples as stipulated in clause 13.1 of IS. [Part-II] 1996 with latest amendments if any.

- 6.3 The manufacturer shall not commence manufacturing the conductor ordered prior to purchaser's approval of the test certificate for raw materials
- 6.4 Test certificates in triplicate for tests on the finished ACSR conductor shall be submitted. The suppliers shall furnish along with RCs, the number of pieces of conductor in each reel and the length of individual pieces.
- 6.5 All tests as detailed in clause 13 of IS-398 (Part-II) 1996 with its latest amendments shall be carried out on conductors covered by this specification and shall be submitted by the contractor for purchasers' approval within four weeks of the acceptance of the letter of intent. No change in the schedule of tests, unless desired by the purchaser shall be subsequently made by the contractor or his subcontractors of the manufacturers without prior - consent of the purchaser.
- 6.6 The purchaser may at any time call for any tests that are laid down in the specification as optional tests. The contractor shall arrange to carry out such tests expeditiously at his own cost. The certificates for such optional tests shall be submitted to the purchaser for approval.
- 6.7 The contractor shall notify the purchaser, at least fifteen days in advance, the time of manufacture so that inspection of materials during manufacture and or witnessing of the tests can be arranged. If the purchaser waives inspection, he will advise the contractor accordingly. Inspection shall also include method of packing and stacking of finished materials in the works.

7 Packing:

The ACSR conductor reels shall be of dimensions approved by the purchaser and made of seasoned wood sufficient strong and in sound condition to ensure that the reels shall reach the site intact with lagging end free from damage due to transport hazards by rail and over land. These reels shall conform to IS 1778/1981 with latest amendments if any.

a) The standard length of the ACSR conductor shall be as per schedule of materials specification. Longer lengths are acceptable. However, short lengths not less than one Km. each are acceptable to the minimum extent of 5% of the quantity ordered.

b) The contractor shall submit in duplicate detailed packing specification for the conductors for the purchaser's approval at least fifteen days prior to commencement of dispatch. Finally approved specification shall be furnished along with the dispatch documents.

8 REEL OR DRUM SHALL BEAR THE FOLLOWING INFORMATION

- a. Reel or drum number
- b. Size and description of contents
- c. Length of each piece of conductor (on reels)
- d. No. of pieces in each package/reel
- e. Gross weight
- f. Net weight
- g. Purchase order No. & Date
- h. Place and designation of consignee

The above details shall be legibly and indelibly marked.

- 9 The Bidder shall furnish the guaranteed technical particulars as per the Proforma enclosed to this specification.

Name of the bidder		
Sl. No.	Particulars	Bidder
1	Maker's Name, Address & Country	
	a) Aluminium rods	
	b) Steel wire/rods	
	c) Complete Conductor	
2	Stranding and Wire Diameter (mm)	
	a) Aluminium	
	b) Steel	
3	Nominal Aluminium area in Sq.mm.	
4	Sectional Area of Aluminium Strands in Sq.m.m.	
5	Total Sectional area in Sq.mm.	
6	Cross sectional area of nominal diameter wire in Sq.mm.	
	a) Aluminium wire	
	b) Steel Wire	
7	Overall diameter of conductor in mm.	
8	Breaking load of conductor in Kg.	
9	Minimum breaking load in Kg. for	
	a) Aluminium wire	
	b) Steel Wire	
10	Zinc coating of steel wire	

	a) Uniformity of coating No. and duration of dips (Process test with stood I min. X Nos.)	
	b) Minimum weight of coating (grm./Sq.mm.)	
11	Mass in Kg. per Km.	
	a) Aluminium wire	
	b) Steel Wire	
	c) Conductor	
12	Resistance in Ohms per Km. at 20 Deg.C.	
	a) Continuous maximum current rating of conductor (Amps) in still air or 45 Deg.C ambient temperature.	
	b) Temperature rise for the above current Deg. C.	
13	Purity of Aluminium Rods	
14	Maximum working tension for complete conductor Kg.	
15	Modulus of Elasticity (Kg/sq cm X 10 ⁶)	
	a) Aluminium	
	b) Steel	
	c) Conductor	
16	Co-efficient of linear expansion per degree	
	a) Aluminium	
	b) Steel	
	c) Conductor	
17	Standard length of each piece in Km.	
18	Tolerance, if any on standard length	
19	No. of standard lengths in one reel	

20	Approximate dimensions of the reel in Cms.	
21	Mass of the conductor in one reel in Kg.	
22	Gross mass of the reel including mass of the conductor.	
23	Mass of the reel in Kg.	
24	Standard according to which the conductor will be manufactured and tested.	
25	Date of commencement of production of conductor.	
26	Other Particulars	

K-RIDE

SECTION -19

H.G FUSE UNIT

K-RIDE

**SPECIFICATION FOR 11KV H.G. FUSE UNITS WITH 11 KV SOLID CORE
INSULATORS**

1.0 **Scope:** This specification covers the manufacture, testing at manufacturer works and supply of 11kV Horn Gap Fuse Units along with 11 kV Solid Core Insulators. The Fuse units shall conform to the enclosed drawing.

2.0 **Atmospheric Conditions:** The fuse units are to be installed at places with the following weather conditions.

Temperature	:	Maximum ambient	- 50°C
	:	Average	- 32°C
	:	Minimum	- 05°C
	:	Altitude	- Max. 1000 Mtrs. above sea level

3.0 **Construction:**

3.1 The construction of the fuse units shall be of high quality as it is intended to ionize the fault current at the time of expulsion. The fuse shall generally conform to IS, dealing with high voltage expulsion and drop out fuses.

3.2 The fuse units shall be suitable for horizontal mounting only. The mounting shall be by using 45x45x5 cleat welded to 25x6 M.S. flat fixed to the central portion of the insulator. All the M.S. Parts should be hot dip galvanized as per relevant IS.

(A) **COMPLETENESS OF SUPPLY:**

The component offered shall be complete and operative in all aspects and shall conform to high standard of Engineering design and workmanship.

(B) Deviation from technical specifications: Tenderer shall furnish the details of deviations/modification proposed by him if any towards improvement of the said offer.

4.0 **INSULATORS:**

4.1 The insulator used shall be of 11KV solid core type, brown glazed porcelain suitable for highest system voltage of 12 KV. The Insulators shall generally conform to IS: 5350 (part-II) and as per the enclosed drawing.

4.2 The insulator shall be in one piece. The stresses due to expansion and contraction in any part of the insulator shall not lead to its deterioration. The insulator shall be glazed effectively on all the surfaces except for the parts on which the particulars are supported during firing which may be left unglazed. The solid core insulator shall be baked in Temperature controlled kilns only.

- 4.3 Insulators shall pass visual test, dimensional test, porosity test, puncture test, temperature cycle test as per relevant ISS.

Following tests shall be conducted and test certificate duly signed by a responsible officer of the supplier's organization shall be submitted.

1. Dry Power Frequency voltage withstand test.
2. Dry Power Frequency voltage flashover test.
3. Wet Power Frequency voltage withstand test.
4. Wet Power Frequency voltage flashover test.
5. High voltage impulse voltage withstand test.
6. High voltage 50% impulse voltage flashover test.
7. High voltage visible discharge test.
8. Electro mechanical failing load test.

- 4.4 **MARKING:** Each insulator shall be legibly and indelibly marked with the following:

- 1) Name of trade mark of the manufacturer.
- 2) Month and year of manufacture.
- 3) ISI certificate mark, if any

The marking shall be durable and shall be printed by the transfer process before firing. Stickers are not permitted.

The bidders can use insulators conforming to relevant ISS and having ISI Mark.

The successful bidder should get the insulator make approved by BESCO, before making supplies/take up bulk production.

- 5.0 **ARCING HORNS:** The H.G. Fuse unit shall be provided with arcing horns of 8mm diameter hot dip galvanized iron rod. The other particulars like G.I. Strip, brass wing nuts, G.I. Flats etc., are furnished in the drawing enclosed.
- 6.0 The H.G. Fuse units shall be designed to withstand the voltage that is indicated for solid core insulators.
- 7.0 Type tests on one H.G. Fuse unit as per the provisions of the relevant shall be conducted at CPRI or in a recognized laboratory approved by BESCO and the test certificates along with the drawing attested by the concerned laboratory shall be submitted for approval before commencing supplies.

8.0 PACKING:

The H.G. Fuse Units shall be securely packed in crates or boxes to withstand rough handling during transit and storage.

9.0 INSPECTION:

- 9.01 All tests and inspection shall be generally made at the place of manufacturer. Purchaser (BESCOM/ KRIDE) shall be provided with all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification. Purchaser and its representative shall at times be entitled to have access to the works and to all places of manufacture where insulators are manufactured and the supplier shall afford all facilities to them for unrestricted inspection of the works, inspection of materials and inspection of manufacturing process of insulators for conducting necessary tests and specified herein.
- 9.02 The supplier shall keep the Purchaser informed in advance of the time of Starting and progress of manufacture of insulators in various stages so that arrangements could be made for inspection.
- 9.03 No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.
- 9.04 The BESCOM/ KRIDE has the right to have the tests carried out by an independent agency, when considered necessary.

10.0 NAME PLATE:

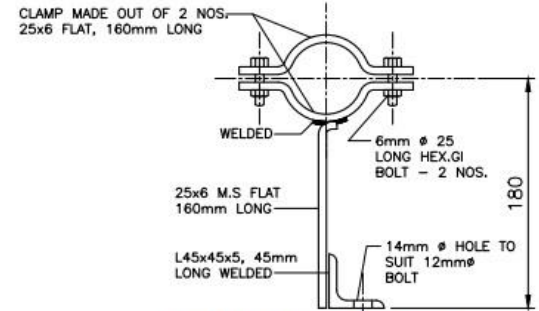
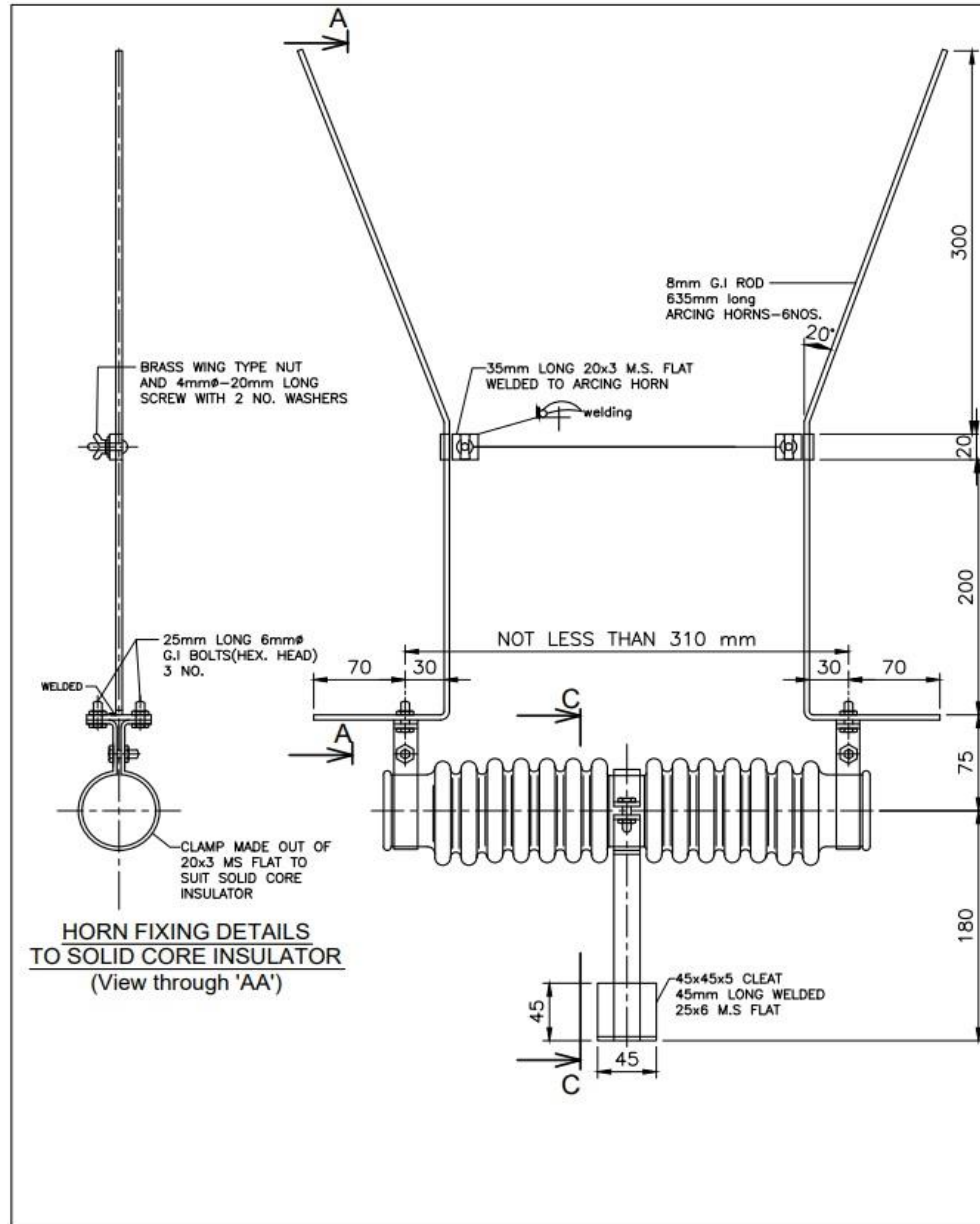
Each H.G. Fuse Unit shall be provided with a Name plate of minimum size 50x40mm and shall be fixed with the following details which are legibly and indelibly marked.

- 1) Name of Manufacturer
- 2) BESCOM
- 3) Purchase Order No. and Date
- 4) Sl.No.

11.0 SAMPLE

The Contractor shall submit two samples and get them approved by the competent authority before taking up the manufacture. The approved samples will be kept as under

- i) One approved sample will be with the manufacturer at the manufacturing premises so that so that the inspecting officer can inspect the materials offered for inspection with reference to the approved sample.



**DETAILS OF CLAMP TO FIX
SOLID CORE INSULATOR
TO CROSS ARM
(View through 'CC')**

BILL OF MATERIALS/SET

SL. NO.	DESCRIPTION	QTY.
1.	11KV CLASS SOLID CORE INSULATORS	3 NOS.
2.	G.I HORNS USING 8mm ϕ ROD AS DETAILS SHOWN THROUGH AA WITH CLAMPING ARRANGEMENT USING 20x3 M.S. FLAT AND G.I BOLTS.	6 SETS
3.	CLAMPS MADE OUT OF 25x6 M.S. FLAT & L 45x45x5 CLEAT AS SHOWN IN DETAIL THROUGH CC WITH REQD. BOLTS	3 SETS
4.	P.G CLAMP ONE GROOVE SUITABLE TO 8 mm ϕ G.I ROD AND OTHER GROOVE SUITABLE TO 8 TO 10 mm ϕ ACSR CONDUCTOR.	6 NOS.

NOTES:-

1. THE DRAWING HAS BEEN PREPARED BASED ON WORK SHOP SAMPLE USED IN FIELD.
2. ALL METALLIC PARTS SHALL BE HOT DIP GALVANISED.
3. FOR SOLID CORE INSULATOR REFER DRAWING NO:-BESCOM/GM/QS&S/29

	Signatures	All dimensions are in mm unless otherwise stated.	 Approved:
Chd	<i>[Signature]</i> AGM (QS&S)	11 KV HORN GAP FUSE USING SOLID CORE 11KV INSULATORS	
Sub	<i>[Signature]</i> DGM (QS&S)		DRG.NO.BESCOM/GM/QS&S/21 REV-002 DATED:24-11-2018
SCALE: N.T.S			

SECTION-20

LIGHTENING ARRESTOR

K-RIDE

TECHNNICAL SPECIFICATION FOR GAPLESS METAL OXIDE DISTRIBUTION TYPE SURGE ARRESTERS WITH POLYMERIC HOUSING FOR USE IN 11KV SYSTEM

1.0 SCOPE

This specification covers design, manufacture testing and supply of gapless Metal Oxide Distribution type surge arresters with polymeric housing for use in the 11kV overhead distribution system, to protect electric power systems from expose to over voltages which might over stress the dielectric strength of equipment used. Over voltages can be caused by lightning strokes (lightning over voltages). Switching and circuit breaking (Switching over voltages) or certain load flow conditions (Temporary over voltages).

2.0 APPLICABLE STANDARDS

2.1 Standards

Following Indian/International standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the specification, shall be referred while accessing conformity of polymeric surge arresters with these specifications.

2.1.1 In the event of supply of polymeric surge arresters conforming to standards other than specified, the Bidder shall confirm that these standards are equivalent or better to those specified. In case of award, salient features of comparison between the standards proposed by the bidder and those specified in this document will be provided by the supplies to establish equivalence.

Sl. No.	Indian standard	Title	International Standard
1	IS 15086 part-4 2017	Polymeric surge arresters, Part -4: Surge arresters without gapes for A.C. Systems overhead lines above 1000V	IEC:60099-4 2014, Edition-3 or latest if exists
2		Polymeric surge arresters – 5 selection & application recommendations	IEC:6009-5, 2013 or latest if exists
3		Polymer burning behavior	IEC:60707 & UL94
4	IS:13134	Guide for the selection of Polymeric surge arrestor with respect of to polluted conditions	IEC:60815
5		Thermal Mechanical performance test and mechanical performance test on Polymeric surge arrestors	IEC:60575
6		Hydrophobicity Classification Guide	STRI guide:1.92/1
7		Radio interference characteristics of overhead power lines and high voltage equipment	CISPR:18-2 Part 2
8	IS:8263	Methods of RI Test of HV surge arresters	IEC:60437
9		Standards for surge arresters- composite – Distribution Dead – end Type	ANSI C29.13
10		Hot dip zinc coating on structural steel & other allied products	ISO:1459 ISO:1461
11	IS:2629	Recommended practice for Hot, Dip Galvanization for iron and steel	ISO:1461(E)
12	IS:6745	Determination of Weight of Zinc coating on Zinc coated iron and steel articles	ISO:1460
13	IS:3203	Methods of testing of local thickness of electroplated coatings	ISO:2178
14	IS:2633	Testing of Uniformity of coating of Zinc Coated articles	
15		Standard specification for glass Fiber standards	ASTM D 578-05
16		Standard test method for Compositional analysis by thermogravimetric.	ASTM E 1131-03
17	IS:4699	Specification for refined secondary Zinc	

3.0 Technical Description of Polymeric Surge arresters**3.1 Service condition**

The polymeric surge arresters to be supplied shall be suitable for satisfactory continuous operation under conditions as specified below:

Maximum ambient temperature	: 50°C
Minimum ambient temperature	: -5° C
Relative humidity	: 0 to 1005

3.2 System Parameters

The arresters must be able to operate under the system parameters mentioned in this specification:

Nominal voltage system kV(rms)	11kV
Frequency	50Hz
Grounding of neutral	Solidly
Temporary over voltage (Earth fault factor)	10.4kV rms for 10sec.
Highest system voltage kV(rms)	12kV
Short circuit levels	16kA
Equipment Insulation withstand level	75kV
Wet Power Frequency withstand voltage	38kV

3.3 Surge arresters' requirements:**a) Mechanical requirements:**

Creepage length	300mm (Min.)
Pull strength	1000N (Min.)
Cantilever load	75Nm (Min.)
Torsion	30Nm (Min.)

b) Electrical requirements:

Arrester Max. Continuous Operating voltage Uc	8kV rms
Arrester Rated voltage Ur	12kV rms, with distribution medium - DH class as per latest Edition
Arrester Class / Nominal discharge current	DL / In=10kA
Min repetitive charge transfer capability: Qrs	Minimum 0.4C
Max. Lightning Impulse residual voltage @ In	29kVp
Max. Steep Impulse residual voltage @ In	32kVp
Minimum Thermal Charge rating for two impulses	Qth : 1.1C
TOV values	1 secs : kV 10 Sec : kV 100 Sec : kV
Surge arrester housing Insulation withstand voltages i) Lightning Impulse (Dry) ii) Power Frequency (Wet)	As per IEC 60099-4 / IS 15086 Part-4 Standard
High current impulse withstand (4/10 micro second value) kA (peak)	100kA
Pressure relief current High current Low current	16kA , High & low currents as per IEC 60099-4 / IS 15086 Standards
Partial Discharge	≤ 10 pC
Pollution Condition	Heavy

Minimum Bending load (kgm)	
SSL	50kgf
SLL	25kgf
Terminal torque	2.5kgm

- 3.3.1** The polymeric surge arresters shall be suitable for 3 Phase, 50Hz, effectively earthed 11kV O/H distribution system in a heavily polluted atmosphere.
- 3.3.2** Bidder must be an indigenous manufacture and supplier of polymeric surge arresters of rating 11kV or above OR must have developed proven in house technology and manufacturing process for polymeric surge arresters of above rating OR possess technical collaboration/association with a manufacture of polymeric surge arresters of rating 11kV or above.
- 3.3.3** Polymeric surge arresters shall have sheds with good self – cleaning properties, surge arresters shed profile, spacing, projection etc., and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC-60815/IS:13134.
- 3.4** **Dimensional Tolerance of polymeric surge arresters**
The tolerance on all dimensions e.g., diameter, length and creepage distance shall be allowed as follows:
 $\pm (0.04d + 1.5)$ mm when $d < 300$ mm.
 $\pm (0.025d + 6)$ mm when $d > 300$ mm.
Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be.
However, no negative tolerance shall be applicable to creepage distance.
- 3.5** **Interchangeability**
The surge arresters including the end filling connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.
- 3.6** **Corona and RI Performance**
All surface arresters shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The surge arresters and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generated any radio interference beyond specified limit under the operating conditions.
- 3.7** **Maintenance**
- 3.7.1** The surge arresters offered shall be suitable for use hot line maintenance technique so that usual hot line can be carried out with ease, speed and safety.

4.0 BASIC FEATURES:

4.1 Design and construction

Surge arresters having one or several non-linear metal oxide resistor with highly non-linear voltage – current characteristics, connected in series, but having no integrated series or parallel gaps.

The surge arresters shall be of cage design/ warp design

Cage: Using FRP rods which can be used as mechanical supporting part to accommodate the stack of MO elements. The Silicon rubber insulation is then moulded directly on to the MO elements without any internal gas volume left.

The MO elements is safely kept in place by the cage together with the high compressive force and they are embedded in to silicon rubber. Thus, the active part is almost protected from mechanical impact resulting in high transports safety.

Wrap design: The Mechanically supporting part of the housing is formed by a wrapped

FRP using Prepeg glass rovings or pre-impregnated bands that are wound around the MO resistor stack and cured. The resulting wrap, surrounding the varistor stack, to have open "windows" moulded with silicone rubber for relieving the short circuit. Shall be void free construction.

Since, there is a direct contact of the MO elements with the polymer material in cage and wrap designs, heat produced by the MO elements is more easily dissipated through the housing into the environment. This increases thermal stability and follows utilize more than MO elements with respect to electrical stress.

4.1.1 **Cage:**

It shall be a glass –fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibres shall be Boron free electricity corrosion resistant (ECR) glass fiber or boron free E-Glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through pultrusion process. The FRP rod shall be void free.

4.1.2 **Housing (Sheath)**

The surge arrester with housing made of silicon Rubber (SR) material without air voids neither between the housing and the metal oxide resistors nor the housing itself. Arresters must have directly moulded, housing FRP rod shall be covered by a seamless sheath of a silicon rubber compound of thickness of 3mm minimum.

It should protect the FRP rod/ FRP tapes shall be covered against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding area shall be free from voids.

4.1.3 **Weather Sheds**

The weather sheds made of silicon rubber shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (Housing) shall be free from voids, and shall be resistant against UV- radiation as well as tracking.

Silicone Rubber (RTV – 2/LSR) shall have inherent burning behavior, shall pass the test of IEC 60707 and UL94 with the highest class Vo, i.e. self- extinction within 10 seconds without development of burning drops. The limiting oxygen index(LOI) is greater the 35% i.e. to continue burning after inflaming an oxygen content of more than 35% is required.

4.1.4 **End Fittings**

The End fittings transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminium alloy. They shall be connected to the rod by means of a controlled compression technique. The gap between fitting and sheath shall be sealed by a flexible silicone rubber sealing performance between housing i.e. seamless sheath and metal connections. The sealing must be moisture proof. End fitting shall be of type to suitable for vertical and horizontal mounting and should match all mechanical and electrical requirements specified for the arrester. Terminals shall be made of M10 bolts allow the connections of line and ground leads.

4.1.5 **Disconnecter**

Disconnecter withstand

When an arrester is fitted or associated with a disconnecter, this device shall withstand, without operating, each of the following tests:

- a. Test to verify the retitive charge transfer rating, Qrs (see clause 8.5.2 of IS 15086(part 4):2017).

- b. Operating duty test with rated values of thermal charge rating, Q_{th} (see clause 8.7.2 of IS 15086(part 4):2017).
- c. Mechanical tests on agreement between manufacturer and user (see NOTES 1 and 2 8.9.4.1 of IS 15086(part 4):2017).

Disconnecter operation

Three values of current according to clause 8.9.3 of IS 15086(part 4):2017. There shall be clear evidence of effective and permanent disconnection by the device.

5.0 Workmanship

- 5.1 All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such surge arrester as are guaranteed by them to be satisfactory and suitable for continued good service in power Distribution System.
- 5.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 5.3 The design of the surge arrester shall be such that stresses due to expansion and contraction in any part of the arrester shall not lead to deterioration.
- 5.4 The MO shall be sound and free of cracks and voids that may adversely affect the arrester.
- 5.5 Weather sheds shall be uniform in quality. They shall be clean, sound, and smooth and shall be free from defects and excessive flashing at parting lines.
- 5.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 5.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610gm/sq.m or 87mm thickness and shall be in accordance with the requirement of IS:4759. The zinc used for galvanizing shall be of purity 99.5% as per IS:4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux, ash rust strains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand of least four successive dips each lasting for one(1) minute duration under the standard test. The galvanizing shall be carried out only after any machining.

6.0 Equipment Marking:

- 6.1 Each surge arrester's unit shall be legibly and indelibly marked with the following details as per IEC- 60099-4, Latest Edition
 - (a) Month & Year of manufacture.
 - (b) Manufacturer's name/Trade mark, Model no and identification Serial No.
 - (c) Maximum Continuous operating voltage.
 - (d) Rated Voltage
 - (e) Nominal discharge current and class of arrester
 - (f) Repetitive Charge Transfer Capability in Coulombs
 - (g) Pressure relief class : Type A or Type B, Rated short circuit current in kA rms
 - (h) Cantilever strength-SSL/SLL/Terminal torque
 - (i) Total leakage and resistive leakage current- I_r at MCOV value (before installation)
 - (j) Purchase order reference
- 6.2 Each ZnO element's Aluminum sprayed surface shall be printed with information like:
 - a. Batch No.
 - b. Designation with thermal energy and charge transfer rate
 - c. Rating & MCOV

- d. Nominal Discharge current
- e. AC reference voltage measured at reference current
- f. Residual voltage measured at nominal discharge current
- g. Type of the block (design code given by manufacturer)
- h. Manufacturer's name

The manufacturers may use QR code printed on the block in case of size limitation.

7.0 Drawing

7.1 The Bidder shall furnish full description and illustration of the material offered.

7.2 The Bidder shall furnish the outline drawing (3 copies) of arrester unit including a cross sectional view prior to supply.

7.3 After placement of award, the supplier shall submit full dimensioned manufacturing arrester drawings containing all the details in four (4) copies to the owner for approval. After getting approval from owner and successful completion of all the type tests, the supplier shall submit 10 more copies of the drawing to the Owner for further distribution and field use.

7.4 After placement of award the supplier shall also submit fully dimensioned arrester crate drawing for different type of surge arresters, drawing (cross sectional view) of ZnO elements used inside arrester for approval of the owner.

The drawings shall be submitted with the following details:

For the arrester:

- a) Manufacturer name
- b) Class and model no of arrester
- c) Rated and MCOV of arrester
- d) Nominal discharge current
- e) Pressure relief type and current (High current and low current)
- f) Thermal energy rating: W_{th}
- g) Repetitive Charge Transfer rating: Q_{rs} .

For the ZnO element:

- a. Batch No.
- b. Designation with thermal energy and charge transfer rate
- c. Rating & MCOV
- d. Nominal Discharge current
- e. AC reference voltage measured at reference current
- f. Residual voltage measured at nominal discharge current
- g. Power loss value measured at continuous operating voltage
- h. Type of the block (design code given by manufacturer)
- i. Manufacturer's name

8.0 Tests and Standards

Polymeric surge arrester offered shall be manufactured with the same configuration and raw materials as used in the Surge arrester for which design and type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than 5 years old.

8.1 Design Tests

Manufacture should submit test reports for design Tests as per relevant clauses of IEC-60099-4 / IS15086 Part-4 Latest Editions & IEC – 60099-5 / IS 15086 Part-5 latest Editions Standards prior to supply of item. Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract:

UV test: The test shall be carried out in line with clause 7.2 of ANSI IC29.13.

8.2 Type Tests

The following type tests shall be conducted on a suitable number of individual Surge arrester, components and materials.

8.2.1 The bidder shall submit type test reports as per IEC 60099-4 / IS prior to supply of item. Additional type tests as required above shall be carried out by the manufacturer after award of contract for which no additional charges shall be payable. In case the tests have already been carried out, the manufacturer shall report for the same.

SI No.	Description of type test	Test procedure / Clause as per standards IEC 60099-4 / IS 15086 Latest Editions
1.	Residual Voltage Tests on elements <ul style="list-style-type: none"> • Steep Current Impulse residual voltage • Lightning Current Impulse 8/20 μS. • Switching impulse residual voltage test 	8.3 / 10.8.3 8.3.2 / 10.8.3.2 8.3.3 / 10.8.3.3 8.3.4 / 10.8.3.4
2	Test to verify long term thermal stability under continues operating voltage / Accelerated ageing test	8.4 / 10.8.4
3.	Repetitive charge transfer rate	8.5 / 10.8.5
4.	Heat Dissipation behavior of Test sample	8.6 / 10.8.6
5.	Operating duty test on prorated sections / Switching surge energy rating (IEEE)	8.7 / 10.8.7
6.	Power frequency vs time test / TOV test	8.8 / 10.8.8
7	Repetitive charge transfer test on Disconnectors	8.9.2/ 10.8.9.2
8	Operating duty test on Disconnectors	8.9.2 / 10.8.9.2
9	Disconnecter Operation Tests	8.9.3/ 10.8.9.3
10	Short circuit test	8.10 / 10.8.10

11.	Bending moment test	8.11 / 10.8.11
12	Environmental test on arresters	8.12 / 10.8.12
13	Weather ageing test on polymer arresters	10.8.17
14.	Tests for arrester disconnectors	Clause 4.1.5 of technical specifications

8.2.2 It shall be the option of the owner to accept the surge arresters based on type test reports submitted by the manufacturer. The owner shall be free to repeat the type tests & may witness the same.

For the purpose of facilitating the type test.

8.2.3 All the type test given in Clause No:8.2 in addition to routine and acceptance test shall be carried out on surge arresters along with hard ware fittings wherever required.

8.3 Acceptance (Sample) Tests

8.3.1 For Surge Arrester

a)	Measurement of Power Frequency voltage at Reference Current	Clause 9.2.1 As per IEC:60099-4 IEC:2014
b)	Lightning impulse residual on the complete arrester	
C)	Internal partial discharge test	
d)	Repetitive charge transfer rate with minimum Qrs = 0.4 C	

8.4 Routine Tests

A)	Measurement of reference voltage (Uref) (See 3.35 and 6.2)	Clause 9.1 As per IEC:60099-4 IEC:2014
b)	Residual voltage test	
c)	Internal partial discharge test	
d)	Current distribution test for multi-column arrester	
e)	For arrester units with sealed housing, a leakage check shall be made on each unit by any sensitive method adopted by the manufacture.	

8.5 Tests During Manufacture

Following tests shall be also be carried out on all components if applicable.

a)	Chemical analysis of zinc used for galvanizing
b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
c)	Chemical analysis, hardness tests and magnetic particle inspection for forgings

8.6 Sample batch for Type Testing

8.6.1 The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner. The bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner.

8.7 Additional Tests

8.7.1 The Owner reserves the right at his own expenses, for carrying out any other test(s) of reasonable nature carried out at supplies premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material complies with the specifications.

8.7.2 The Owner also reserves the right to conduct all the tests mentioned in this specification on the samples drawn from the site at supplies premises or at any other test center. In case of evidence of noncompliance, it shall be binding on the part of the supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the owner.

8.8 co-ordination For Testing

8.8.1 The supplies shall have to co-ordinate testing of surge arresters with hard ware fittings to be supplied by other supplier and shall have to guarantee overall satisfactory performance of the surge arresters with the hardware fittings.

8.8.2 The bidder shall intimate the owner about carrying out of the type tests along with detailed testing programme at least 3 weeks in advance of the scheduled date of testing which the owner will arrange to depute his representative to be present at the time of carrying out the tests

8.9 Quality Assurance Plan

8.9.1 The successful bidder shall submit following information to the owner:

8.9.1.1 Test certificates of the raw materials and brought out accessories

8.9.1.2 Statement giving list of important raw materials, their grades along with manes of sub – supplies for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.

8.9.1.3 List of manufacturing facilities available along with Routine test facilities.

8.9.1.4 Level of automation achieved and lists of areas where manual processing exists.

8.9.1.5 Lists of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

8.9.1.6 List of testing equipment's available with the bidder for final testing of equipment's along with valid calibration reports.

8.9.1.7 The manufacture shall submit manufacturing quality plan (MPQ) for approval & the same shall be followed during manufacture and testing,

8.9.2 The successful bidder shall submit the routine test certificates of brought out raw material/accessories and central excise passes for raw material at the time of inspection.

8.10 Guarantee

The Supplier of surge arresters shall guarantee overall satisfactory performance of the surge arresters.

8.11.1 At least three copies of type test reports shall be furnished. One copy shall be returned duly certified by the owner. Only after that supply of the item can be made.

8.11.2 Copies of acceptance test reports shall be furnished in at least three(3) copies. One copy shall be returned duly certified by the owner, only after which the materials shall be dispatched.

8.11.3 Record of the acceptance test reports shall be maintained by the supplier. These shall be produced for verification as and when desired by the owner.

8.11.4 Test certificates of test during manufacture shall be maintained by the supplier. These shall be produced for verification as and when desired by the owner.

9.0 Inspection

- 9.1** The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where surge arresters and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the supplier's and sub-supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
- 9.2** The material for final inspection shall be offered by the supplier only under packed condition. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogenous and shall contain surge arresters manufactured in 3-4 consecutive weeks.
- 9.3** The supplier shall keep the owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 9.4** No material shall be dispatched from its point manufacture before it has been satisfactory inspected and tested unless the inspection is waived off by the owner in writing. In the later case also, material shall be dispatched only after satisfactory testing specified here in has been completed.
- 9.5** The acceptance of any quantity of material shall in way relieve the supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

10.0 Packing

- 10.1** All surge arresters shall be packed in strong corrugated box of min.7 ply duly palette or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100kg to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.
- 10.2** The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 10.3** Suitable cushioning protective padding or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 10.4** All Packing cases shall be marked legibly and correctly so as ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty or illegible markings. Each wooden case/crate/corrugated box shall have all markings stenciled on it in indelible ink.
- 10.5** The bidders shall provide instructions regarding handling and storage precautions to be taken at site.

Tests on surge arresters' units**1. RIV Test (Dry)**

The surge arresters string along with complete hardware fittings have a radio interference voltage level below 100 microvolts at one MHZ when subjected to 50 Hz AC voltage of 10kv class surge arresters under dry condition. The test procedure shall be in accordance with IS:8263/IEC:437/CISPR 18-2. This test is applicable for surge arresters > 72.5kV

2. Brittle Fracture Resistance Test

Brittle fracture test shall be carried out on naked rod along with end fittings by applying "IN HNO₃ acid" (63 g conc. HNO₃ added to 937 g water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96 hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

3. Recovery of Hydrophobicity & Corona test.

The test shall be carried out on 4mm thick samples of 5cm x 7cm.

- i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification. Dry the sample surface.
- ii) The samples shall be subjected to mechanical stress by bending the sample over a ground electrode. Corona is continuously generated by applying 12kv to a needle like electrode place 1mm above the sample surface. The test shall be done for 100 hrs.
- iii) Immediately after the corona treatment, spray the surface with water and record the HC classification. Dry the surface and repeat the corona treatment as at clause 2 above. Note HC classification. Repeat the cycle for 1000 hrs or unit HC of 6 or 7 obtained. Dry the sample surface.
- iv) Allow the sample to recover and repeat hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC1 – HC 2 within 24 hours, depending on the material and the intensity of the corona treatment.

4. Chemical composition test for Silicon content.

The content of silicon in the composite polymer shall be evaluated by EDX (energy Dispersion X-ray) Analysis or Thermogravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

Annexure – B

Guaranteed technical Particulars of surge arresters

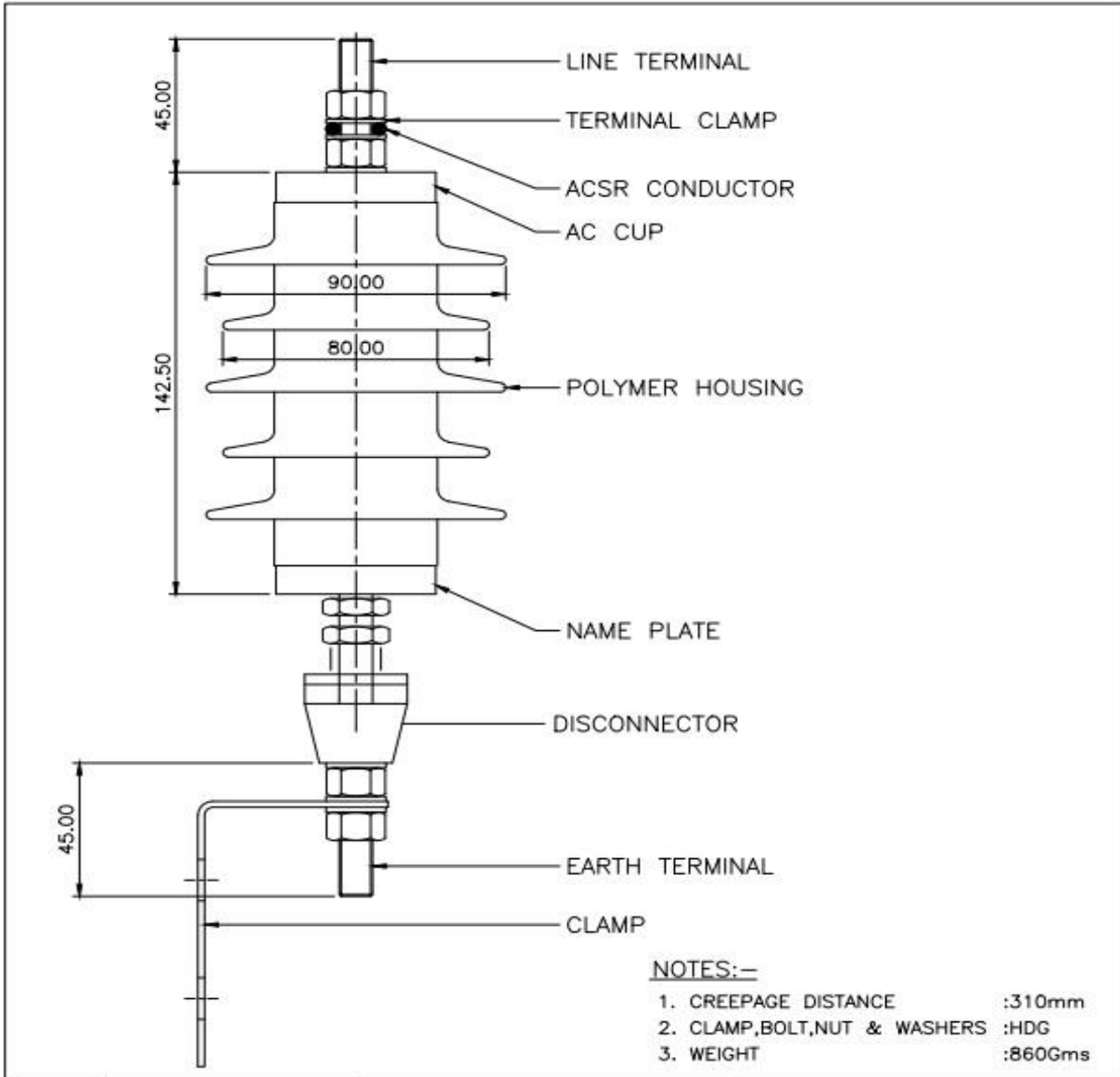
Name of the manufacture:


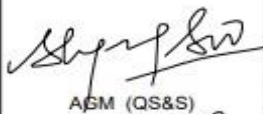

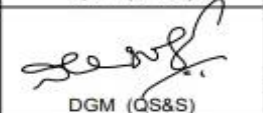
Address of works:

Sl.no	Description	Unit	
1.	Arrester Type or Designation	Kvrms	
2.	Arrester continuous operating voltage Uc	Kvrms	
3.	Arrester rated voltage Ur	KA	
4.	Nominal discharge current in	KA	
5.	Arrester Class	DH/DM/DL	
6.	High current discharge current 4/10us	KA	
7.	Repetitive Charge Transfer rate	C	
8.	Repetitive Charge Transfer rate duration	µs	
9	Temporary overvoltage capability (kV rms)	0.1 sec 1.0 sec 10 sec 100 sec	
10.	Rated short circuit current Isc		
	a. pressure relief class		
	b. High current	kA	
	c. Low current	A	
11.	Pull strength	N	
12.	Cantilever strength	Nm	
13.	Torque strength	Nm	
14.	Total height of arrester	mm	
15.	Creepage length	mm	
16.	Flashover distance	mm	
17.	Housing Lightning impulse 1,2/50 Us withstand level	kVp	
18.	Housing Wet power frequency withstand level	kVrms	
19.	Housing type		
20.	Housing material		
21.	Colour of Housing		
22.	Void – free Design (state)	Yes/No	
23.	Bonding/Interfacial sealing(State)	Yes/No	

SECTION 8B: TECHNICAL SPECIFICATIONS

24.	Reference current	mA	
25.	Reference Voltage range(Min/Max)	kV	
26.	Max. partial discharge level	pC.	
27.	TOV curve enclosed?	Yes/No	
28.	Arrester will be able to operate under the system parameters mentioned is S3	Yes/No	
29.	Maximum residual voltage of arrester for: Lightning current impulse 8/20us at 5kA 10kA 20kA Step lightning current impulse 1/10 us at nominal discharge current In	kV	
30.	Minimum recommended centre to centre distance between arresters	mm	
31.	Minimum recommended distance from centre of arrester to nearest grounded object.	mm	
32	Each ZnO block Dimension		
32	Date of last Type test		



	Signatures	All dimensions are in mm unless otherwise stated.	 BESCOM
Chd	 AGM (QS&S)	10KV 5KA POLYMER LIGHTNING ARRESTER WITH GROUND DISCONNECTOR	Approved:  General Manager,(Elec.) QS&S
Sub	 DGM (QS&S)		
SCALE: N.T.S			DRG.NO.BESCOM/GM/QS&S/60 REV-002 DATED:24-11-2018

SECTION-21

**L.T DISTRIBUTION BOXES &
H.T METERING CUBICLE.**

TECHNICAL SPECIFICATION FOR L.T. AC DISTRIBUTION BOXES MADE OUT OF SMC MATERIAL SUITABLE FOR 250KVA DISTRIBUTION TRANSFORMER

1. SCOPE:

The scope of this specification is for design, manufacture, testing and supply of outdoor type L.T. distribution boxes made out of SMC Materials as per IS 13410 suitable for operation on 433 volts, 3 phase, four wires AC, 50Hz system and required to be installed at the secondary side of the distribution Transformer centres of 250kVA.

2. COMPONENTS:

The L.T. Distribution boxes shall comprise of the following components:

1. Sheet Moulding Compound Box
2. Bus Bars
3. Moulded case circuit breakers.

3. APPLICABLE STANDARDS:

The L.T. Distribution Boxes with its components shall conform to the following standards of Bureau of Indian Standard (IS) and International Electro Technical Commission (IEC).

1.	IS-13410 1992	Grade of Sheet Moulding Compound Material - Thermosetting Plastic i.e., Glass Reinforced Polyester Sheet Moulding Compound.
2.	IS-13947	Parts I & II Circuit breakers.
3.	IS-6639	Hexagonal bolts for steel structures.
4.	IS-8828 1996	MCCB's for voltages not exceeding 1000V.

4. NORMAL SERVICE CONDITIONS:

Generally, as per IS-13947- Part 1 & II with latest amendments thereon.

5. DEFINITION & TERMINOLOGY - As per

- i) IEC-56 Clause (3) and sub clause thereof for circuit breakers.
- ii) As per 1S-13947 Part I & II thereof for circuit breakers.

6. DESIGN & CONSTRUCTION:

- a. The distribution box shall comprise of a moulded base and moulded door.
- b. Thickness of SMC Door/base shall be minimum 2mm.
- c. The Box and cover should be fixed by concealed hinges with hardware from inside in such a manner that it cannot be manipulated from outside.
- d. The door/cover shall rest on the base of box in such a way that any access from outside is not possible. The door in closed position should be overlapped on collar of base such that direct entry of screwdriver or tool is not possible.
- e. Suitable Mounting Arrangement should be made for mounting Bus Bars and MCCBs.
- f. For cable entry & exit holes with PVC Glands with check nuts of suitable dia, shall be provided at the Bottom and sides.
- g. The hole for entry and exit provided with glands shall be large enough to permit entry of 240 sq.mm lugs and at the same time shall be provided with suitable rubber / epoxy glands to prevent entry of foreign materials in to the box.
- h. Earthing bolts with 2 nuts and washers shall be provided.
- i. The doors shall be of self-closing type with springs or any arrangement so that the doors automatically close when released.
- j. All the corners of the meter box should be round and not pointed ones.

7. BUS BARS:

- 7.1. The main Bus bars shall be of EC grade Aluminium flat and provided with PVC/heat shrink insulation with red yellow and blue colour code to identify each of the phases.
- 7.2. The recommended sizes of the main bus bars and vertical riser links suitable for 250kVA Transformer shall be as follows:

Current rating in Amps	Size of Main Aluminium bus bars in mm (Width X Thickness)	Copper vertical riser links in mm (Width X Thickness)	Number of Circuits (Outgoing)
500 A	50mm x 10mm	25mm x 6mm	2

The bus bars shall be arranged in a staggered vertical formation and shall be supported by porcelain insulators.

NOTE: All the connections made in the bus bar with vertical risers etc., shall be made with suitable size of zinc bolts electro plated to avoid any loose contact.

8. MOULDED CASE CIRCUIT BREAKERS (MCCB):

The MCCBS shall generally comply with IS-13947 Part-I & II. The MCCB shall be a compact unit comprising of all the protective circuits. The MCCBs suitable for 250kVA Transformer.

9. Rating & Characteristics of MCCB:

Continuous current rating of MCCB	Rated short circuit breaking capacity at 0.25 PF kA (rms)	Rated peak making capacity kA (rms)
250 Amps	50kA	105kA

- a) Category of Utilization : A
- b) Rated operating Voltage U_e : 433V Phase to Phase.
250V Phase to Neutral.
- c) Rated insulation voltage U_i : 660V Minimum.
- d) Rated Impulse Voltage U_{imp} : 8kV

e) **Current Limiting:** - The moulded case circuit breakers directly feeding the loads shall be preferably of current limiting type such that under short circuit conditions very low cut off current and are let through for better protection of loads, cables etc.,

f) **Rated Ultimate Short Circuit Breaking Capacity (I_{cu}):** The short circuit current breaking rating of a MCCB is the highest value of the current that the MCCB is capable of breaking without being damaged. I_{cu} shall be 50kA at 0.25 Power factor as per IS 13947.

g) **Rated Service Short Circuit Breaking Capacity (I_{cs}):** The rated service breaking capacity is the maximum fault current a MCCB can successfully interrupt without being damaged. It has been expressed as a percentage of I_{cu} . The $I_{cs} = 100\% I_{cu}$ i.e., **I_{cs} shall be equal to I_{cu} .**

h) **Protective Release:** The MCCB's shall be fitted with suitable protective release to give overload short circuit protection. The protective release and the tripping mechanism shall be such that all three poles of the MCCB shall open in case of fault on any one/two or all three poles.

i) **Current Setting:** The Current of the MCCB shall be for 100% of the MCCB thermal rating. The setting shall be fixed at 100% setting suitable for momentary rating and compatible with the full load current of the Transformers.

9.1 AMBIENT COMPENSATION:

The current setting or the tripping time shall not be affected by change in ambient conditions. The ambient compensation shall be effective over 0°C to 55° C.

9.2 TIME CURRENT CHARACTERISTICS:

The protective release shall have inverse time current tripping for over load and instantaneous for short circuit.

9.3 MECHANISM:

The MCCB shall have manual closing mechanism, which shall be quick make, quick brake and trip free. The position of the knob shall give indication of 'ON', 'OFF & TRIP'.

Facility for manual tripping shall be provided.

9.4 EXTENDED COPPER SPREADERS:

The MCCB Terminals shall be provided with suitable Copper spreaders for both incoming and outgoing terminals of the MCCB for connecting to the Main and Load side.

10. TERMINATION:

The terminals shall have adequate capacity for termination of Aluminium cables of size up to 3 x 240 Sq. mm.

11. EARTHING:

The Earthing shall be as per clause 4.5 and sub clause there of 8828 - 1996 with latest revisions etc.,

12. TESTS:

Type and Routine Tests on the circuit breaker shall be as per IS-13947 Part I & II and as per IS-8828- 1996.

1. Type tests: As per clause of IS-13947 Part I & II.
2. Routine tests: As per IS-13947 part I & II with latest revision thereon.

13. INSPECTION:

In respect of bought out items the contractor shall use equipment's/items supplied by standard/reputed manufacturers and furnish manufacturers Test certificate for information of the KRIDE.

The fabrication and assembly of equipment shall be strictly in accordance with the approved drawings and prior approval of drawing is to be taken before supply. No deviations shall be permitted without the written approval of KRIDE. All the manufacturing and fabrication work in connection with the equipment prior to approval of drawing shall be at contractor's risk.

The supplier shall give to KRIDE sufficient advance intimation to arrange for inspection of the LT Distribution Boxes.

The Supplier shall also arrange for testing of the MCCB's at the manufacturer's premises at his cost

14. MARKING & NAME PLATE:

Each outgoing and incoming circuit near the MCCB and the exit shall be clearly marked.

A Caution board of 433V rating shall be affixed on the front of the box.

A name plate incorporating the following shall be provided:

1. Manufacturer name and address
2. Purchase order reference
3. Rating of the Distribution Box
4. Rating of MCCB used with make and other ratings.

15. DESPATCH:

The manual containing operation, maintenance of the equipment/components shall be supplied along with each distribution box.

16. PACKING & FORWARDING:

The equipment shall be packed suitably. The contractor is responsible for any damage to the equipment due to improper and inadequate packing. The contractor without any extra cost shall supply any material found short without any extra cost.

L.T AC DISTRIBUTION BOXES MADE OUT OF SMC MATERIAL SUITABLE FOR 250KVA TRANSFORMER

ANNEXURE-A

Sl.No	Particulars	Particulars
1.	Name of Manufacturers	
2.	Material	
3.	Grade of Material	
4.	Properties of Material of Construction of Meter Box	
	(a) Heat Deflection Temperature (ref.Std.IS:13360:P-IV/Sec.III)	
	(b) Exposure to flame (ref.Std.IS:1171 (Part-II))	

	(c) Burning Property (ref.Std.IS:1171 (Part-II))	
5.	Clear inside dimensions of meter Box	
	(a) Height	
	(b) Width	
	(c) Depth	
6.	Earthing arrangement	
	(a) No. of earth bolts	
	(b) Material of earthing bolt	
	(c) Dia. & Length of bolts	
	(d) Double nuts provided	
	(e) Plain Washer Provided	
	(f) Treatment of earth bolt and hardware	

GUARANTEED TECHNICAL PARTICULARS

**MOULDED CASE CIRCUIT BREAKER SUITABLE FOR 250KVA DISTRIBUTION
TRANSFORMER**

ANNEXURE-B

Sl.No	Particulars	Technical Particulars
1.	Name of the manufacturer	
2.	Address of Office & Works	
3.	Make	
4.	Type and Model of MCCB	
5.	Number of Poles	
6.	Utilization Category	
7.	Rated Frequency, Hz	

8.	Rated Current Rating	
9.	Rated Operational Voltage (Volts)	
10.	Rated Insulation Voltage (Ui)	
11.	Rated Impulse Voltage (Uimp)	
12.	Rated Ultimate Short Circuit Breaking Capacity, Icu (kA rms)	
13.	Rated Service Short Circuit Breaking Capacity, Ics (kA rms)	
14.	Type of Operating Mechanism	
15.	Operation Principle	
16.	Type of Release	
17.	Overload Release	
18.	Short Circuit Release	
19.	Application Standard	
20.	Time Current Characteristics	

Description for Drawing

Sl.No	Particulars	Details	Qty	Dimensions	Remarks Conforming to
1.	Housing Box with Doors. (Off colour)	Made out of (Thermo setting plastic) sheet moulding compound by the process of hot press compressing moulding confirming to IS-13410	1 No.	H-1000mm x W-690mm x Depth-250mm	IS-13410 of 1992 Dimensions are indicative
2.	Horizontal Aluminium Bus Bar	Horizontal bus bar shall be provided with Heat Shrinkable PVC insulation of red, yellow and blue colour to indicate phases	3 Nos.	50x10mm	
3.	Busbar support insulators	Porcelain			

4.	Vertical risers	To connect from main bus bar to MCCB extended spreaders (main side) made of EC grade copper	6 Nos.	25x6mm	
5.	Vertical droppers	To connect from MCCB extended spreaders to cable (load side) made of EC grade copper	6 Nos.	25x6mm	
6.	Extended Copper Spreaders	To connect vertical risers & droppers to MCCB main & load side terminals to prevent damage to the MCCB terminals.	12 Nos.	Suitable for MCCB terminals	
7.	MCCB	Triple pole, 50 cycles - 250 Amps, Ics=Icu (kA rms) - 50kA	2 Nos.		IS-8828 of 1996
8.	Cable Supporter	Cable supporting frame with Hylam/SMC material insulation and cable fixing clamps	6 Nos.		
9.	Hexagonal Bolts and nuts	MS Hot Dip Galvanized of suitable size			IS-6639

Note:

1.	The doors shall be of self-closing type with spring arrangement so that the doors automatically closed when released.
2.	The doors shall have internal locking arrangement with spring loaded latch operated by a common key for all the boxes.
3.	All the MS bolts & Nuts, plain and spring washers shall be hot dip galvanized.
4.	Zinc Bolts and nuts shall be electro plated.

H.T METERING CUBICLE

TECHNICAL SPECIFICATION FOR HT METERING CUBICLE OF CABLE ENTRY TYPE ON BOTH OUT GOING AND INCOMER SIDES SUITABLE FOR 3 PHASE, 50 CYCLES 11KV SUPPLY

1. Scope:

This specification covers the design, fabrication, painting and supply of HT Metering cubicles (Metal cabinet), supply of components consisting of instrument transformers, meters, etc., housed in suitable cubicle for indoor / outdoor use including the wiring, testing at works, packing and for Departmental supply and Self-Execution Works as per requirement and the approved drawings enclosed.

2. Service Conditions:

The metering equipment shall be suitable for the following site conditions.

- | | |
|--|----------------------------|
| a) Min. Ambient Temperature | : 5°C |
| b) Max. Ambient Temperature | : 50°C |
| c) Max. Humidity | : 10 to 100% |
| d) Altitude | : Not exceeding 1000 Mtrs. |
| e) Rainfall | : 1450mm |
| f) Max. wind pressure (kg/sqmm) | : 150 |
| g) Seismic level (Horz. acceleration) | : 0.3g |
| h) Protected from limited dust ingress | : IP55 |

3. Standards:

Unless otherwise specified elsewhere in this specification, the rating, performance and testing of the metering cubicle and accessories shall conform to the latest amendments to the relevant standards and specific requirement of ESCOMs.

4. General Arrangements:

The HT Metering Cubicle shall be installed electrically in between the incoming supply point and the step-down transformer of consumer's installation. The general arrangement of the cabinet shall be as per the enclosed drawing and final drawing approval has to be obtained after approval of prototype sample, as mentioned and shown in the general arrangement drawing, the meter cubicle shall be provided with the following components duly wire up ready for installation and complete in all respects:

- a) 3 Nos. single phase Potential Transformers
- b) 3 Nos. single phase Current Transformers of appropriate ratio as the case may be.
- c) 6 Nos of epoxy resin cast bus-bar embedded wall entrance bushings of adequate rating with necessary hardware and connector pads.
- d) HT Tri-vector meter 3 phase, 4 wires (Electronic Meter) – 0.2S class conforming to IS 14697, and as per New GOK HT Meter Specification & BESCO approved make with appropriate category and No.s/Quantities as the case may be.
- e) HT aluminium / copper bus bar of appropriate size with standard colour coding as the case may be and Transparent Test Terminal Block (TTB).
- f) The secondary wires from the terminals of CTs and PTS (having with standard colour coding as per annexure) in the CT/PT. compartments shall be covered by suitable PVC conduits and the secondary wires shall be brought in the metering compartment through rubber bush and shall be left open duly crimped with suitable flat pin type copper lugs.
- g) Incoming and outgoing bus-bar arrangements to receive Reychem or equivalent type of cable terminations for incoming and outgoing supply points.

5. Metering Cubicle Construction features:

- a) The HT Metering Cubicle shall have only Metering System as said in 4.0. Metering cubicle is independent from the Load Break Switch (LBS) or any Circuit Breaker.

- b) The cubicle shall be fabricated out of mild steel sheets of thickness not less than 3mm. Cubicles shall be Protected from limited dust ingress as per IP55 of IS 12063, if the air vents are closed. Adequate clearance between HT bus bars and ground shall be provided.
- c) The Overall dimension of the HT Metering Cubicle be width 1000mm (CTPT Side) x height 1800mm (Excluding Canopy) x breadth (Meter Chamber Side) 900mm as per diagram enclosed. The angle iron frame work using angles of minimum sizes 75 x 40 x 6mm and provided with eyebolts for hoisting purposes.
- d) Both Main Cable & Load Side Cable entry shall be at the height of 600mm.
- e) All live points should be at a clearance of 200mm from the earth and 300mm between phases to phase.
- f) Meter visibility should be made such that it is clear for the meter reader to read the meter standing in front of the meter chamber. The cubicle shall mounted on concrete plinth of suitable height. A bottom frame of MS angle as shown in the diagram shall be provided, duly welded for mounting the HT metering cubicle on the plinth. The meter window shall be such that it is at the normal eye level. The suitable concrete steps shall be constructed front and sides for easy access of CT PT chamber & Meter reading.
- g) The design of HT Metering Cubicle shall be such that the water should not enter inside the cubicle. Extended canopy shall be provided to avoid rainwater entry and Protected from limited dust ingress as per IP55 as per IS 12063, if the air vents are closed.
- h) Necessary lifting hooks shall be provided for easy lifting and transportation.

6. Compartments of HT Metering Cubicle:

The HT Metering cubicle shall consist of four metal enclosed compartments as follows:

- | | |
|---|---------|
| a. CT & PT Compartment | : 01 No |
| b. Incoming cable termination Compartment | : 01 No |
| c. Outgoing cable termination Compartment | : 01 No |
| d. Meter Compartment | : 01 No |

Note: Each chamber has to be in welded form only (no screw and bolt system allowed)

a. CT & PT Compartment:

- The CTs to be mounted on the horizontal surface of the CTPT Compartment, with CTs Secondary terminal facing towards the chamber door only.
- The PTs should be mounted on the opposite side wall of the CTPT Compartment only. The PT Secondary terminals should face the downward direction. Suitable clearance shall be maintained for future maintenance work.
- For fixing the CT PT, angular arrangement shall be made with slotted holes to fix the bolt and nuts firmly to the Cubicle Horizontal and vertical surfaces.

b. Incoming and Outgoing cable termination Compartment:

- Separate Incoming (Main) side and Outgoing (Load) side cable termination compartment shall be provided on both sides and each chamber shall be marked to identify the chamber for Incoming and outgoing.
- The connections are proposed to be given by underground cable end terminations which will be fixed on the HT metering cubicles.
- The leads from the termination will be taken inside through 6 Nos of epoxy resin cast bus-bar embedded wall entrance bushings noted above. Detachable gland-plates shall be provided at the bottom side of this compartment for accommodating 11kV XLPE, 3 core cables (120 sqmm to 300 sqmm).
- At the time of work execution, Incoming and outgoing cable shall be suitable marked to identify incomer and load side cable.

c. Meter Compartment:

- The Meter compartment with front door shall be provided on front side of the Cubicle.
- The Meter compartment should be mandatorily able to house 2 Nos of meters (namely Main Meter and Check Meter) along with transparent TTBs and Modem mounted on a

Hylam sheet of minimum 6mm thickness. The Hylam sheet shall be mounted on the wall of the meter compartment leaving not more than half an inch width and depth to avoid easy access to the Secondary wires.

- The Secondary Wires from the CTPT Compartment shall enter the Meter Compartment in a PVC Conduit inside Cubicle beneath the Hylam sheet to the Test Terminal Block. The secondary wires will further run from TTB to the Meter beneath the Hylam sheet. The Secondary wires shall not be exposed.
- On the front door there shall be another door opening (window), with a glass front covered, which shall be used for access to the meter only for purpose of reading.
- This auxiliary door (window) shall be of sufficient size to have access for reading and for downloading the meter data to MRI purpose. The glass used on this auxiliary door shall be toughened glass or laminated safety glass 6mm thick. It shall be possible to replace the glass from inside only and after breaking the seal and opening the door.
- Separate and independent sealing arrangements shall be provided for the Front door of the metering compartment and the auxiliary (window) door needed for downloading the meter data to MRI purposes. The purposes of having a main door and an auxiliary door is to ensure that the staff meant for taking periodical readings have limited access to the meter and do not have access to the metering compartment as a whole.

d. General feature of the compartments:

- i. Detachable 1 inch square 14SWG weld mesh using 25 x 25 x 25 x 3mm angle iron frame Cover shall be provided with 6mm dia sealing bolt to prevent inadvertent access to the Compartment. The roof shall be sloping 5 to 10 degree towards the ends with canopy. The guards for the CTs and PTs are to be provided with sealing arrangements for bolt and nuts at the top of the mesh by making holes for the bolts to pass through. This cover shall be provided for CTPT compartment and Incoming / outgoing compartments.
- ii. A Body Grounding copper / aluminium bus-bar shall be run through for connecting the CT PT secondary wire star connections for CTPT compartment and Incoming / outgoing compartments.
- iii. A Separate Grounding Copper / aluminium Bus-bar **with insulation** and bushing (isolation) shall be provisioned for connecting the PT primary Neutral star connection.
- iv. For all the compartment suitable door shall be provide using the same mild steel sheets to make it tamper proof. Heavy duty concealed type hinges (hinges shall not be accessible from outside) shall be used for the door.
- v. All the doors and removable covers shall be fixed all around with neoprene gaskets and the metering cubicle shall meet the requirements of IP55 protection as per IS12063, if the air vents are closed.
- vi. Separate and independent sealing arrangements shall be provided for all the doors.
- vii. Suitable metal handles shall be provided for opening and closing the doors with heavy duty metallic locks to hold the doors firmly.

7. Metering cubicle finished with powder coating:

The metering cubicle will be powder coated with pure polyester-based powder after 7 tank process. The **colour** of the powder coating shall be **“DA Grey 632 of IS:5”**
The thickness of the powder coating film shall be minimum 50 to 60 microns.

8. Bushings:

- 8.1 The bushings shall be of reputed make.
- 8.2 The insulators shall be guaranteed for long and satisfactory performance, generally conforming to technical particulars covered in the relevant IS with latest amendments.
- 8.3 The bushings used shall be bus bar embedded epoxy resin cast type wall entrance type. The bushing shall withstand all routine tests.

9. Current Transformers:

- 9.1 The HT metering equipment shall be provided with current transformers of reputed makes approved by ESCOMs. The CTs shall be of indoor, single core wound primary, drying resin cast type and shall be of ratio as per the schedule of requirement. They shall be suitable for 3 phase, 50 hz system as required. The terminals of the CTs shall be clearly marked by distinctive signs or letter.
- 9.2 The characteristics of CTs shall conform to the IS: 2705 / part – I and II of 1992 with latest amendment. The CTs shall conform to the following technical particulars.
- | | |
|---|--|
| i) Accuracy Class | : 0.2S |
| ii) Burden | : 2.5VA for all ratios. |
| iii) Rated thermal short current rating | : 150 times the highest rated thermal current rating. |
| iv) Dynamic short time current rating | : 2.5 times the rated short time thermal current rating. |
| v) Insulation level for CTs | : 15 KV |
| vi) Power frequency withstand voltage | : 38 KV |
| vii) Impulse voltage withstand test for 1.2 / 50 micro second impulse | : 95 KV |
- 9.3 **Marking:** Each Current Transformer shall be marked with all relevant detailing on the nameplate in accordance with IS:2705 (with latest amendments).

9.4 General features:

- i. The Height between the CT base plate to the bottom of primary terminal stud of CT should be 300mm as per diagram enclosed.
- ii. The Secondary terminals should be provided at P2 side of the CT and it should be easily accessible from outside when mounted in the Meter Cubicle.
- iii. The Primary and Secondary terminals should be of **STUD TYPE** only. The material used should be copper or bimetallic. The primary terminal should be of (12mm dia) M12 type & the distance between the primary terminals should be 90 mm apart. The primary terminal should be projected out from the surface 50 mm length threaded and provided with suitable nut & washers. The Secondary terminal should be of (4mm dia) M5 type & the distance between the secondary terminals should be 40mm apart. The Secondary terminal should be projected out from the surface 20 mm length, threaded and provided with suitable nut & washers.
- iv. The serial nos. of CTs should be superscribed on top and P2 side surface.
- v. The terminal markings of CTs shall be made on both top and side surface. Both engrave/emboss and sticker marking should be provided.
- vi. The overall dimensions of the CTs should be as per the diagram enclosed.
- vii. The CT Ratios to be used for various Contract Demand shall be strictly as per the table enclosed, unless otherwise there is specific approval from corporate office on case-to-case basis.

10. Potential Transformers:

- 10.1 The PTs shall be of reputed make approved by ESCOMs, and shall be for indoor use and without fuses and be of epoxy dry resin cast type single phase having voltage ratio $11kV / \sqrt{3} / 110\sqrt{3}V$. They shall be suitable for operation on 3 phase, 11kV / 50 cycles, solidly grounded system.
- 10.2 The characteristics of PTs shall conform to the IS: 3156 / part – I and II of 1992 with latest amendment. The PTs shall conform to the following technical particulars.
- | | |
|--------------------------------|------------------------|
| i) Accuracy Class | : 0.2S |
| ii) Burden | : 25VA for all ratios. |
| iii) Insulation level for PTs | : 15 kV |
| iv) One minute Power frequency | |

- v) withstand voltage : 38 kV
 Impulse voltage withstand test for
 1.2 / 50 micro second impulse : 95 kV
 vi) Ratio : 11000/110V

10.3 Marking: Each Potential Transformer shall be marked with all relevant detailing on the nameplate in accordance with IS:3156/1965 (with latest amendments).

10.4 General features:

- i. The Secondary terminals should be provided such that it is easily accessible from outside when mounted in the Meter Cubicle.
- ii. The Primary and Secondary terminals should be of stud type only. The material used should be copper or bimetallic. The primary terminal should be of 50sqmm M12 type. The Secondary terminal should be of M5 type & the distance between the secondary terminals should be 40mm apart. The Secondary terminal shouldn't be engraved inside, it should be able to connect 2-3 wires using copper lugs.
- iii. The primary Neutral terminal should also be min 40mm apart from secondary terminal. All the three phases Neutral should be star connected using a rigid copper bus-bar and grounded running the bus bar using insulators and shouldn't be connected to Meter Cubicle body grounding.
- iv. The serial nos. of PTs should be superscribed on top and sideways.
- v. The terminal markings of PTs shall be made on two sides. Both engrave/emboss and sticker marking should be provided.
- vi. The overall dimensions should be as per the diagram enclosed.

11. Bus Bar:

The Bus bar size shall be as follows depending on the CT ratio used:

Sl. No	CT Ratio	Bus Bar size	Material
1	1.25/1 to 75/1A	20 x 6 mm	Aluminium
2	100/1 to 200/1A	30 x 5 mm	Copper
3	225/1 to 400/1A	30 x 8 mm	Copper

The bus bars should be covered with 11kV Heat Shrinkable sleeves, other than the contact surfaces.

12. HT Meters:

HT Tri-vector Meter 3 phase, 4 wires (Electronic Meter) – 0.2S class conforming to IS 14697, as per New GOK specification and BESCO approved make with following type of meter specific to nature of customer.

Sl. No	Type of Consumer	Category of Meter	No of Meters required
1	Open access consumer without generating facility at the premises	Category C: DLMS, Unidirectional meter having ABT & TOD features	2 Nos (Main and Check)
2	Open access consumer having generating facility at the premises with net meter	Category B: DLMS, Bidirectional meter having ABT & TOD features	2 Nos (Main and Check)
3	Consumer having generating facility at the premises with net meter	Category B: DLMS, Bidirectional meter having ABT & TOD features	2 Nos (Main and Check)
4	Consumer without generating facility at the premises	Category C: DLMS, Unidirectional meter having ABT & TOD features	1 No.

13. Secondary Wiring:

Colour coded Wire shall be 4sqmm copper sheathed insulated copper wires for CT & 2.5sqmm for PT connections besides providing a sealable cover for the terminals shall be also painted in Red, Yellow, Blue & Black to indicate phase and neutral wiring, besides clear indications on the cubicles to identify the main and load sides for proper registration of KVAH, KWH, etc.,
The Wire Ferrule and nomenclature to be used are as shown in the wiring diagram for single meter wiring and dual meter (Main & Check Meter) wiring

14. Test Terminal Block (TTB):

A reputed make Test Terminal Block (TTB) shall be used for each meter connected. The TTB shall be of Bakelite of reputed make with transparent cover. The TTB shall be positioned at the front so that the wiring work during the testing can be easily carried out. The terminals connecting material shall be bimetallic. The size of the terminal shall be of minimum 5.5sqmm and the terminal connection screws size shall be of 3.5sqmm.

15. Other General features:

- a) The secondaries of the instrument transformers shall be laid in a PVC conduit from the instrument transformers chamber into the Tri-vector / TTB through the cable chamber. The wire connections from the conduit shall enter the TTB from the rear side through hole of requisite diameter made on the partition sheet metal between meter and cable chamber. The load side wiring connections from the TTB shall again be run in a conduit up to meter terminal and the wire connections shall enter the meter terminal blocks from the rear side of the meter mounted on sheet metal, through holes at the ends of the conduits. The TTB shall be of Bakelite of reputed make with **transparent cover**. The TTB shall be positioned at the front so that the wiring work during the testing can be easily carried out.
- b) The cable terminations on the load side / main side are not covered in the scope of supply. Arrangement is shown in the drawings for purpose of providing the necessary facilities in the cubicle. Care shall be taken to maintain the required clearances for use in 11kV system. However, the cubicles shall be provided with a suitable fixing bracket on which the cable termination box can rest and the leads connected on to the outgoing terminals through the floor entry bushings.
- c) Grounding: 25 x 3 mm copper strip shall run from cable entry chamber to CTs and PTs. The core / body of CTs and PTs shall be connected to this copper strip. The other end of the 25 x 3 mm copper strip shall be connected to 12 mm bolts and nuts provided for grounding at cable entry chamber. Similar 12 mm bolts and nuts shall be provided at the load side also. The armour of XLPE cable shall have provision for grounding in the HT Metering cubicle.

16. Marking:

Each HT Metering Cubicle shall be punched or embossed as "Property of BESCO" at the front side of the Meter Cubicle such that it is clearly visible. Also the nameplate shall carry all the details in accordance with relevant IS as follows:

- i) Make:
- ii) Sl. No.:
- iii) Type:
- iv) Voltage Class:
- v) Year of Manufacturer:
- vi) P.O details., etc.,

17. Proto type and drawing:

The manufacturer will have to offer a sample for inspection before supply of item. The sample will be inspected by a team of purchasers representatives / agency (CPRI). On approval, the contractor will have to submit the drawings accordingly and get it approved from the purchaser before supply.

18. TESTS:

The Cubicle manufacturer should use the instrument CT & PTs approved by ESCOMs and should confirm to dimensions and features mentioned in this specification.

18.1 MT lab Testing of CTs, PTs and HT Meters:

All the CTs, PTs and HT Meters purchased from the original manufacturer (approved vendor), shall be sent to the MT lab along with manufacturer test report for testing. The components will be tested as per relevant IS. The testing fee shall be borne by the manufacturer. The successfully tested CTs, PTs & HT Meters shall be sealed for having passed by MT lab.

Only the successfully tested & sealed CTs, PTs and HT Meters shall be assembled to the HT Metering cubicle and kept ready for complete Unit testing at manufacturer works.

18.2 Minimum Testing facilities:

The manufacturer must clearly indicate the details of testing facilities available at the works of manufacturer and that the facilities are adequate to carry out all routine and acceptance tests. These facilities should be available to purchaser Engineers, if deputed to carry out or witness the tests at the manufacturers works.

For HT Metering Cubicle:

- Power frequency withstand test generator set with control panel.
- Current source for temperature rise test with digital ammeter, volt meter, temperature indicators and tong tester.
- Power operated shearing machine.
- Power operated press brake.
- Power operated press.

The tenderer shall furnish details of powder coating process employed.

18.3 Acceptance and Routine Test:

Following tests shall be carried out as acceptance and routine tests for Complete assembled HT Meter Cubicle:

- a. Temperature rise test on complete unit at rated current of cubicle.
- b. Power frequency withstand test at 28kV.
- c. Overall dimension check.

19. Inspection:

The inspection may be carried out by the purchaser at any stage of manufacture. The manufacturer shall grant free access to the purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the manufacturer of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

20. Documentation:

- a. The manufacturer shall furnish two sets of following drawings and documents:
 - i. Complete assembly drawings of the metering cubicle showing plan, elevation and typical sectional views and locations of cable boxes, busbars, metering compartments and meter.
 - ii. Foundation plan showing location of foundation channels, anchor bolts of anchors, floor plan and openings for cables etc.,
 - iii. Type test certificates for the type testing bought out items, if already carried out.
 - iv. Descriptive pamphlets and literature of bought out items including CT characteristic curves, etc.,
- b. All drawings and data shall be annotated in English.

- c. The manufacturer shall be required to furnish four sets of final versions of all the above said drawings and documents within 15days after the proto type inspection for purchasers approval.
- d. Approval of drawings / work by manufacturer shall not relieve manufacturer of his responsibilities and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirement of the latest revision of applicable standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and purchaser shall have power to reject any work or materials which, in his judgment, is not in full accordance therewith.

21. Packing and forwarding:

The equipment shall be packed in crates suitable for vertical / horizontal transport, as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and market with appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided.

Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

22. Technical Compliance for Instrumental Transformer & HT Meters:

The following Technical Compliance required with respect to the Instrumental Transformer (CTs & PTs) and HT Meters to provide reliable Power Supply and avoid interruption to consumers.

22.1 Type test:

For the CTs, PTs and HT Meters the type tests shall be carried out for each rating of short time withstand current with lowest CT ratio.

a. For Current Transformers:

All Testes (Except High Voltage power frequency wet withstand test) as per clause No. 9.1.1 of IS 2705 (Part – I) 1992. Amended up to date, considering outdoor application of CTs

- Short time current tests.
- Temperature rise test.
- Lightning impulse test for CT for service in electrically exposed installation.
- Determination of errors or other characteristics accordingly to the requirements of the appropriate designation or accuracy class.

b. For Potential Transformers:

All Testes (Except High Voltage power frequency wet withstand test) as per clause No. 9.1.1 of IS 3156 (Part – I) 1992. Amended up to date, considering outdoor application of PTs

- Short time current tests.
- Temperature rise test.
- Lightning impulse test for CT for service in electrically exposed installation.
- Determination of errors or other characteristics accordingly to the requirements of the appropriate designation or accuracy class.

c. For HT Meters:

All tests as per clauses of New GoK HT meter specification.

d. For Complete Unit:

- Temperature rise test on complete unit at the rated current of cubicle of each voltage class with highest CT ratio (IS 3427 -1997)
- Power frequency withstand test at 28kV.
- Impulse wave withstand test at 75kV considering that the cubicle are meant for outdoor use as per IS 2071.

- Type test for IP55 protection as per category '1' as mentioned as per clause no 7.5 of IS 12063.
- Short time withstand current test, shall be performed on the cubicle by passing a current of 13.1kA for 1 Sec for 11kV, with CT/PT bypassed. (IS 3427 – 1997)

The HT Metering cubicles, CTs, PTs and HT Meters shall be fully type tested as per relevant IS and this specification. The manufacturer shall furnish detailed type test reports of all the type tests for offered CTs, PTs, HT Meters and HT Metering cubicles. For these CTs & PTs, the type tests shall be for each rating of short time current. These tests should have been carried within 5 years prior to the date of submission of type test reports. The purchaser reserves the right to demand repetition of some or all TTRs in presence of purchaser's representative. In case the unit fails in any one type test, the complete supply shall be rejected.

All the above type tests shall be carried out at NABL laboratories to prove that the complete HT Metering cubicle, CTs, PTs and HT Meters offered meet the requirements of specification. The successful tenderer shall take approval / waive of type tests from the purchaser prior to commencement of supply.

22.2 Minimum Facilities required:

The manufacturer must clearly indicate the details of testing facilities available at the works of manufacturer and that the facilities are adequate to carry out all routine and acceptance tests. These facilities should be available to purchaser Engineers, if deputed to carry out or witness the tests at the manufacturers works.

- a. For CT/PT at original manufacturers works:
 - Class of accuracy test panel for CTs with phase angle and ratio error measuring unit with Current source, burden box and standard CT
 - Class of accuracy test panel for PTs with phase angle and ratio error measuring unit with Voltage source, burden box and standard PT
 - Partial discharge test setup.
 - Resistance voltage divider
 - High frequency generator set with control panel.
 - Milli ohms meter.
 - Over voltage inter turn test equipment.
- b. HT Meter:
As per new GoK HT meter specification.

22.3 Acceptance and Routine Test:

Following tests shall be carried out as acceptance and routine tests.

- i. For Current Transformers:
All tests as per clause No 9.1.2 of IS-2705 (Part-I) 1992.
- ii. For Potential Transformers:
All tests as per clause No 9.1.2 of IS-3156 (Part-I) 1992.
- iii. For HT Meter:
All tests as per clause of New GoK HT meter specification.

For CTs, PTs and HT Meters required tests shall be carried out at the original manufacturer's works in the presence of purchaser's representative.

23. Guarantee/ Warranty:

The manufacturer shall stand guarantee for the materials supplied, especially CT, PT, Meter, Modem, etc., for a period of 18 months from the date of Supply of Meter Cubicle or from the date commissioning of HT Metering Cubicle whichever is earlier, for manufacturing defects.

24. Annexures:

The following annexures are herewith enclosed for adhering to the above specification.

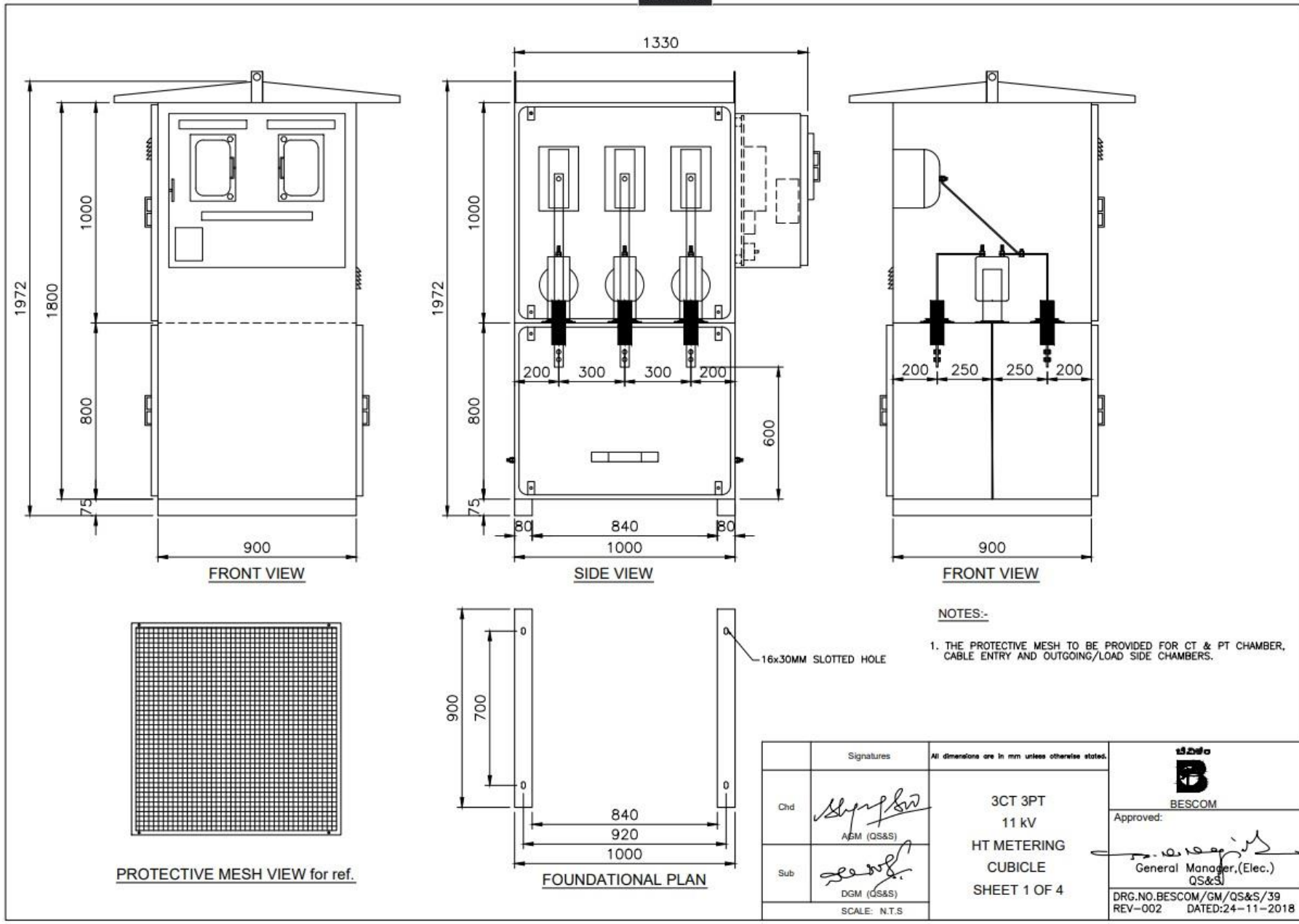
1. Table showing CT ratios to be used for various HT consumer Contract Demand
2. HT Meter Cubicle Dimension diagram
3. 11kV Current Transformer Dimension diagram
4. 11kV Potential Transformer Dimension diagram
5. Single Meter wiring diagram
6. Dual Meter (Main & Check Meter) wiring diagram

Table showing 11kV CT Ratios for different Contract Demands

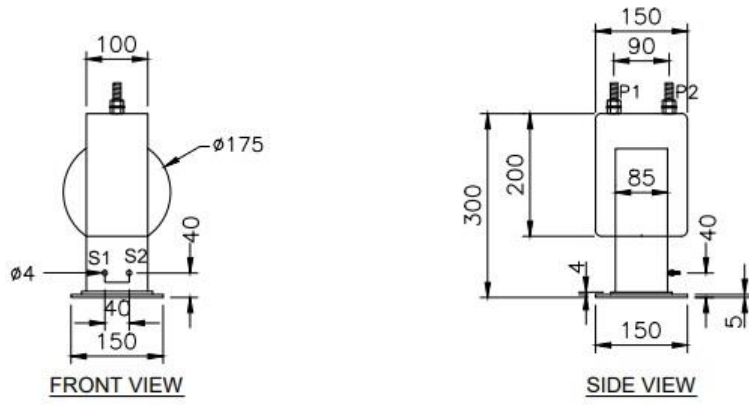
Sl. No.	Contract Demand (kVA)	Required CT ratio
1	25	1.25/1
2	26-50	2.5/1
3	51-100	5/1
4	101-150	7.5/1
5	151-200	10/1
6	201-250	12.5/1
7	251-300	15/1
8	301-400	20/1
9	401-500	25/1
10	501-600	30/1
11	601-800	40/1
12	801-1000	50/1
13	1001-1200	60/1
14	1201-1500	75/1
15	1501-2000	100/1
16	2001-2500	125/1
17	2501-3000	150/1
18	3001-3500	175/1
19	3501-4000	200/1
20	4001-4500	225/1
21	4501-5000	250/1
22	5001-6000	300/1
23	6001-8000	400/1

Note: These are all general 11 kV CT ratios for different contract Demands. Any deviations in the CT ratios shall be approved from corporate office on case-to-case basis.

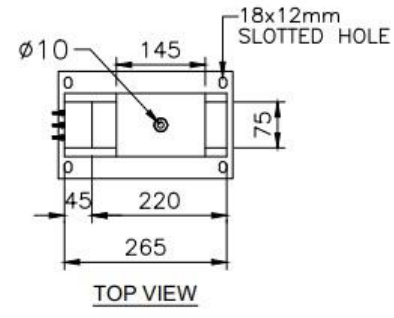
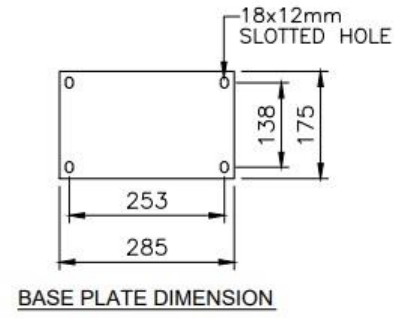
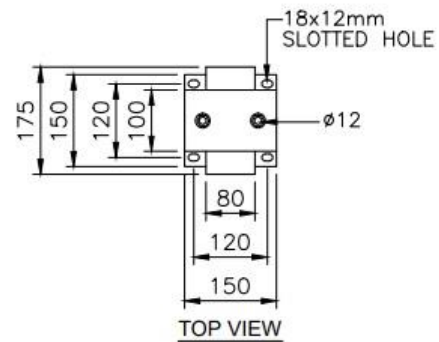
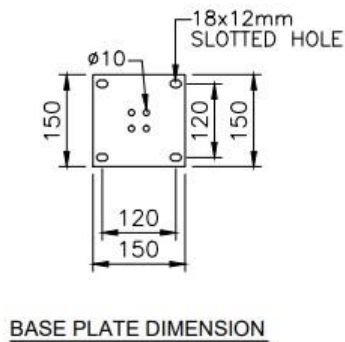
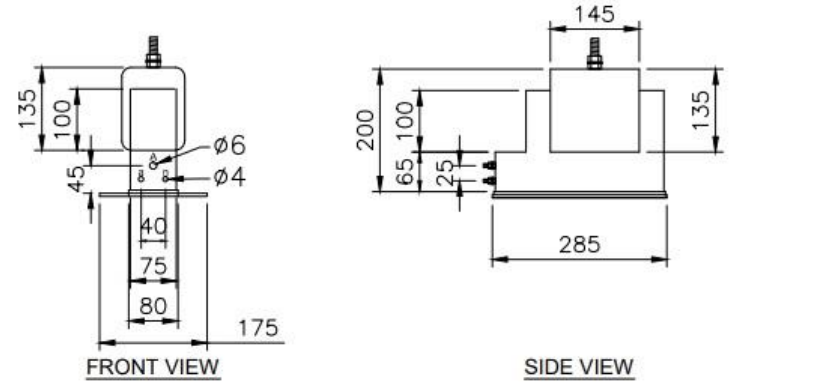
K-RIDE



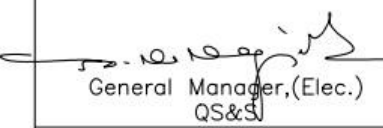
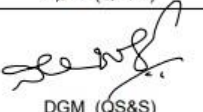


DRAWING FOR INDOOR 11KV CURRENT TRANSFORMER (CT)



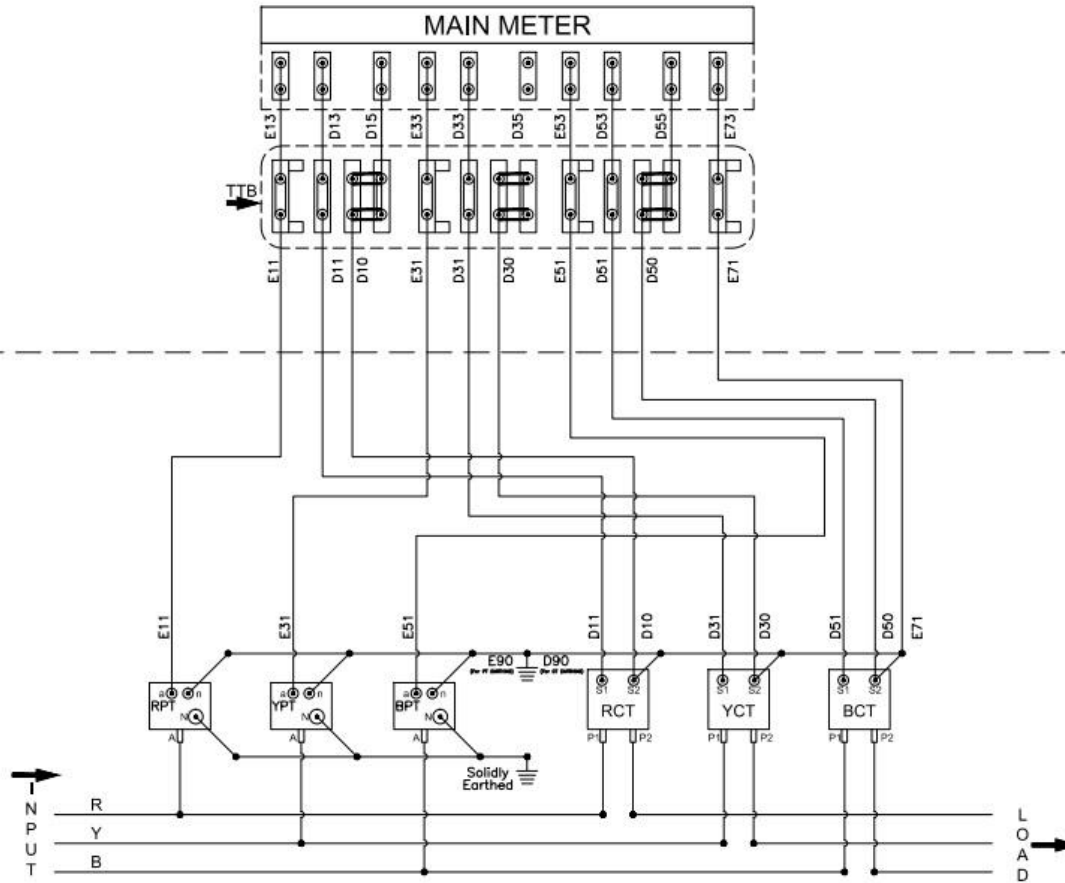
DRAWING FOR INDOOR 11KV POTENTIAL TRANSFORMER (PT)


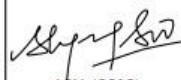
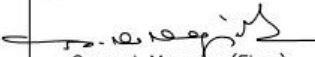
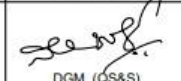


	Signatures	All dimensions are in mm unless otherwise stated.	 BESCOM
Chd	 AGM (QS&S)	3CT 3PT 11 KV HT METERING CUBICLE SHEET 2 OF 4	Approved:  General Manager, (Elec.) QS&S
Sub	 DGM (QS&S)		DRG.NO.BESCOM/GM/QS&S/39 REV-002 DATED:24-11-2018
SCALE: N.T.S			

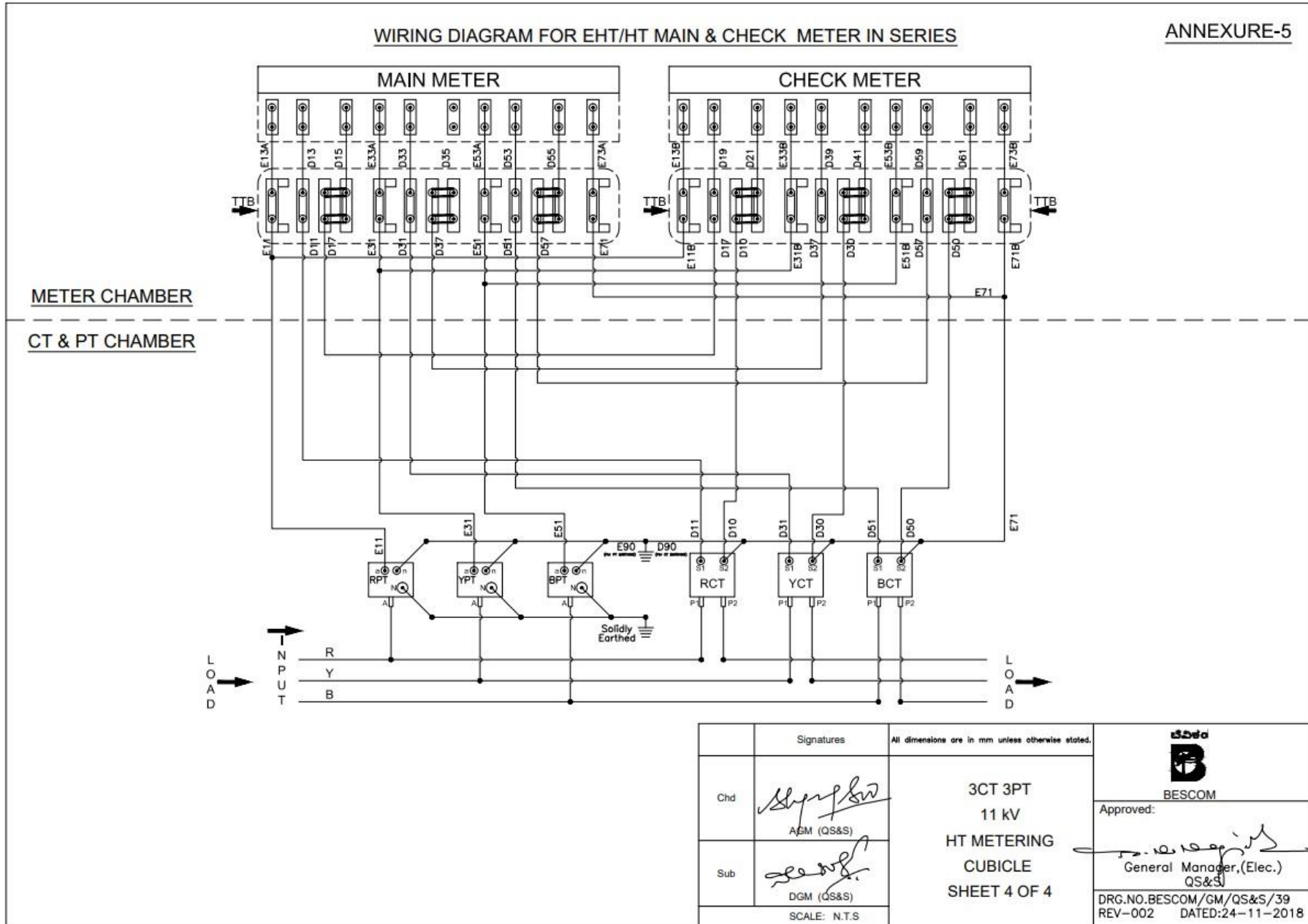
WIRING DIAGRAM FOR 11kV HT METERING (for Regular Consumer)


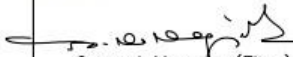
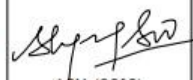
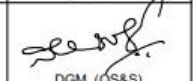
ANNEXURE-4



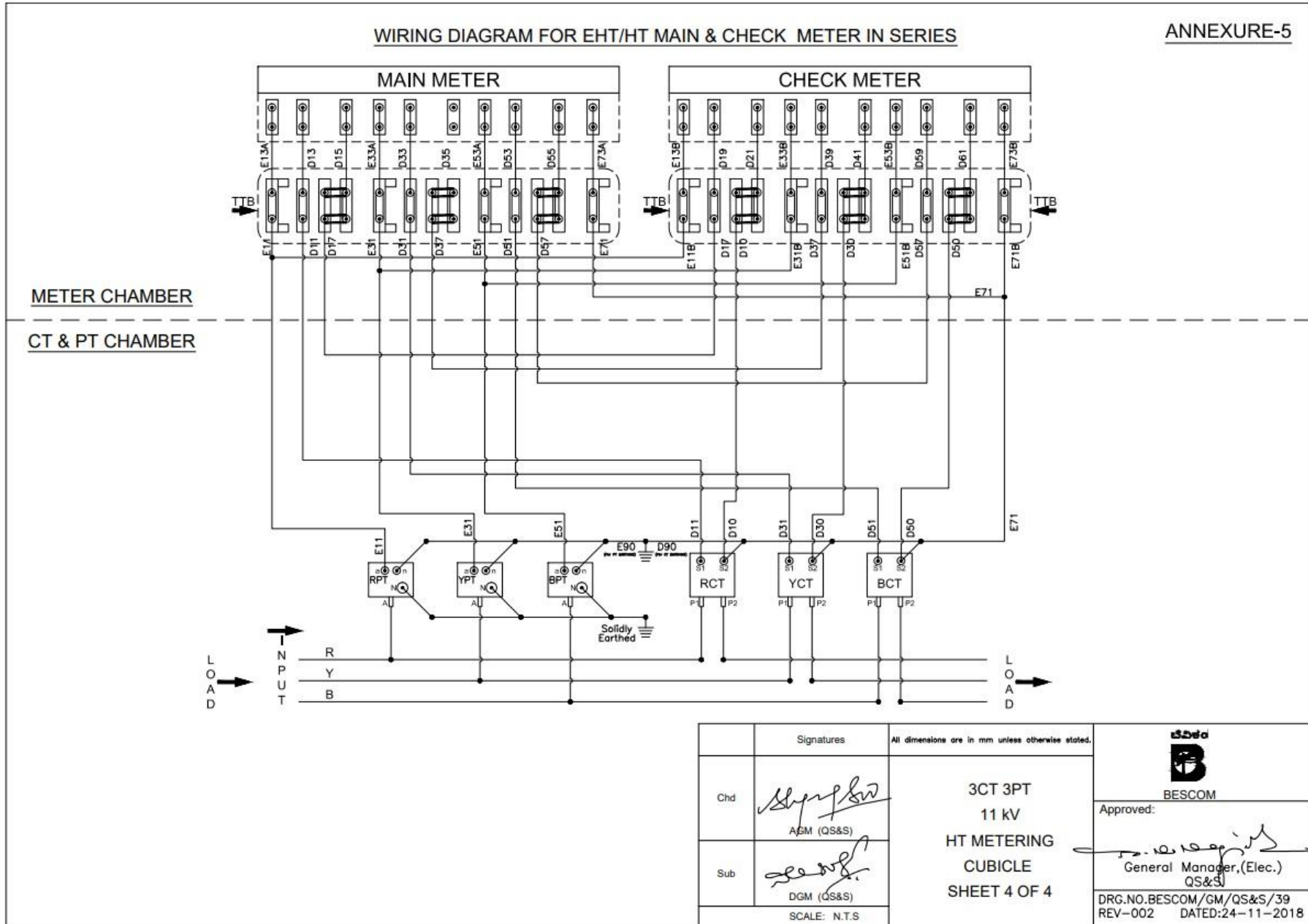
	Signatures	All dimensions are in mm unless otherwise stated.	 BESCOM
Chd	 ASM (QS&S)	3CT 3PT 11 kV HT METERING CUBICLE SHEET 3 OF 4	Approved:  General Manager, (Elec.) QS&S
Sub	 DGM (QS&S)		DRG.NO.BESCOM/GM/QS&S/39 REV-002 DATED:24-11-2018
SCALE: N.T.S			

ANNEXURE-5



	Signatures	All dimensions are in mm unless otherwise stated. 3CT 3PT 11 kV HT METERING CUBICLE SHEET 4 OF 4	 Approved:  General Manager, (Elec.) QS&S	
Chd	 AGM (QS&S)			DRG.NO.BESCOM/GM/QS&S/39 REV-002 DATED:24-11-2018
Sub	 DGM (QS&S)			SCALE: N.T.S

ANNEXURE-5



SECTION-22

L.T PROTECTION KIT

TECHNICAL SPECIFICATION FOR LT PROTECTION KIT FOR DISTRIBUTION TRANSFORMERS UP TO AND INCLUSIVE OF 100 KVA.

1.0 SCOPE:

This Specification covers design, manufacture and supply of LT protection kit for distribution Transformers. The LT protection kit offered shall be suitable for outdoor installation and mounting on RCC Poles. They shall serve for protection on LV side of distribution transformers ranging from capacity 25 KVA upto and inclusive of 100 KVA, distribution transformers.

2.0 CLIMATIC CONDITIONS:

The LT Protection kit along with its mounting shall suit outdoor installations.

3.0 STANDARDS:

The L.T Protection kit along with its components/Mounting arrangement shall conform to the latest edition of relevant standards.

4.0 (A) COMPLETENESS OF SUPPLY:

The component offered shall be complete and operative on all aspects and shall conform to high standard of Engineering design and workmanship.

(B) Deviation from technical specifications: Tenderer shall furnish the details of deviations/modification proposed by him if any towards improvement of the said offer.

5.0 TECHNICAL PARTICULARS:

The brief Technical particulars of various components to be offered are as hereunder.

5.01 A typical sketch detailing the L.T protection kit to be supplied is annexed. It is mentioned that the dimensions regarding mounting and conductor sizes are binding.

5.02 **1.1 KV PIN INSULATORS:**

- a) The insulators shall conform to IS-1445/1977 with latest amendments if any and baked in temperature-controlled kiln only. They should be brown glazed.

The pin Insulator shall be in conformity with Fig.1 of IS-1445/1977, and with threaded forged G.I Pins. The profile of threads being as given on Fig. 5 of IS-1445/1977.

- b) The Insulators shall have the following electrical and mechanical characteristics.

1	Dry power frequency with stand voltage	:	23 KV (RMS)
2	Wet power frequency with stand voltage	:	10 KV (RMS)
3	Power frequency puncture With stand voltage	:	1.3 x the actual dry flash over voltage
4	Minimum failing load	:	366.902 Kgf. (3.5 KN)

- c) **One sample 1.1 KV insulators used in LT Protection kit shall be submitted as per QR and sample will be verified by BESCO/ KRIDE officials. The make of the insulators shall be mentioned in the Guaranteed Technical Particulars.**

- d) The type tests, acceptance tests and routine tests for 1.1 kV Pin Insulators shall be as per IS: 1445/1977. **The type test certificates in respect of the insulators used shall be furnished prior to supply.**

- e) Mounting frame assembled with insulators, terminal connectors shall be packed in suitable crates, loose items such as Fish Plates, Bolts and nuts etc., to be packed in suitable polythene bags.

5.03 **TERMINAL CONNECTOR (For receiving LT leads from Transformer and tap off to line):**

- a) The fasteners used shall be galvanized.
 b) The materials used shall be Aluminium alloy.
 c) All Ferrous components shall be galvanized.
 d) 6 numbers of pad connector shall be provided as shown in the drawing.
 e) 6 numbers of Aluminium plates of size 120x60x10mm shall be provided as shown in the drawing fixed to (d) above with 4nos of GI bolts & nuts to each plate.
 f) 12 Nos of 95 sq mm heavy duty long barrel Aluminium lugs shall be supplied and fixed to the Aluminium plate with 16mm dia 40mm GI bolts & nuts with spring & flat washers.

5.04 BILL OF MATERIALS:

The bill of materials is as indicated in the drawing.

5.05 G.I. PINS:

The 1.1 KV G.I pins used shall conform to IS-2633/1972 and IS-6745/1972. The dimensions shall conform to Fig-2 of IS-7935/1975 with shank length of 40 mm as indicated in the drawing.

6.0 PACKING:

Each LT protection kit i.e mounting frame assembled with insulators, terminal connectors shall (with fittings) shall be packed in wooden crates suitable for easy and rough handling and acceptable for transport. Wooden separators shall be fixed between each kit to keep individual insulators in position without movement within the crate. The package containing the insulators shall have a mark BESCO and P.O No. & Date.

7.0 Name Plate: Each LT Protection kit Unit shall be provided with a Name plate of minimum size 100X40mm shall be fixed with the following details which are legibly and indelibly marked.

- 1) Name of the material
- 2) Name of Manufacturer
- 3) BESCO
- 4) Purchase Order No. and Date
- 5) SI.No.

8.0 INSPECTION:

8.01 All tests and inspection shall be generally made at the place of manufacturer. Purchaser (BESCO) shall be provided with all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification. Purchaser and its representative shall at times be entitled to have access to the works and to all places of manufacture where insulators are manufactured and the supplier shall afford all facilities to them for unrestricted inspection of the works, inspection of materials and inspection of manufacturing process of insulators for conducting necessary tests and specified herein.

8.02 The supplier shall keep the Purchaser informed in advance of the time of Starting and progress of manufacture of insulators in various stages so that arrangements could be made for inspection.

8.03 No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

8.04 The BESCOM/ KRIDE has the right to have the tests carried out by an independent agency, when considered necessary.

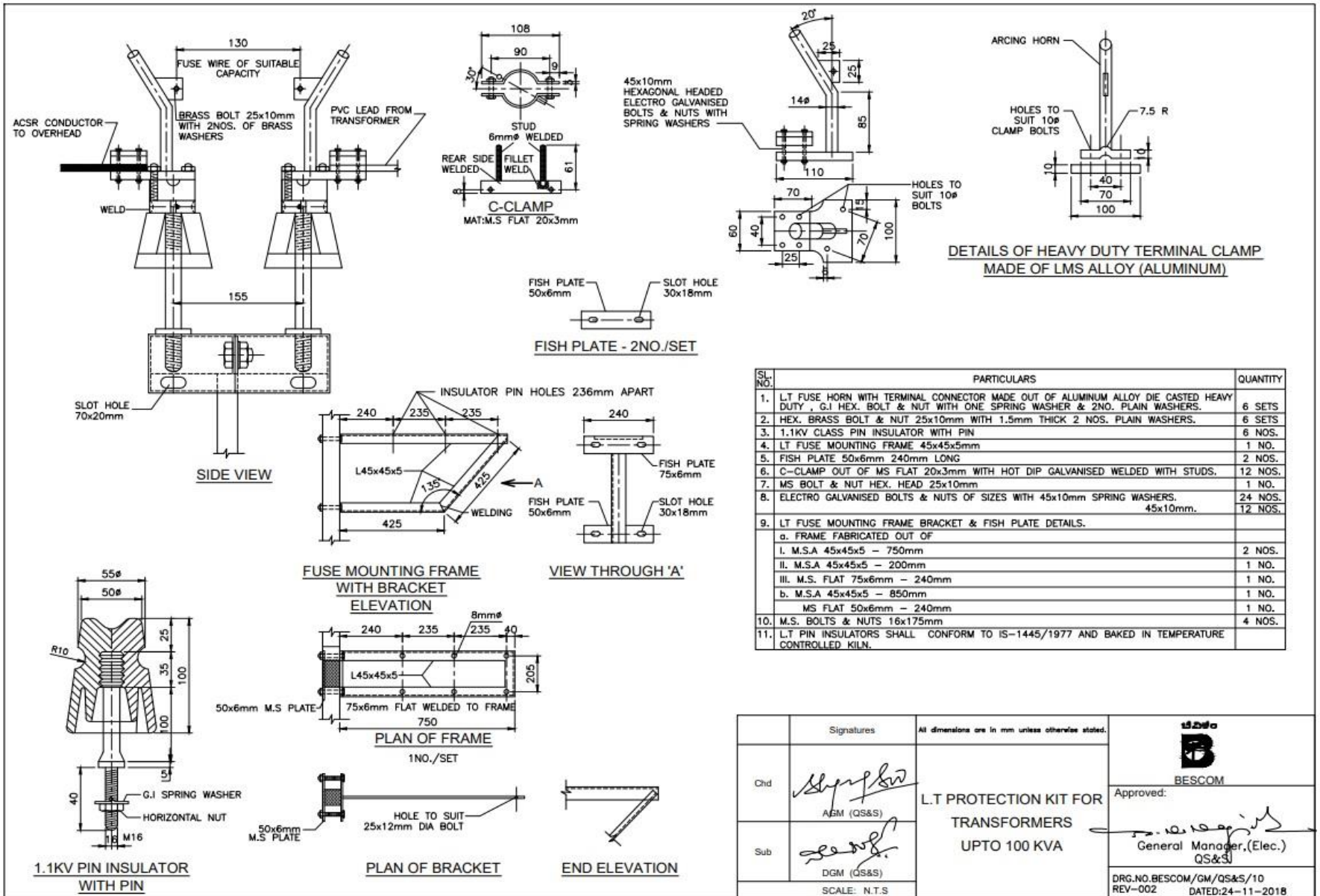
9.0 SAMPLE

The Contractor shall submit two samples and get them approved by the competent authority before taking up the manufacture. The approved samples will be kept as under

- ii) One approved sample will be with the manufacturer at the manufacturing premises so that so that the inspecting officer can inspect the materials offered for inspection with reference to the approved sample.

K-RIDE

SECTION 8B: TECHNICAL SPECIFICATIONS



SL. NO.	PARTICULARS	QUANTITY
1.	L.T FUSE HORN WITH TERMINAL CONNECTOR MADE OUT OF ALUMINUM ALLOY DIE CASTED HEAVY DUTY , G.I HEX. BOLT & NUT WITH ONE SPRING WASHER & 2NO. PLAIN WASHERS.	6 SETS
2.	HEX. BRASS BOLT & NUT 25x10mm WITH 1.5mm THICK 2 NOS. PLAIN WASHERS.	6 SETS
3.	1.1KV CLASS PIN INSULATOR WITH PIN	6 NOS.
4.	L.T FUSE MOUNTING FRAME 45x45x5mm	1 NO.
5.	FISH PLATE 50x6mm 240mm LONG	2 NOS.
6.	C-CLAMP OUT OF MS FLAT 20x3mm WITH HOT DIP GALVANISED WELDED WITH STUDS.	12 NOS.
7.	MS BOLT & NUT HEX. HEAD 25x10mm	1 NO.
8.	ELECTRO GALVANISED BOLTS & NUTS OF SIZES WITH 45x10mm SPRING WASHERS. 45x10mm.	24 NOS. 12 NOS.
9.	L.T FUSE MOUNTING FRAME BRACKET & FISH PLATE DETAILS.	
	a. FRAME FABRICATED OUT OF	
	i. M.S.A 45x45x5 - 750mm	2 NOS.
	ii. M.S.A 45x45x5 - 200mm	1 NO.
	iii. M.S. FLAT 75x6mm - 240mm	1 NO.
	b. M.S.A 45x45x5 - 850mm	1 NO.
	MS FLAT 50x6mm - 240mm	1 NO.
10.	M.S. BOLTS & NUTS 16x175mm	4 NOS.
11.	L.T PIN INSULATORS SHALL CONFORM TO IS-1445/1977 AND BAKED IN TEMPERATURE CONTROLLED KILN.	

	Signatures	All dimensions are in mm unless otherwise stated.	BESCOM
Chd	<i>[Signature]</i> AEM (QS&S)	L.T PROTECTION KIT FOR TRANSFORMERS UPTO 100 KVA	Approved:
Sub	<i>[Signature]</i> DGM (QS&S)		General Manager, (Elec.) QS&S
	SCALE: N.T.S		DRG.NO. BESCOM/GM/QS&S/10 REV-002 DATED:24-11-2018