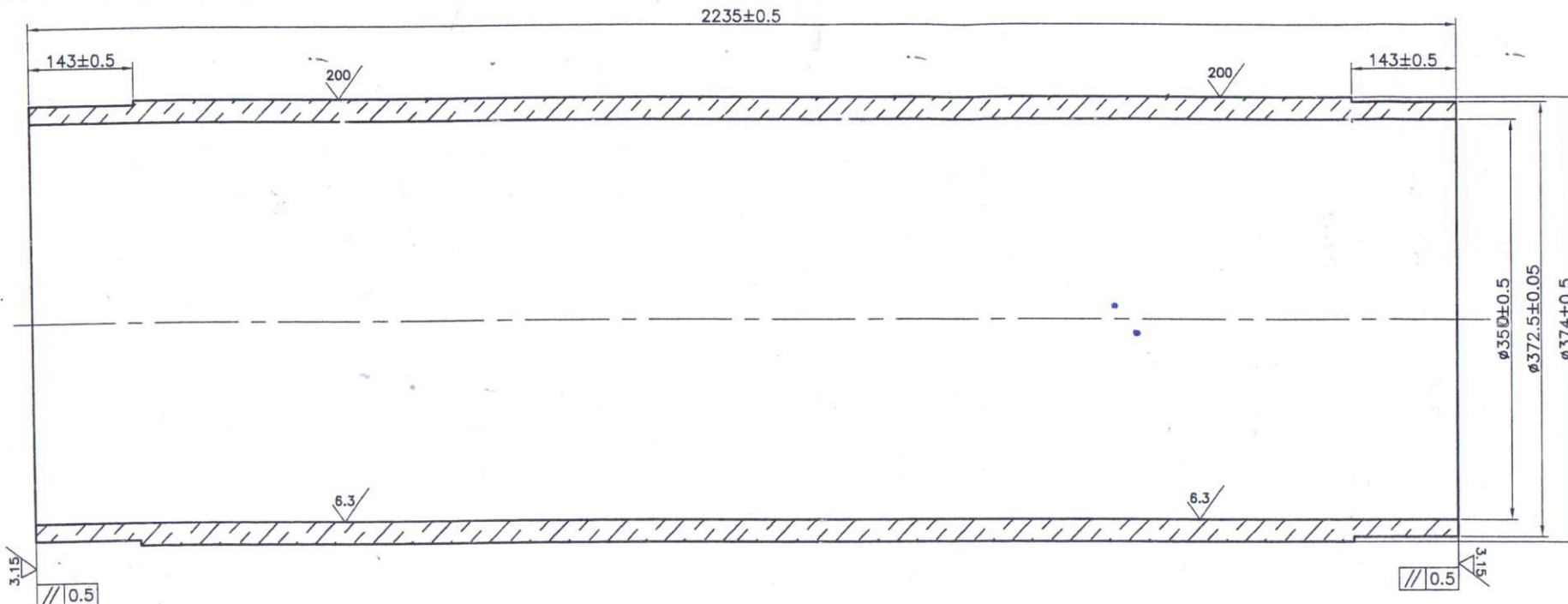


REV 00
DRG No. 3 987 13 50311 00

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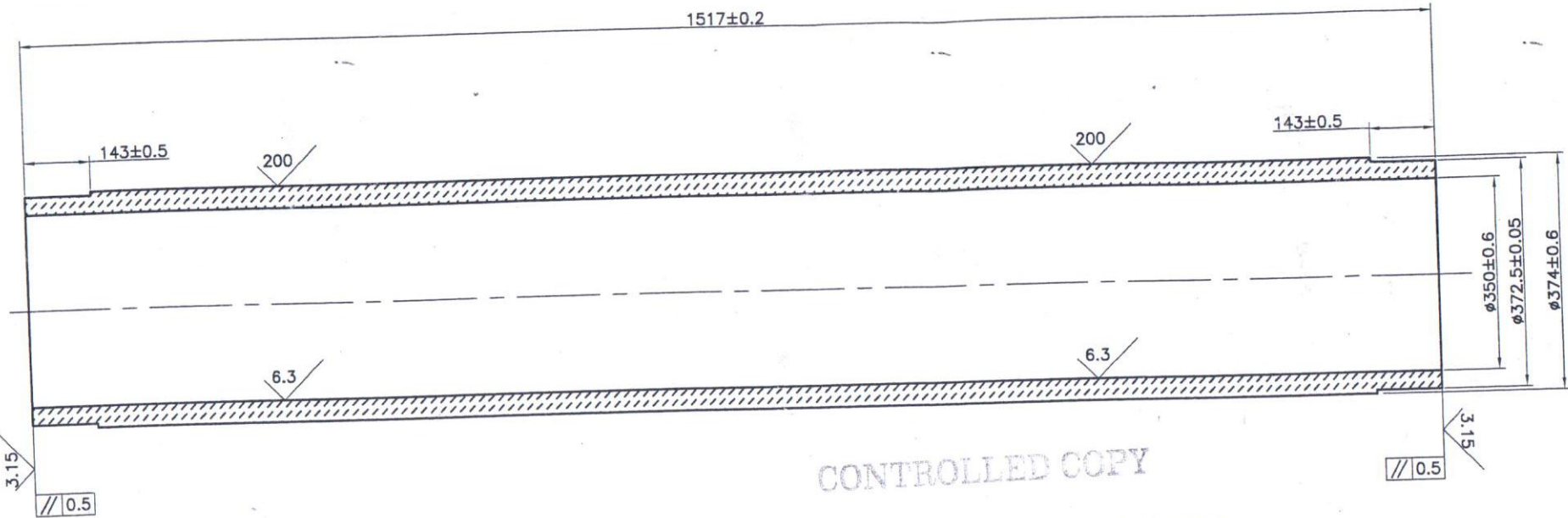
NOTES:

1. MATERIAL SHOULD COMPLY WITH MATERIAL SPECIFICATION OF BHEL EPD: CIFRPHI:001:2010 LATEST REVISION AND IEC: 61462-1998 IN GENERAL.
2. WINDING ANGLE: PRESSURE & BENDING FILAMENT WINDING ANGLE AT 25° & 54°
3. FRP TUBE TO BE FREE FROM SURFACE SCRACHES, BENDS, FLAWS, VOIDS AND DENTS ETC.
4. SHARP CORNERS TO BE ROUNDED OFF TO RADIUS R2.
5. PACKING: a) EACH FRP TUBE SHOULD BE WRAPPED WITH 10 mm THICK EXPANDED POLYSTYRENE SHEET FOR EXTRA CUSHIONING.
- b) ALL INDIVIDUALLY WRAPPED TUBE SHOULD BE PACKED IN A WELL SEASONED WOOD FABRICATED CRATE ENSURING NO DAMAGES TO TUBES. OPEN ENDS SHOULD BE COVERED WITH 5.0mm THICK CIRCULAR PVC CORRUGATED BOARD BY SHRINK WRAPPING
- c) ALL RELEVANT MARKINGS SHOULD BE LABELED OR PRINTED ON THE CRATE/BOX.
6. THE FRP TUBE SHALL HAVE MIRROR FINISH ON THE ID SURFACE.
7. INNER SURFACE OF THE FRP TUBE SHOULD BE COATED WITH NON GLASS FIBER EPOXY SUCH THAT NO REACTION TAKEN PLACE BETWEEN FRP TUBE TO SF6 GAS OR TRANSFORMER OIL.

CONTROLLED COPY

SIGN AND DATE	REF. DRG. No.	BHARAT HEAVY ELECTRICALS LTD; ELECTROPORCELAINS DIVISION BANGALORE 560 012			NAME	SIGN	DATE										
		DEPT	GRADE OF TOL DIM	SCALE	WEIGHT (kg)	REF TO ASSY.DRG	ITEM No.	No. OF ITEMS									
INVENTORY No.	REV	DATE	ALTERED CHECKED	REV	DATE	ALTERED CHECKED	REV	DATE	ALTERED CHECKED	CODE	C/M/F	NTS	45 (Approx)	DRAWING No.	3 987 13 50311	REV.	00
															No. OF SHEETS		

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NOTES:

1. MATERIAL SHOULD COMPLY WITH MATERIAL SPECIFICATION OF BHEL EPD: CIFRPHI:001:201G LATEST REVISION AND IEC: 61462-1998 IN GENERAL.
2. WINDING ANGLE : PRESSURE/BENDING FILAMENT WINDING ANGLE AT 25°/54°
3. FRP TUBE TO BE FREE FROM SURFACE SCRACHES,BENDS,FLAWS,VOIDS AND DENTS ETC.
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- c) ALL RELEVANT MARKINGS SHOULD BE LABELED OR PRINTED ON THE CRATE/BOX.
6. THE FRP TUBE SHALL HAVE MIRROR FINISH ON THE ID SURFACE.
7. INNER SURFACE OF THE FRP TUBE SHOULD BE COATED WITH NON GLASS FIBER EPOXY SUCH THAT NO REACTION TAKEN PLACE BETWEEN FRP TUBE TO SF6 GAS OR TRANSFORMER OIL.

SIGN AND DATE REF. DRG. No. INVENTORY No.

REV	DATE	ALTERED CHECKED	REV	DATE	ALTERED CHECKED	REV	DATE	ALTERED CHECKED

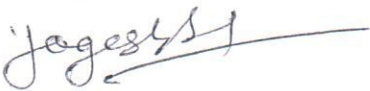

BHARAT HEAVY ELECTRICALS LTD; ELECTROPORCELAINS DIVISION BANGALORE 560 012		NAME	SIGN	DATE		
		DRN	C. MADAIHAH	24.03.2014		
		CHD	S S P	24/3/14		
APPD	S S P	24/3/14				
DEPT	GRADE OF TOL DIM	SCALE	WEIGHT (kg)	REF TO ASSY.DRG	ITEM No.	No.OF ITEMS
	C/M/F	N T S	46 (Approx)			
TITLE	FRP TUBE 132 KV COMPOSITE HOLLOW INSULATOR		CARD CODE	DRAWING No. 3 987 11 50111 00		REV.
			No.OF SHEETS			

SUPERSEDES DRG. No.

Purchase Specification for Fiber Reinforced Plastic Tubes

Spec. No : BHELEPD:CI:FRP:HI:001
REV : 01
DATE : 24/03/2012
PAGE : 1 of 2

I No	Specification	Requirement	
1	Purpose	To manufacture Polymer composite Hollow Insulators by Injection molding technique for products such as Composite Hollow Insulators up to 800kV for circuit breaker, CT, VT, Capacitor Housings, Power Transformers etc for Standard and polluted zones using catalyst based Liquid Silicone rubber compound (Two part A & B system) and FRP tubes.	
2	Scope of Supply	Fully finished FRP (Fiber Reinforced Plastic) Tubes made by wet filament winding technique using uncut fibers, meeting the technical requirements as per Sl. No 3 of this Specification and mentioned in the concerned drawings. The tubes should be post-cured. Internal diameter side Polyester coating should be done if mentioned in the drawing.	
3	Technical requirements		
Sl. No.	Parameter	Reference Standard	Specified value
I.	Visual Examination	---	Tubes should be free from any defects like voids inconsistency of the material, deformation, crack etc.
II.	Dimensions	As per drawing	As per drawing
III.	Dye Penetration Test	IEC 61462 & IEC 61109	No Dye Penetration for 15 Minutes (minimum)
IV.	Flammability Test	IEC 60707	FV0
V.	Water absorption	DIN 53475	0.1 % Maximum
VI.	Water absorption, 100 ^o C	DIN 53479	0.1 % Maximum
VII.	Water diffusion test	IEC 61462	Leakage Current should not exceed 1mA and no puncture and surface flash over after applying 12 kV for one minute.
VIII.	Specific Gravity		2.0 ± 0.1
IX.	Tg Temperature	ASTM D 3418	125 ^o C
X.	Chemical Resistance		FRP Rod material should not react with Solvents (Not Phenole and Ketone), Mineral Oils and dilute acid.
XI.	Tensile E-Modules Axial	ASTM D3039	52000 MPa
XII.	Tensile Strength Axial	ASTM D3039 / DIN 53453	1050 MPa
XIII.	Shear Strength	ASTM D 3846	15 MPa

<p>Prepared by</p> <p style="text-align: center;"></p> <p>Yogesh Sharma Manager Composite Insulator</p>	<p>Approved by</p> <p style="text-align: center;"></p> <p>S. Ravikumar AGM IO & CPBG</p>
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Purchase Specification for Fiber Reinforced Plastic Tubes

Spec. No : BHELEPD:CI:FRP:HI:001
REV : 01
DATE : 24/03/2012
PAGE : 2 of 2

XIV.	Impulse Di-electrical Strength	DIN 53481	16 to 18 kV / mm
XV.	Di-electrical Strength Axial 50 Hz, 12.7mm ring section	DIN 53481	8 to 10 kV / mm
XVI.	Di-electrical Strength Transverse 50 Hz, 3 mm	DIN 53481	16 to 18 kV / mm
XVII.	Di-electrical Loss factor (T_g δ)	DIN 53483	0.30 TO 0.50 %
XVIII.	Relative Permittivity	DIN 53483	3.4 TO 3.6
XIX.	Mechanical test requirement of the FRP Tubes	As per Drawing	As per Drawing
4.	Winding Angle	25 DEG & 54 DEG	
5.	Packing	Each FRP tube should be wrapped using 10 mm thick expanded polystyrene Sheet to avoid foreign material (like dust etc) deposition. To be packed in a well seasoned wood crate or strong corrugated box, such that no damage (like scratch, dent, Bend, crack etc) should take place during transportation/transit. Relevant marking to be labelled or printed on the crate / box.	
6.	Marking	Each tube should be marked 1. Manufacturer's Name, 2. Serial Number 3. Date of manufacture, 4. Place of Manufacturing	

Prepared by

Yogesh Sharma
Manager
Composite Insulator

Approved by

S. Ravikumar
AGM
IO & CPBG