PSICH001	SPECIFICATIONS FOR INSULATING TUBE	Drg.No.	RD DG 4 26 1133 3001 Version 1 and Version 2
		Date	03.05.2016
		Product	THDF-500

1.0 APPLICATION:

"Insulating Tube" with "Metal Inserts" is a part of a high voltage electrical insulation system for heavy duty switchgear applications & allied areas. The component is required for a 36 kV AC, 50 Hz System.

2.0 TECHNICAL SPECIFICATIONS:

2.1 <u>TUBE MATERIAL</u>

2.1.1 The Fiber Reinforced Plastic (FRP) material (commercial grade or suitable) lining to be used in INSULATING TUBE, should have the following set of properties:

#	Property	Unit	Value
1	Density	g/cm^3	~1.3
2	Tensile Strength	MPa	~1000
3	Impulse Dielectric Strength	kV/mm	≥ 16
4	Relative Permittivity	-	~3.4
5	Dielectric Loss Factor	%	≤0.4
6	SHRINKAGE@160°C for 15 Hours	%	≤ 2
7	SHRINKAGE@Ambient Temp.	%	< 0.5
8	Water Absorption @ Ambient Temp.	%	< 0.5
9	Water Absorption @ 100°C	%	< 0.5

2.1.2 **Type of Fiber:** FRP with Aramid / Kevlar/ any other suitable FRP material, qualifying the above properties shall be used as fiber for the Insulating Tube.

2.1.3 **Product Qualifying Requirement (Other):** The FRP fibers should be wound & impregnated with hot curing epoxy resin in vacuum/ pressure in a manner that the supplied insulating tube should be void-free & also should be free from any structural defects & further essentially achieve all the above defined electrical, mechanical & other physical properties as stated in 2.1.1. The epoxy used in the Insulation Tube should also be compatible to Hydrogen Gas, which is used as cooling medium in a manner that the safety is ensured in case of any possible arcing or any possible discharge conditions thereof during operation.

Contd..

	2.1.4	The final insulating tube shall have excellent Chemical Resistance (no corrosion or chemical etching) against both i) organic acids & ii) inorganic acids.
	2.1.5	The shape of the "Insulation Tube" shall be in accordance to the approved drawing.
2.2		**METAL INSERTS**
	2.2.1	Profiled "metal inserts" as per approved drawing shall be machined using NC machining from mechanical grade "aluminum alloy" (described in the supplied drawing) as per (DIN/BIS/IS standards).
	2.2.2	The "aluminum alloy inserts (flanges)" shall be joined to the "epoxy tube insulation" using a hot curing adhesive or similar (which is compatible to hydrogen gas as coolant) and joined in a manner that structural defects & leakages are avoided in the joining.
	2.2.3	The bonding between "insulating tube" & "metal inserts (flanges)" shall be done without roll pins /threaded bolts/ cross bolts etc. The bonding should essentially withstand specified mechanical forces, besides should offer leak-tightness for use in differential pressure applications.
	2.2.4	The "aluminum foils" of 0.25 mm thickness should be wounded at prescribed positions in the supplied drawing (Drawing No. RD DG 4 26 1133 3001-1)
	2.2.5	The last aluminum foil should be connected/grounded by suitable arrangement to aluminum flange/metal Insert (Drawing No. RD DG 4 26 1133 3001-3)
	2.2.6	Sharp corners at the edges of aluminum foils to be rounded/folded suitably during winding process in order to avoid high electrical stress point.
3.0		**FACTORY TEST**
	3.1	Dimensional report of the insulation tube as per the standard procedure.
	3.2	Mechanical load bearing capability (Tensile Strength, 30 kN ± 10%) for the jointed Insulating Tube and metal insert to be ensured.

4.0 QUALIFYING REQUIREMENTS:

4.1 The supplier shall be of National / International repute with proven record and should have supplied similar material/s for gas insulated switchgear and/or similar applications.

5.0 GENERAL

5.1 Metal Flanges shall be free from any sharp corners. Wherever not specified in the drawing, a radius of R 0.5 mm shall be provided at unspecified corner/Edge.

5.2 The components shall be packed individually in appropriate packing with moisture absorbents, so as to prevent transit damages due to moisture ingress.

5.3 The components shall be guaranteed for a period of 12 months from the "date of receipt" of material at BHEL Stores against all manufacturing defects.

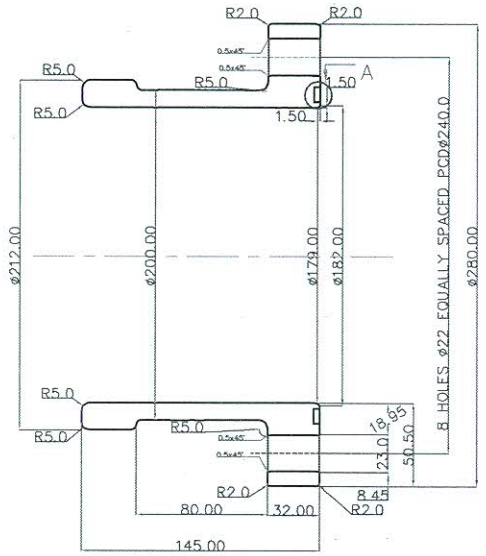
5.4 Proper sealing between "Insulating Tube Assembly" and the "Metal Inserts" by suitable "O-ring" and "filling material" to be ensured.

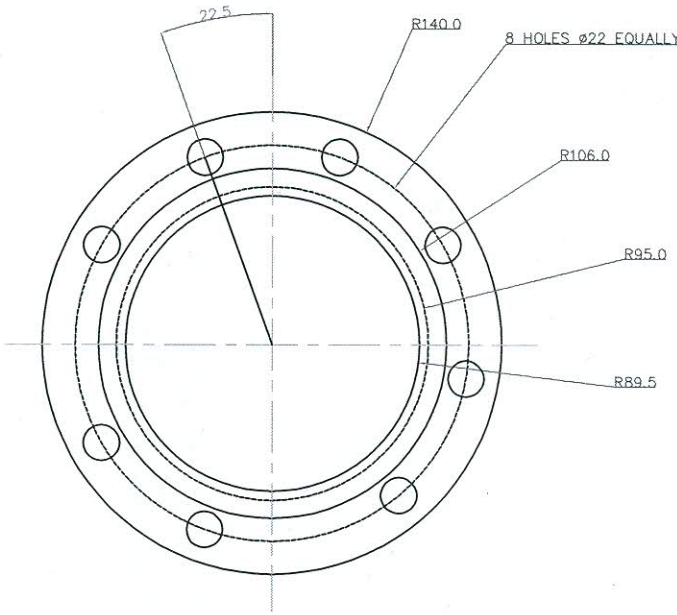
5.5 In case of any doubt in technical specifications, the Supplier shall contact BHEL in writing for clarifications.

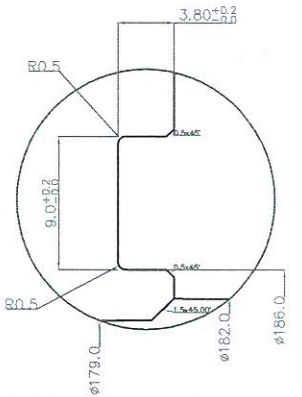
DRG. NO. RD DG 4 26 1133 2001

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)







View A

Note:
RD DG 4 26 1133 0000 –
Version 1

VAR.DO	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	IT.NO. / VAR	MATL. CODE / MATL. SPECN.	A C	UNIT	UNIT WT. / QTY.	GS	ZONE
		01	LT INSERT			RD DG 4 26 1133 3001		HE-30			01		

TYPE OF PRODUCT

NAME OF CUSTOMER 27.8 kV 500/660MW THDF BUSHING

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN	Hari R		06.07.15	
CKD	MM Rao		07.07.15	
APPD	K S R Prasad		07.07.15	01

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED
ZONE			ZONE		

DEPT. / CODE	GRADE OF TOL. DIM. C/M/F	SCALE	WEIGHT(KG)	REF. TO	ITEM NO.	NO.OF ITEMS
		NTS		RD DG 4 26 1133 0000		

TITLE: LT INSERT

CARD CODE

DRAWING NO. RD DG 4 26 1133 2001 REV. 00

SHEET NO. NO. OF SHEETS

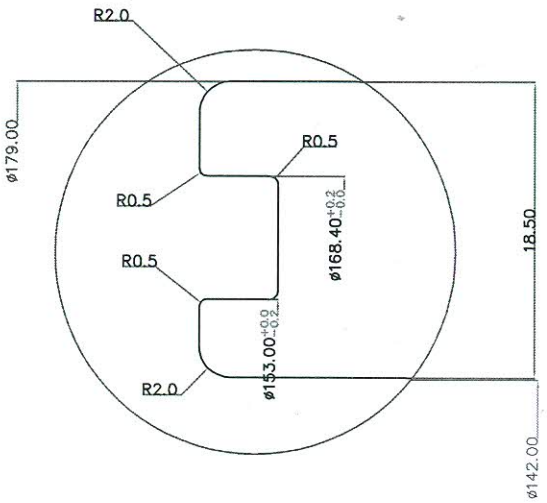
INVENTORY NO. | SIGN. AND DATE | REF. DRG. NO.

DRG. NO. RD DG 4 26 1133 3001-3

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

Last Aluminum Foil is suitable coonected to Metal/AL/LT Flange



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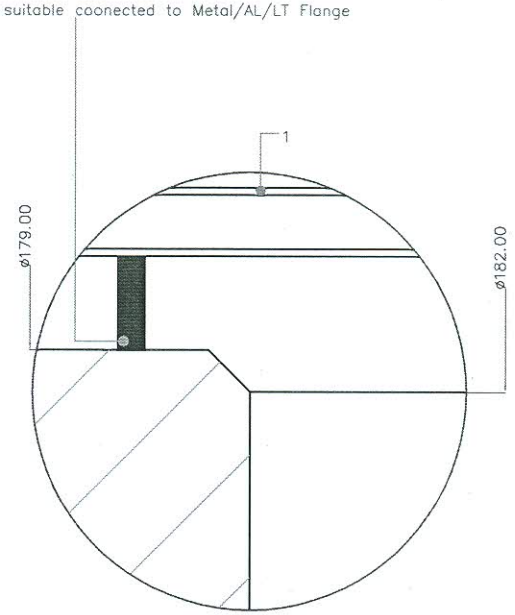

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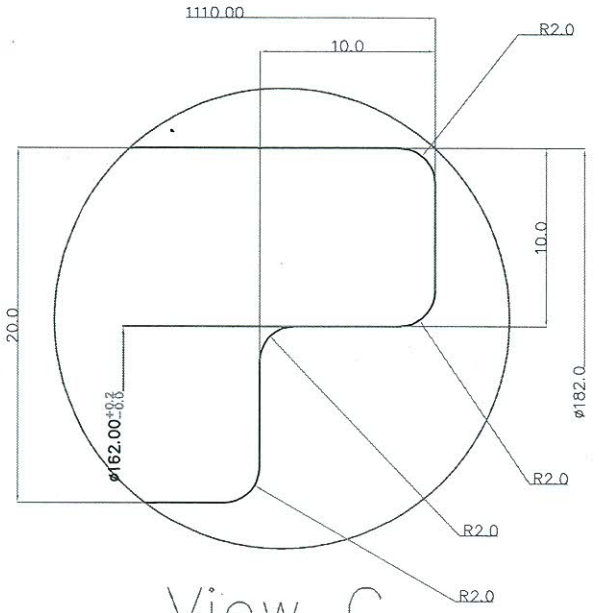


View C

INVENTORY NO. | SIGN. AND DATE | REF. DRG. NO.

Note:
RD DG 4 26 1133 0000-
Version 1

VAR.OO	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	IT.NO.	MATL. CODE	A/C	UNIT	UNIT WT.	GS	ZONE
		01	Al. Foil /Conductive Paint/ Carbon Fiber		RD DG 4 26 11333001		Aluminium				07		
							VAR	MATL. SPECN.			QTY.		

TYPE OF PRODUCT

NAME OF CUSTOMER 27.8 kV 500/660MW THDF BUSHING

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN	Hari R		06.07.15	
CKD	MM Rao		07.07.15	
APPD	K S R Prasad		07.07.15	01

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED
ZONE			ZONE		

DEPT. / CODE | GRADE OF TOL. DIM. C/M/F | SCALE NTS | WEIGHT(KG)

REF. TO RD DG 4 26 1133 0000 | ITEM NO. | NO.OF ITEMS

TITLE

FRP TUBE

CARD CODE

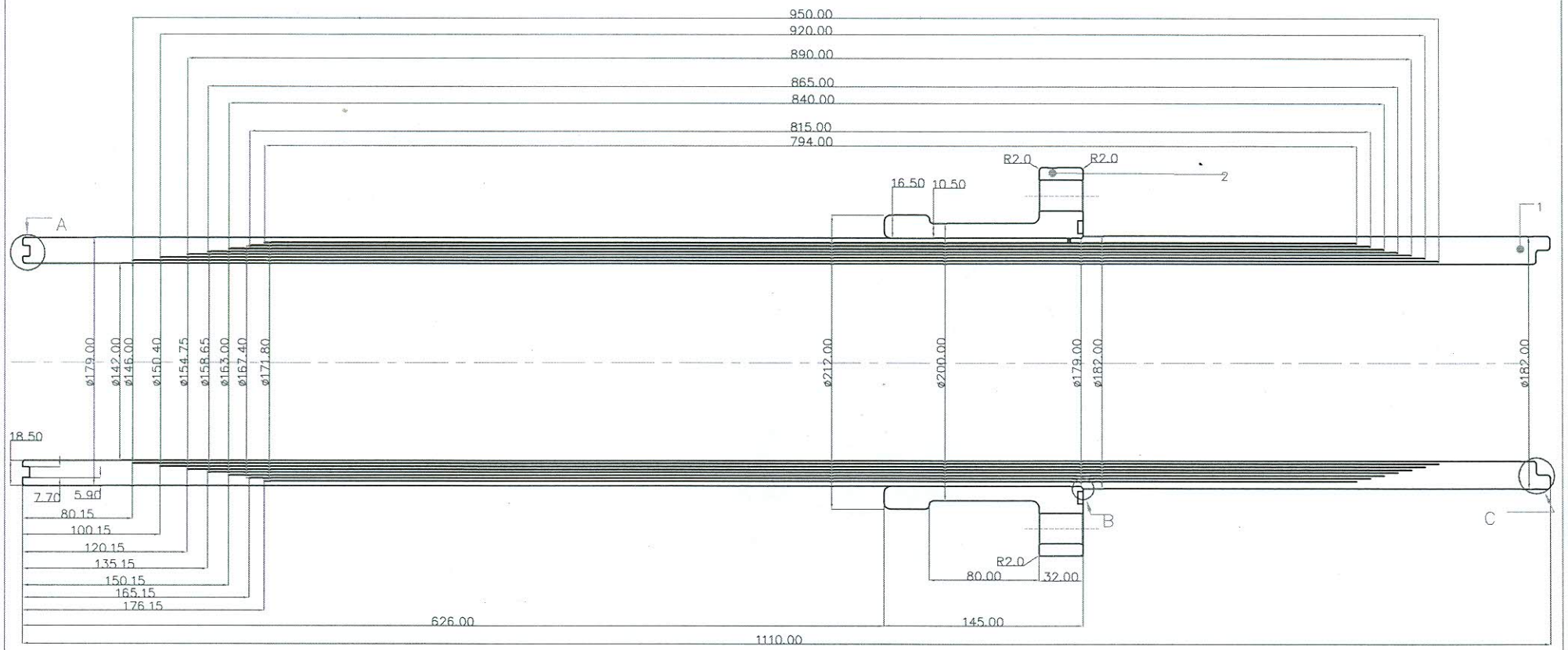
DRAWING NO. RD DG 4 26 1133 3001-3 | REV. 00

SHEET NO. | NO. OF SHEETS

DRG. NO. RD DG 4 26 1133 3001-1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)



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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

FOIL DIMENSIONS (0.25 mm THICKNESS)							
LENGTH	950	920	890	865	840	815	794
ID	146.00	150.40	154.75	158.65	163.00	167.40	171.80

Note:
RD DG 4 26 1133 0000-
Version 1

VAR.00	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	STD	DRAWING NO.	IT.NO.	MATL. CODE	A/C	UNIT	UNIT WT.	GS	ZONE
			03	Al. Foil/High Conductive Carbon Fiber		RD DG 4 26 11333001		Aluminium/Carbon Fibre			07		
			02	LT INSERT		RD DG 4 26 1133 2001		HE-30			01		
			01	FRP TUBE		RD DG 4 26 1133 3001		FRP			01		
							VAR	MATL. SPECN.			QTY.		

TYPE OF PRODUCT
NAME OF CUSTOMER 27.8 kV 500/660MW THDF BUSHING

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

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DRN	Hari R		06.07.15	
CKD	MM Rao		07.07.15	
APPD	K S R Prasad		07.07.15	01

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED
ZONE			ZONE		

DEPT. / CODE	GRADE OF TOL. DIM. C/M/F	SCALE	WEIGHT(KG)	REF. TO	ITEM NO.	NO.OF ITEMS
		NTS		RD DG 4 26 1133 0000		

TITLE: FRP TUBE

CARD CODE

DRAWING NO. RD DG 4 26 1133 3001-1 REV. 00

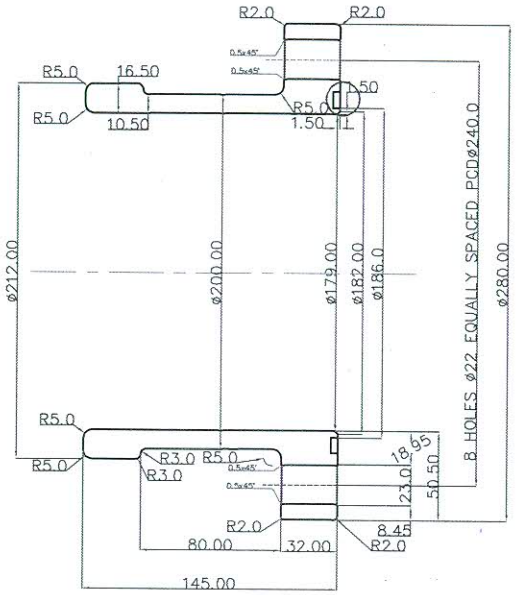
SHEET NO. NO. OF SHEETS

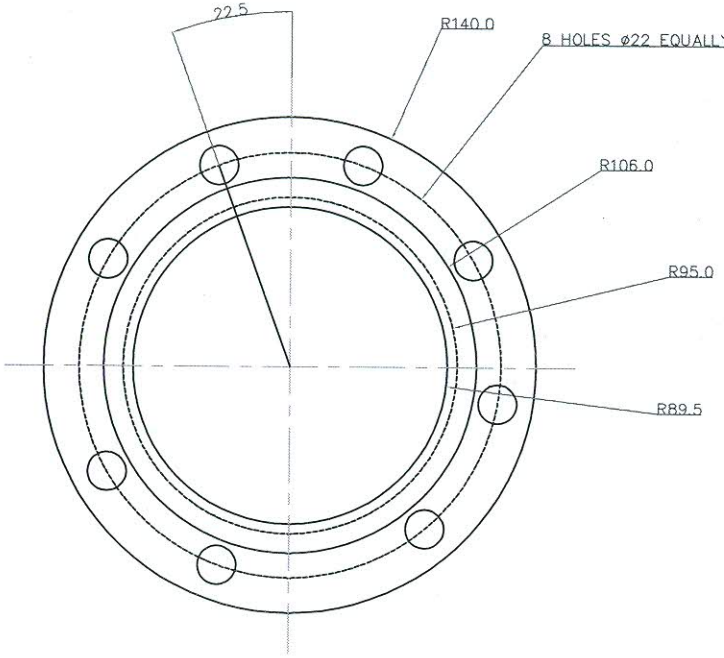
REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO.

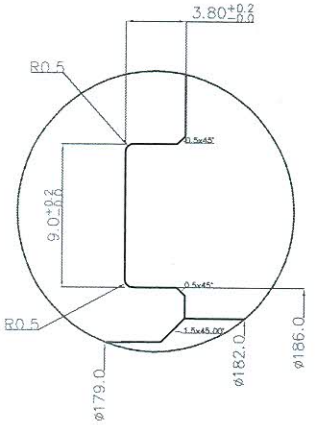
DRG. NO. RD DG 4 26 1133 2001

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)







View A

Note:
RD DG 4 26 1133 0000–
Version 2

			01	LT INSERT	RD DG 4 26 1133 3001		HE-30				01		
VAR.OO	REMARKS	VAR NO.	ITEM NO.	DESCRIPTION	STD.	DRAWING NO.	IT.NO. VAR	MATL. CODE MATL. SPECN.	A C	UNIT	UNIT WT. QTY.	GS	ZONE

TYPE OF PRODUCT

NAME OF CUSTOMER 27.8 kV 500/660MW THDF BUSHING

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN	Hari R		06.07.15	
CKD	MM Rao		07.07.15	
APPD	K S R Prasad		07.07.15	01

REV.	DATE	ALTERED / CHECKED	REV.	DATE	ALTERED / CHECKED
ZONE			ZONE		

DEPT. CODE	GRADE OF TOL. DIM. C/M/F	SCALE	WEIGHT(KG)	REF. TO	ITEM NO.	NO.OF ITEMS
		NTS		RD DG 4 26 1133 0000		

TITLE: LT INSERT

CARD CODE

DRAWING NO. RD DG 4 26 1133 2001 REV. 00

SHEET NO. NO. OF SHEETS

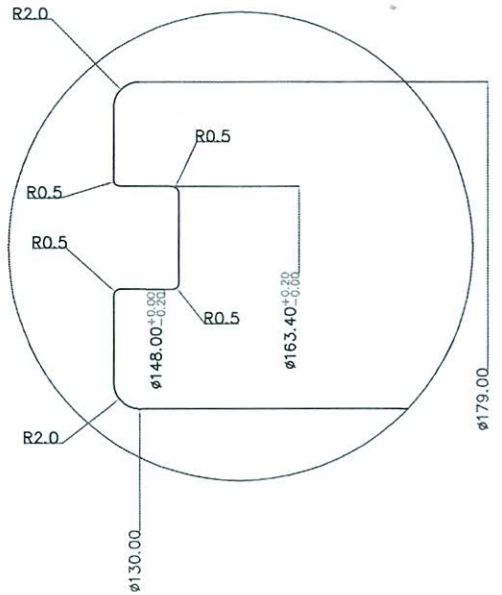
INVENTORY NO. | SIGN. AND DATE | REF. DRG. NO.

DRG. NO. RD DG 4 26 1133 3001-2

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

Last Aluminum Foil is suitable coonected to Metal/AL/LT Flange



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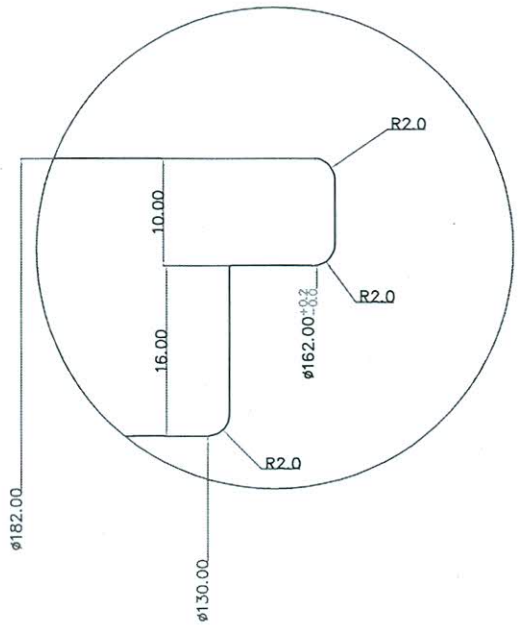

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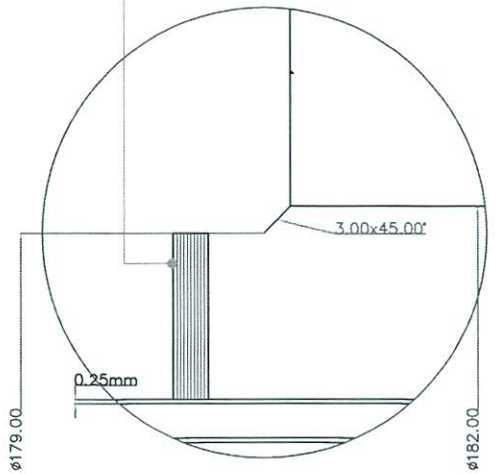


View C

Note:
RD DG 4 26 1133 00001–
Version 2

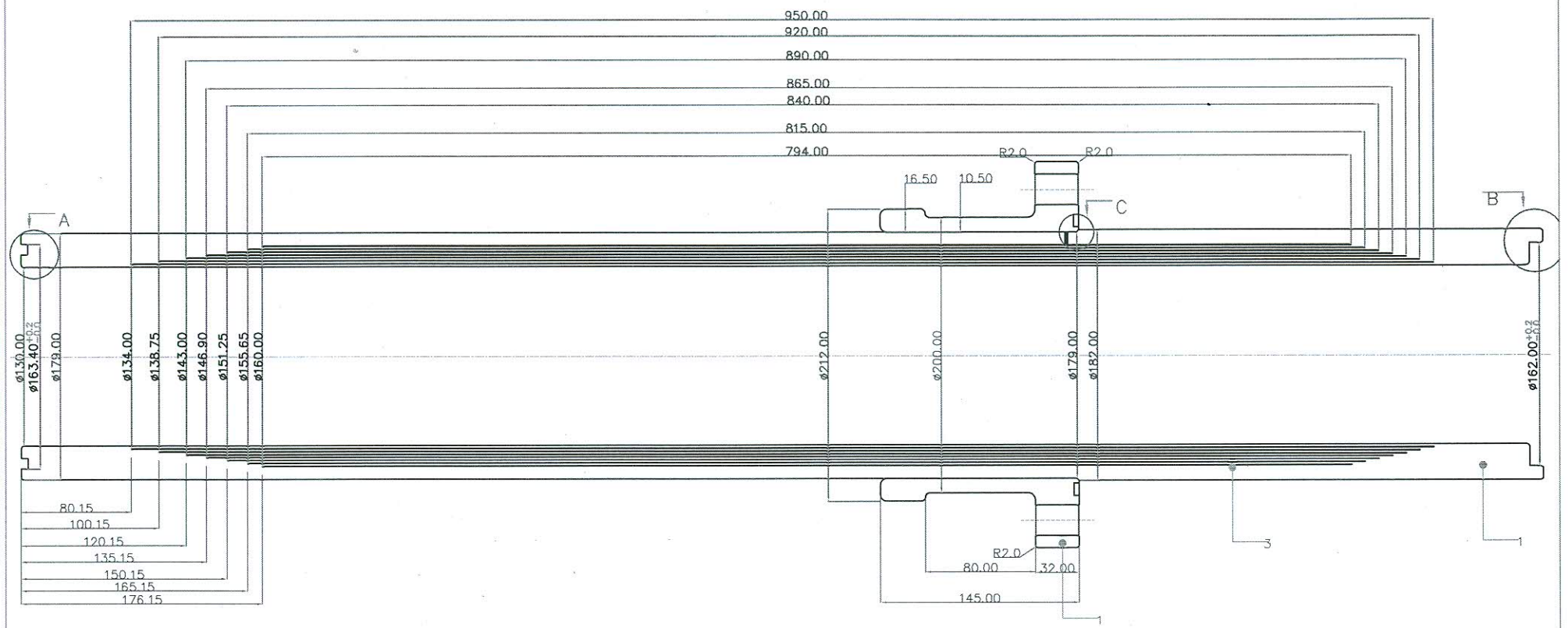
TYPE OF PRODUCT							
NAME OF CUSTOMER	27.8 kV 500/660MW THDF Bushing						
BHARAT HEAVY ELECTRICALS LTD. HYDERABAD		DRN	Hari R		06.07.15	NO.OF VAR.	
		CKD	Hari R		07.07.15		
		APPD	K S R Prasad		07.07.15	01	
DEPT. / CODE	GRADE OF TOL. DIM. C/M/F	SCALE	NTS	WEIGHT(KG)	REF. TO	ITEM NO.	NO.OF ITEMS
					RD DG 4 26 1133 0000		
TITLE		CARD CODE	DRAWING NO.			REV.	
FRP TUBE–2			RD DG 4 26 1133 3001–2			00	
			SHEET NO.	NO. OF SHEETS			

INVENTORY NO. | SIGN. AND DATE | REF. DRG. NO.

DRG. NO. RD DG 4 26 1133 3001-1

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)



FOIL DIMENSIONS (0.25 mm THICKNESS)							
LENGTH	950	920	890	865	840	815	794
ID	134.00	138.75	143.00	146.90	151.25	155.65	160.00

Note:
RD DG 4 26 1133 0000–
Version 2

		03	Al. Foil/High Conductive Carbon Fiber	RD DG 4 26 11333001	Aluminium/Carbon Fibre		07
		02	LT INSERT	RD DG 4 26 1133 2001	HE-30		01
		01	FRP TUBE	RD DG 4 26 1133 3001	FRP		01

TYPE OF PRODUCT
NAME OF CUSTOMER 27.8 kV 500/660MW THDF Bushing

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

	NAME	SIGN.	DATE	NO.OF VAR.
DRN	Hari R		04.05.16	
CKD	Hari R		04.05.16	
APPD	Dr. M M Rao		04.05.16	01

DEPT. CODE	GRADE OF TOL. DIM. C/M/F	SCALE	WEIGHT(KG)	REF. TO	ITEM NO.	NO.OF ITEMS
		NTS		RD DG 4 26 1133 0000		

TITLE	CARD CODE	DRAWING NO.	REV.
FRP TUBE–1		RD DG 4 26 1133 3001–1	00
		SHEET NO. / NO. OF SHEETS	

REF. DRG. NO. | SIGN. AND DATE | INVENTORY NO.