



TENDER SPECIFICATION FOR
LSR EQUIPMENT FOR MANUFACTURE OF HOLLOW CORE INSULATORS

I. BROAD FEATURES

- a. For manufacture of Composite Hollow insulators using LSR – Liquid silicone rubber technology with moulding over FRP/metal end fittings on single or both sides.
- b. Shall be suitable for multi shot operation for manufacturing products up to 8.0 meters in length.
- c. Complete set up consisting of following :
 1. HORIZONTAL CLAMPING UNIT – Inclusive of
 - a. Mould handling device
 - b. Product handling device
 - c. Flange heating device
 - d. Hydraulic system
 - e. Mould heating device
 - f. Chilling system
 - g. Computer based control system
 2. Mixing and metering equipment for liquid silicones
 3. Heat shrink equipment for fixing of metallic end fittings on FRP Tube.
 4. Set of moulds for the drawings provided

II. QUALIFICATION CRITERION

1. The bidders for the equipment shall be on turnkey basis i.e., the bidders shall design, manufacture, supply, erection & commissioning at site, demonstrate successful trial production on the mould resdeveloped for the product drawing furnished , provide spares and service backup.
2. The bidders shall be original equipment manufacturer and or their authorized channel partners only.
3. The bidders shall have a proven performance for the turnkey project execution for the similar projects and shall have executed a minimum of 3 such installations outside their own country. List of supplies made with date and detailed address may be furnished along with technical bid.
4. The equipment to be manufactured and supplied from the bidders country of origin.
5. The bidders shall have service backup in India with qualified service personnel, details of the same shall be provided along with the technical bid.

Note :

- a. *The qualification criterion as above is not exclusive of each other and successful bidders shall fulfil the entire criterion.*
- b. *Bidders to provide documentary evidence for the qualification criterion set in along with the technical bids. BHEL at its discretion may verify the credentials provided for fulfilling the qualification criterion set.*
- c. *A copy of the price bid (with the prices blocked out may be enclosed along with the technical / commercial bid)*

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TECHNICAL SPECIFICATIONS

1.0 HORIZONTAL CLAMPING UNIT

Sl No.	Description	Specification Parameter	Remarks
1.01	Type	I. Frame type construction II. Multi shot – capable of taking multiple shots for longer products. III. Flat bottom and without longitudinal bars IV. Accessibility from both sides	
1.02	Material of construction	Steel profile with necessary reinforcements to withstand the maximum operating pressure over the period of the life cycle of equipment and without losing closing accuracy beyond permissible limits.	Bidders to provide the material details in the Techno-commercial bid.
1.03	Fixing surface to fix the mould base plate on both the fixed and moving side	Minimum 2650 x 1200 mm	Bidders to indicate the actual size
		Provision for integrated electrical heating	To be indicated as an optional feature and to be quoted separately in price bid.
1.04	Horizontal Clamping device	Consisting of fixed machine frame and moving sides on hanging carriage mounted on precision linear slide ways	Bidders to indicate the constructional features
		Hydraulic clamping cylinders	Bidders to indicate the number of cylinders and construction features
		Clamping force – Min 1600 KN	Bidders to indicate the working and design clamping force. The clamping device to be designed such that the clamping force is applied on the central axis and the clamping force is uniformly distributed over the entire area.
		Distance between fixing plates : Indicated dimension Minimum – 400 mm Maximum – 1800 mm	Bidders to indicate the dimensions in their design
		Closing stroke – 1600 mm	Provision of positioning the carriage over the entire length of closing stroke through displacement transducers freely programmable shall be

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			provided.
		Height of the horizontal central axis of fixing plates from base plate – 1400 mm minimum	Bidders to indicate the dimension in their design
		Clamping mechanism	Bidders to provide the details of the clamping mechanism for mounting the moulds to be provided along with an indicative drawing.
		Weight of the mould and associated accessories to be mounted approx – 6500 kgs(max)	Bidders to indicate the maximum working weight that can be mounted on the fixing plates.
		Centring mechanism – with centring heads and receptacle flanges, closing bars and positioning cylinders	Bidders to indicate the centring mechanism built in the machine with detailed description and sketches.
1.05	Injection Nozzle Devices	Minimum 2 Nos of Injection nozzle devices with retracting mechanism shall be provided. The nozzle retracting mechanism to retract during opening & closing and in open condition of the moulds. The nozzle to move upward and only when the moulds are closed.	Bidders to provide the details of the nozzle dimension and sealing system for design of mould. Flexibility for positioning the nozzle shall be provided to adapt to different moulds / designs.
1.06	Mould Handling Device	Mould handling device for handling the mould consisting of carriage, hoist travel beams, 2 nos of electrically operated chain hoists and independent controls. Capacity of chain hoists : 2500 Kgs Lift height : 3000 mm maximum Lift speed : Two stage Fast & Slow	Bidders to provide the constructional and mounting details of the mould handling device on the clamping unit frame work. The control unit shall have provision for independent and simultaneous operation of electric hoists through a selection switch.
1.07	Product Handling Device	Product handling device for a. For handling the FRP tubes from transport rack and while inserting into the mould b. During demoulding operation c. For handling the finished product from mould to transport rack. Consisting of hoist travel rail, 2 nos of electric chain hoists and controls. Capacity of chain hoists : 500 Kg Lift height : 3000 mm maximum Lift speed : Two stage Fast & Slow	Bidders to provide the constructional and mounting details of the product handling device on the clamping unit frame work. The control unit shall have provision for independent and simultaneous operation of electric hoists through a selection switch.
1.08	Hydraulic Unit	Complete hydraulic unit consisting of electrically driven hydraulic pumps, hydraulic control system with necessary safety features built in, oil	The pumps in the hydraulic systems shall run only during mould closing / opening. Pressure compensation shall

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		cooler, accumulator, level indicator, inline filter, breather etc. System to provide for two operating speeds.	be performed by inbuilt accumulator. The inline filter and breather shall be suitable selected to avoid fine dust particles ingress into the system. All bought out components shall be of preferred make indicated. Bidders to provide details of the hydraulic
1.09	Control Unit	Independent control suitably mounted and positioned ergonomically for the operator to have clear view of the equipment in operation and oversee the controls. Control unit to consist of : <ul style="list-style-type: none">- Operational control : Computer integrated PLC based processor with a set of predefined programmes and having provision to select the suitable programme.- With provision of auto mode and manual mode of operation- HMI with a minimum 12" screen- Provision for positioning of movable carriage at any given location over the entire length of travel.- Emergency manual STOP button.- Emergency or malfunction auto STOP and display with flashing strobe and hooter- Cycle time indicator and counter- Display of mould temperature, mould close / open status, resin flow, curing, demoulding etc., with a mimic diagram- Display of hydraulic unit status, pressure, temperature etc.- Display of LSR mixing unit status and parameters- Provision for integrated data logging of operating	Bidders to provide the complete details and a write up of the control system. The features indicated in the specification is only indicative. Additional features which can enhance the operational ease, enhance the productivity and ensure additional safety for the men and machine shall also be provided and indicated accordingly. The bought out components shall be of preferred make. If alternative makes are preferred details shall be provided in the technical bid and the same is subject to BHEL acceptance. The bidders to provide the programme in the soft form as backup to BHEL. Upgrades within the warranty period shall be provided free of cost.

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		<p>parameters for every cycle.</p> <ul style="list-style-type: none">- Fault indication and diagnostic annunciation.- Provision of password for programming and machine parameter setting.- Separate password for machine operators.- Provision for remote monitoring on LAN- Display of intrusion and alarm from barrier scanners.- Etc....	
1.10	Safety Features	<ol style="list-style-type: none">1. Laser / beam scanners for indication and interlocking the controls during intrusion of personnel within the clamping unit limits.2. Over pressure, over temperature and other malfunction indication, alarm and auto STOP.3. Emergency STOP button with manual override.4. Flashing lights and buzzer while mould closing.5. Password protection for operator.	Bidders to provide the list and details of safety features incorporated in technical bid. The safety features asked for in the specification is only indicative, additional safety features shall be suggested and incorporated.
1.11	Mould Heating Device	<p>Mould heating device for heating the moulds on both fixed and movable units.</p> <p>With suitable programmable temperature control device for both pre-heating and curing operations.</p> <p>Mode of heating :</p> <ol style="list-style-type: none">a. Through water tempering device - preferred.b. Optional Electrical heating. <p>Temperature : Max 150 Deg. C</p>	Bidders to provide the type and details of the mould heating device adopted. The kW rating of the heating device shall be provided.
1.12	Cooling /Chilling Unit	<p>CFC free Cooling /Chilling unit for injection nozzles cooling shall be provided. Chilled water temperature shall be at least 15 Deg. C</p>	Bidders to provide the type and details of the cooling / chilling unit. The kW rating of the chilling unit, refrigeration system and refrigerant adopted shall be indicated. The piping / hose from chilling unit to the nozzle with necessary controls shall form part of bidders' scope.

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1.13	Provision of Flange Heating	Suitable connection for electric heating of metallic flanges to be fixed to the FRP tubing shall be provided along with heating power of minimum 2 x 15 Kw heaters on either side, programmable temperature indicator / control integrated into the main control & HMI. Maximum temperature : 150 Deg. C	Bidders to provide the details of flange heaters
1.14	Demolding Device	The equipment shall have the demolding device along with the main clamping unit. The device used for removing the cured component from the mould with suitable hydraulic / pneumatic pulling mechanism shall be quoted as an optional feature.	Bidders to indicate the details and constructional features of demolding device offered.
1.15	Other Details	The following information shall be provided: a. Overall dimension of the equipment. b. Working space, space for maintenance and upkeep and machine margin space required. c. Total connected load to the equipment in kW. d. Water quality required. e. Environmental conditions for safe operation. f. Set of minimum spares required and to be maintained in our inventory. g. Hydraulic oil specification and quantity for first fill. h. Compressed air required : pressure, flow rate and quality i. Tools & tackles to be provided by BHEL for Erection & Commissioning and for routine operation. j. Any other requirement.	Bidders to indicate these details in the technical bid. List is not exhaustive, other requirements if any shall be appended.

NOTE : The features and specification given as above is only indicative. Suppliers may offer other state of the art features which can help in enhancing the productivity and quality of output. Details of the additional features shall be elaborated clearly and these additional features shall be quoted as optional items. BHEL may opt for incorporating the features at its discretion.

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2.0 MIXING AND METERING UNIT

Sl No.	Description	Specification Parameter	Remarks
2.01	Mixing and Metering unit for two part silicone casting / injection at atmospheric pressure and temperature.	<p>Two part (Part – A & B) homogenous mixing and metering unit suitable for casting / injection of silicone polymer under atmosphere and at room temperature. Provision for injection of coloring medium shall also to be provided in the static mixer.</p> <p>Unit consisting of :</p> <ul style="list-style-type: none">- One set of barrel ejection device and reciprocating piston dosing pump for each part A & B.- Barrel ejection device shall be pneumatically driven with a sturdy rack and carrying plate for 200 L capacity barrels- Reciprocating piston dosing pump of double acting type with complete servo / solenoid valves, piping and accessories to provide a leakage free dosing.- Level indicators for the barrels, suitably designed and integrated into the control panel.- Programmable variable mixing system with ratio variable between 0.90:1 to 1.10:1- Multiple injection in intervals of minimum 5 programmable steps- Static flow mixer providing fully homogenous mix with more than 2 billion layers. Dismounting arrangement to be provided for cleaning of mixer.- Hydraulic unit for operation of reciprocating piston pumps of suitable capacity complete. (Note : Possibility of using the hydraulic unit of clamping unit for the purpose through a second hydraulic circuit can be	<p>Bidders to provide complete details along with schematic diagram, P & I diagram and other relevant features of the equipment offered, inclusive of the following :</p> <ul style="list-style-type: none">- Rate of injection : minimum and maximum rate to be indicated.- Provision of varying the rate of injection shall be provided.- Pressure of injection and its control mechanism to be indicated.- Feature built in for avoiding air entrapments to be explained.

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		explored and provided) - Control unit : with a control panel mounting the instrumentation and electric control components for mixing and metering unit, with integration to the clamping unit HMI.	
2.02	Evacuation and Cleaning procedure	Provision for cleaning the internals shall be provided. Cleaning interval and programme if any from the control unit shall be indicated.	Bidders to provide detailed write up and procedure for cleaning the equipment internals of the silicone material during change in batch or long operational stoppages.
2.03	Other Details	The following information shall be provided: a. Overall dimension of the equipment. b. Working space, space for maintenance and upkeep and machine margin space required. c. Total connected load to the equipment in kW. d. Water quality required. e. Environmental conditions for safe operation. f. Set of minimum spares required and to be maintained in our inventory. g. Hydraulic oil specification and quantity for first fill. h. Compressed air required : pressure, flow rate and quality i. Tools & tackles to be provided by BHEL for Erection & Commissioning and for routine operation. j. Safety features incorporated. k. Any other requirement.	Bidders to indicate these details in the technical bid. List is not exhaustive, other requirements if any shall be appended.

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3.0 HEAT SHRINK EQUIPMENT FOR FIXING OF METALLIC END FITTINGS ON FIBRE CORE

Sl No.	Description	Specification Parameter	Remarks
3.01	Heat shrink equipment for fixing of metallic end flanges on fibre core for hollow core composite insulators.	<p>Horizontal flat bed type, one end adjustable for varying length, hydraulically / mechanically operated heat shrink mechanical flange fitting equipment suitable for hollow core insulator manufacturing by LSR injection method.</p> <p>Diameter of Flange : 1000 mm maximum Length of hollow core insulators : 4000 mm maximum. The bed to have provision for extension of length at later date.</p> <p>The end plates for mounting and heating flanges shall have provision for mounting of different sized flanges.</p> <p>The heating of the flanges shall be uniform across the area and the temperature difference shall not exceed ± 5 Deg. C</p> <p>Programmable temperature indicator controllers for each of the head with an indication accuracy of ± 0.1 Deg to be provided.</p> <p>The base plate shall have graduated scale for setting measurement and controlling the hollow core insertion. Control panel with instrumentation and display units for operation and machine electrical control shall be included as an integral or stand alone floor mounted type.</p> <p>Hydraulic unit if required shall be independent and self contained and operated through the main control panel.</p>	
3.02	Other Details	<p>The following information shall be provided:</p> <ol style="list-style-type: none">Overall dimension of the equipment.Working space, space for maintenance and upkeep	<p>Bidders to indicate these details in the technical bid. List is not exhaustive, other requirements if any shall be appended.</p>

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		<p>and machine margin space required.</p> <p>c. Total connected load to the equipment in kW.</p> <p>d. Water quality required.</p> <p>e. Environmental conditions for safe operation.</p> <p>f. Set of minimum spares required and to be maintained in our inventory.</p> <p>g. Hydraulic oil specification and quantity for first fill.</p> <p>h. Compressed air required : pressure, flow rate and quality</p> <p>i. Tools & tackles to be provided by BHEL for Erection & Commissioning and for routine operation.</p> <p>j. Safety features incorporated.</p> <p>k. Any other requirement.</p>	
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4.0 SET OF MOULDS

The product drawing No. EL DG 3 987 14 501000 & No. EL DG 3 987 18 501000 is enclosed herewith. A quotation for the mould suitable for manufacture of hollow core insulator by LSR injection method shall be submitted. The mould complete with cavity, back up / base plate, nozzle port, air vents, guide bars / dowel pins for accurate alignment, provision for hot water inlet and outlet for heating (for water heating type), provision for thermocouple port for temperature monitoring & control, lifting and handling tackles (eye hook), demolding arrangement etc. Shall be included as part of the mould.

The bidders to provide the details of material selection for mould, method of manufacturing, surface finish, dimensions of various ports, total weight, operation and maintenance instructions and other relevant information along with the technical bid. The mould design to take care of joints during subsequent shots of operation. The bonding should not lead to gaps/steps.

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5.0 PRICE BID FORMAT

The bidders to submit their price bids as per the format given below, for reference copy of the price bid without mentioning the prices but only indicating the bill of materials, quantity, optional items / features, taxes and duties and any other cost element or other relevant information to be submitted along with the techno-commercial bid. The cost to be indicated for each of the item / feature separately. BHEL at its discretion may select only the required items and features for final procurement, the selection of items / features will be freezed after technical evaluation and communicated to the bidders before opening the price bid.

SI No.	Description	Rate	Remarks
01	Horizontal Clamping Unit inclusive of <ul style="list-style-type: none">- Clamping device- Injection nozzle devices- Mould handling device- Product handling device- Hydraulic unit- Central control unit- Mould heating device- Cooling / chilling unit		
02	Mixing and Metering Unit		
03	Heat Shrink Equipment for fixing of metallic end fittings on hollow fibre core		
04	Charges for supervision of Erection, Commissioning and on the site training		
05	Set of Moulds to Drg. No. EL DG 3 987 14 501000 and Drg. No. EL DG 3 987 18 501000		

NOTE :

1. Price basis to be indicated viz., ex-works / CIF Indian port.
2. Packing, inland transportation, freight, and other charges if any to be indicated separately.
3. Taxes or duties applicable if any to be indicated separately.
4. Any other charges if applicable shall be indicated clearly and separately.

6.0 PRE DESPATCH INSPECTION

The equipment will be inspected at the vendors works before shipment, the bidders to allow for inspection at their works and the communication to be provided well in advance for making inspection arrangements. BHEL shall bear the expenses for the travel and stay. OEM qualified personnel to provide training to BHEL personnel for operation, trouble shooting and maintenance of the equipment during ins
Bidders to provide 3 sets of operation manual, maintenance manual and spares and consumables list, along with the same in soft form on a CD. Further, bidders to provide online / web based backup and service support for ensuring trouble free performance and continuous operation.

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7.0 TRAINING

The suppliers have to provide training to personnel from BHEL for 5 working days thoroughly at their works on all the aspects of imparting knowledge on the principles of operation, maintenance of the equipment and accessories, trouble shooting for process and equipment related problems, process optimization and other features.

8.0 DOCUMENTATION

Bidders to provide 3 sets of operation manual, maintenance manual and spares and consumables list, along with the same in soft form on CD / Pen drive. Further, bidders to provide online / web based backup and service support for ensuring trouble free performance and continuous operation.

9.0 CONTACT DETAILS FOR CLARIFICATION

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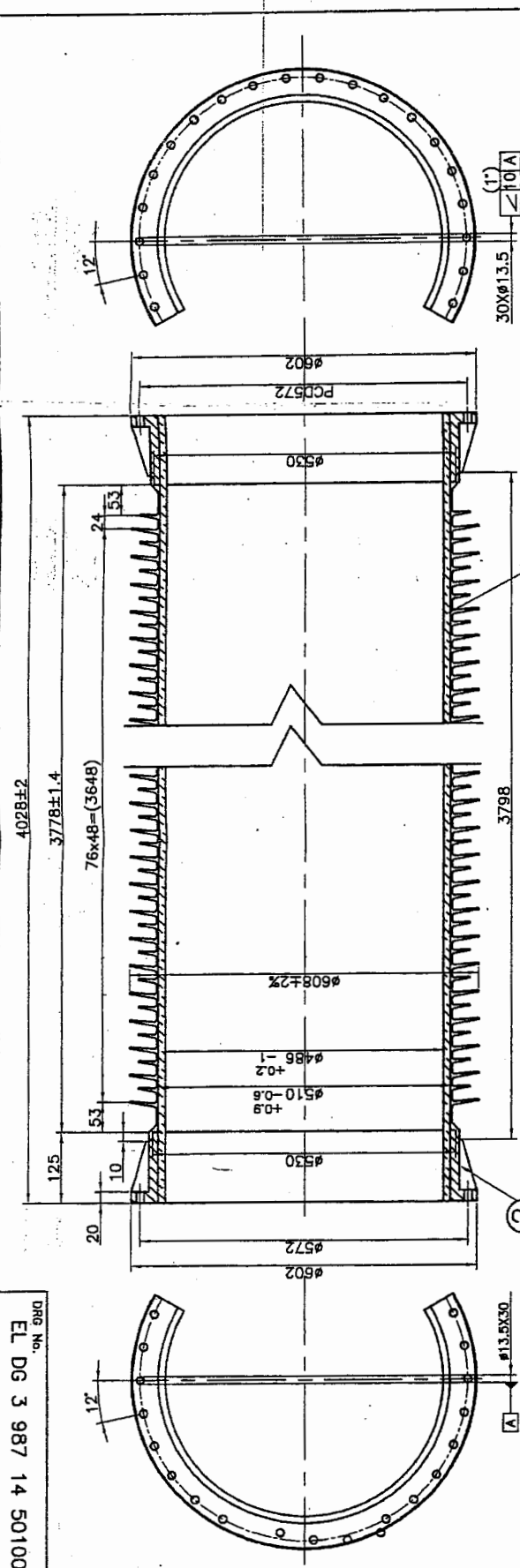
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FIRST ANGLE PROJECTION

DRG No.
EL DG 3 987 14 50100



TECHNICAL PARTICULARS


- | 1. MINIMUM CREEPAGE DISTANCE | 13711 mm |
|-------------------------------|--------------------|
| 2. ARCING DISTANCE | 3778 mm ± 5 |
| 3. No. OF SHEDS | 77X2 |
| 4. TUBE MATERIAL | CEVOLIT A2315 |
| 5. SHED MATERIAL | CEVOLIT A1001 |
| 6. MINIMUM SPECIFIED PRESSURE | 0.6 MPa Rel. |
| 7. BURST PRESSURE | >2.4 MPa Rel. |
| 8. ROUTINE MECHANICAL LOAD | 10000 N |
| 9. SPECIFIED MECHANICAL LOAD | 25000 N |
| ROUTINE TEST | |
| 1. PRESSURE TEST | 1.20 MPa Rel. 100% |
| MARK | MSP 0.60 MPa Rel. |

NOTE

1. INSULATOR WILL CONFORM TO IEC:61109/IEC 61462

CONTROLLED COPY

3	WEATHER SHEDS	LIQUID SILICONE RUBBER	—	118
2	FLANGE	ALUMINUM ALLOY	2	43
1	TUBE	FRP	1	151
	ITEM No.	DESCRIPTION	MATERIAL	WT.KG QTY. (APPROX.)

	SCALE	WEIGHT (kg)	REF TO ASSY. ORG		ITEM No. No. OF ITEMS	
	N T S	312				
	(Approx)					
NEW ELECTRICALS LTD:						
PORCELAINS DIVISION						
MORE 560 012						
			DRN	N. CHIRIKUNNA	SIGN	DATE
			CHD	S S P	<i>Ch</i>	19.12.02
			APFD	S S P	<i>Ap</i>	19.12.02
					<i>Ap</i>	19.12.02

LOW INSULATOR 0 kV	CARD CODE	DRAWING No.	REV.
		EL DG 3 987 14 50100	AD
		No. OF SHEETS	

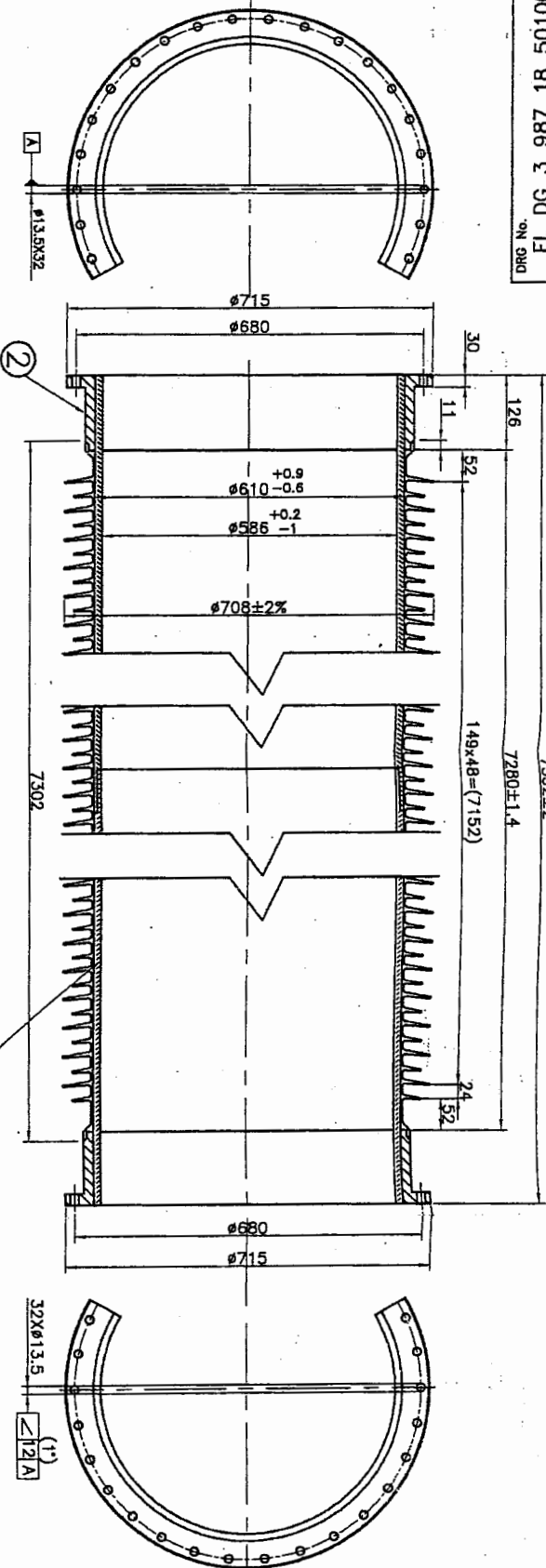
SUPERSEDES DRG. No.

SHT.24 SIZE A3 420 x 297mm

ALL DIMENSIONS ARE IN mm.

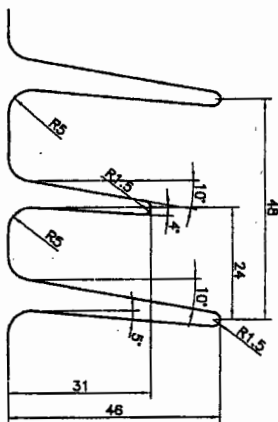
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1. MINIMUM CREEPAGE DISTANCE	26630 mm
2. ARCING DISTANCE	7280 mm F5
3. NO. OF SHEDS	150x2
4. TUBE MATERIAL	CEVOLT A2315
5. SHED MATERIAL	CEVOLT A100T
6. MINIMUM SPECIFIED PRESSURE	0,65 MPa Rel.
7. BURST PRESSURE	>2,6 MPa Rel.
8. ROUTINE MECHANICAL LOAD	14000 N
9. SPECIFIED MECHANICAL LOAD	35000 N

Abstract




CONTROLLED COPY

ITEM NO.	DESCRIPTION	MATERIAL	QTY.	WT. KG. (APPROX.)
3	WEATHER SHEDS	LIQUID SILICONE RUBBER	-	158
2	FLANGE	ALUMINUM ALLOY	2	49
1	TUBE	FRP	2	339

1. PRESSURE TEST MARK	1.30 MPa Rel. 100% MSP 0.65 MPa Rel.
NOTE	
1. INSULATOR WILL CONFORM TO IEC:61109/IEC 61462	

BHARAT HEAVY ELECTRICALS LTD.
ELECTROPORCELAINS DIVISION
BANGALORE 560 012

DEPT	GRADE OF		SCALE	WEIGHT (KG)	REF TO ASS'Y/DWG	ITEM No.	NO OF ITEMS
CODE	TOL DIM C/M/M		N T S	547 (approx)			
TITLE					CARD CODE	DRAWING No.	REV.
COMPOSITE HOLLOW INSULATOR FOR 800 KV						EL DG-3 987 18.50100	A0
						No. OF SHEETS	

SUPERSEDES DRG. No.

SHT.24 SIZE A3 420 X 297