GAS INSULATED EPOXY INSULATORS

For 145kV and Above

1.0 GENERAL:

This specification governs the quality of Alumina filled epoxy mouldings. This material is especially suitable for use in SF_6/ Arced SF_6 gas media. Calcined alumina filler in epoxy resin has been provided to enhance resistance to decomposed SF6 gas.

2.0 RAW MATERIALS :

The moulding consists of following raw materials.

a) Epoxy System
b) Filler
c) Metal Inserts

3.0 EPOXY SYSTEM :

Epoxy system consists of resin (Biphenyl-A based), hardener (anhydride based) and filler, if necessary, a small amount of catalyst can be used. It should be a class-F, hot curing system. Standard and proven epoxy system shall be used (like CY-205 & HY-905CIBA GEIGY). Plasticizer and pigment should not be used in the system. The mixed compound should be vacuumized under 5 torr. Automatic pressure gelation shall be used for moulding the component and initial curing should be done at 130-140^{0}C for 4 hrs under pressure. Post curing at 130 deg C for 8 hours The epoxy system shall have a dielectric constant in the order of 5.0. Other properties should be as per section-9 of this specification.

4.0 FILLER :

High purity (≥ 99%) calcined alumina with specific gravity around 3.8 shall be used as filler. Before processing filler materials is to be thoroughly dried at 80^{0}C for 8 hrs. Two sizes of alumina powder 300 meshes and 100 meshes shall be blended in 80%-20% proportions, respectively.

5.0 METAL INSERT :

Machined metal insert (as per drawing.) shall be used while moulding and shall be retained firmly in the mould prior to injection of the mix. The surfaces of the insert in contact with the epoxy shall be sand blasted / alumina grit blasted prior to its placement in the mould. The inserts shall be thoroughly degreased, using solvent, prior to use to promote adhesion. HT inserts shall be silver plated to 10 to 12 microns, if specified in drawing. This plating can be done either before or after the moulding. A flash (2-5 micron) of nickel prior to silver plating is desirable.

6.0 MIX :

The resin, hardener and the filler shall be mixed in weight percentage as per requirement to get good mechanical, electrical and thermal properties . The mixture should be homogeneous and shall be evacuated to 5 mbar (torr) before transfer to the mould. The mix shall be heated uniformly to obtain good flow consistency.

7.0 Casting Method:

These insulators shall be produced by means of vacuum casting due to high quality requirements of the insulation components. Thermally controlled molds shall be used to achieve higher process stability. Indirectly heated molds are not allowed.

8.0 FINISH:

The moulded material shall be homogeneous, smooth, compact and free from cracks, blisters, gas pockets, and foreign inclusion. It should have uniformly distributed bond. **Insulators shall be supplied in their natural colour**.

9.0 PROPERTIES :

Unless otherwise specified the tests shall be conducted in accordance with the relevant methods of Corporate Standard AA0851701.

Sl No	Parameter	Unit	Desired Value	Alternate Test Standard
Mechanical Properties				
1.	Density	g/cm^3	> 2.0	ISO 1183-1
2.	Tensile strength	N/mm^2	> 75	ISO 527
3.	Flexural strength	N/mm^2	>110	DIN 53452
4.	Compression strength	N/mm^2	>200	ISO 604
5.	Heat deformation Temperature	deg C	> 110	ISO11357-1
6.	Co-efficient of linear Thermal expansion	K^{-1}	$36x10^{-6}$	DIN 53752
7.	Water absorption	% by weight	<0.03	ISO 62
Electrical Properties				
8.	Insulation withstand	kV/mm	> 20	IEC60243-1
9.	Dielectric Constant		>4.5	DIN 53483/ IEC 60250
10.	Tan delta		< 0.03	DIN 53483/ IEC 60250
11.	Electric Resistance (volume Resistance)	Ohm-cm	$> 10 \times 10^{14}$	DIN 53482/ IEC 60093
12.	Comparative Tracking index (CTI)		> 600	ISO 60112

10.0 SAMPLES FOR TESTS

The set of moulded test specimens, as given below, pre-pared from the same batch shall be supplied for testing and approval.

(3± 0.2) mm tk x (50 x 50) ± 1 mm	-	4 Nos.
10 mm tk x 15 mm width x 120 mm length	-	3 Nos.
(3± 0.2) mm tk x (13± 0.5) mm x 75 mm length	-	5 Nos.

11.0 MACHINABILITY :

The component shall be freely machinable and saw able without showing any signs of splitting, cracking or chipping.

12.0 Leak proof test

Component shall be test for leak proof at 3kg/cm^2 air pressure

13.0 Load Test

Cantilever load test of 500kg shall be conducted at one sample.

14.0 Burst Pressure Test

For 420 kV GIS

i) Pressure on concave side should be 19.5 bar
ii) Pressure on convex side should be 22.5 bar

15.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied with each lot of components giving component name, drawing No, BHEL P.O. No, Batch/ Lot No. and Test values observed against specified parameters in clause 9.0, 12.0 and 13.0.

16.0 IDENTIFICATION TRACEABILITY MARKS:

Identification slips shall be tagged suitably on all moulding giving following information

a. Manufacturer's First Name
b. BHEL PO No.
c. Part No
d. Manufacturing digit batch no and running serial no,

Record shall be maintained at Manufacturer's end having following information

i. Batch No
ii. Batch Qty
iii. date of manufacturing
iv. BHEL PO No.
v. Tests Certificates
vi. Raw material Test Certificates having batch no.
vii. Process parameter like temp, curing time, etc.

17.0 PACKING:

The material shall be suitably packed to prevent corrosion and damage during transit. As these components are very critical and accuracy level is very high, vendor to pack each components in trays of thermocol or equivalent. The lot should be supplied in shock proof and unbreakable container/box. Necessary arrangement shall be made to avoid ingress of water into the container/box. A 50 gm silica gel moisture absorbent packet shall be placed in box for each component.

In case of doubts in specifications, the supplier shall contact BHEL for Clarifications