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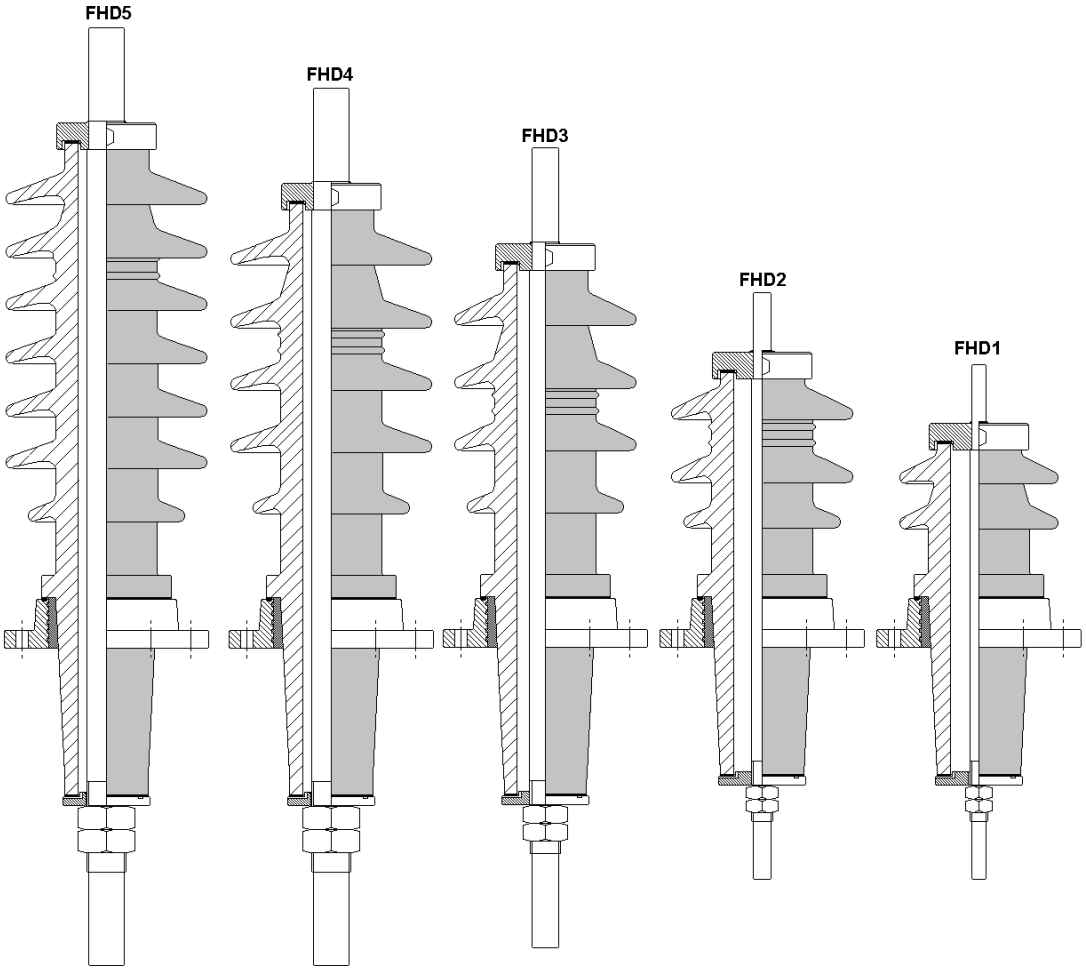
World leader in transformer accessories and premould connectors

FHD range of Transformer Bushings manufactured by ZEP.



FHD range shown above have cemented Aluminium flanges for partial discharge ≤10pc at rated voltage.

General

The FHD units are derived from the HD – ESAA 2/3/16 series of bushings that have were in existence prior to 1966.

The main difference between the FHD range and the HD – ESAA 2/3/16 range is the incorporation of Aluminium flanges cemented to the porcelain for mounting of the bushing to the transformer.
The benefit of the FHD units with the aluminium flange is that the units are **partial discharge free (≤10pc)** at nominal voltages right through the range.

Handling Instructions

All units being of porcelain construction should be handled with care to avoid chipping or breaking the porcelain.
Units should not be placed directly onto metal benches; concrete floors or placed side by side without some suitable cushioning material under and or between them. Units placed on a flat surface should be chocked to ensure they cannot roll off a table or bench or roll into one another and cause damage.

Technical Information

The range consists of three (3) main voltage ratings as follows:

FHD1 = 11kV Heavy Pollution (95kV BIL)
FHD2 = 11kV Very Heavy Pollution - 22kV Medium Pollution (150kV BIL)
FHD3 = 22kV High Pollution - 33kV Medium Pollution (200kV BIL)
FHD4 = 33kV Heavy Pollution (200kV BIL)
FHD5 = 33kV Very Heavy Pollution (200kV BIL)

Note: The pollution level description shown above is calculated at the shown voltage levels and measured creepage distance and are described in accordance with IEC 815

Light Pollution:	16mm/kV
Medium Pollution:	20mm/kV
Heavy Pollution:	25mm/kV
Very Heavy Pollution:	31mm/kV

Nominal Current ratings for each bushing type are as follows:

300A, 500A, 800A, 2000A, 2650A and 3150A

Types with current ratings 800A and higher are generally supplied with round spigot either end for connection of slip on palms.
Refer to ZEP office for information on connection palms available.

For 300A and 500A units are supplied with a top cap having a 14mm diameter hole in the palm for connection and an M16 threaded stem at the bottom supplied with 3 x M16 nuts and 2 washers for cable lug connection internally.
See Figure 1 below:

Figure 1:

TYPICAL CONNECTION ARRANGEMENT FOR 300A & 500A UNITS

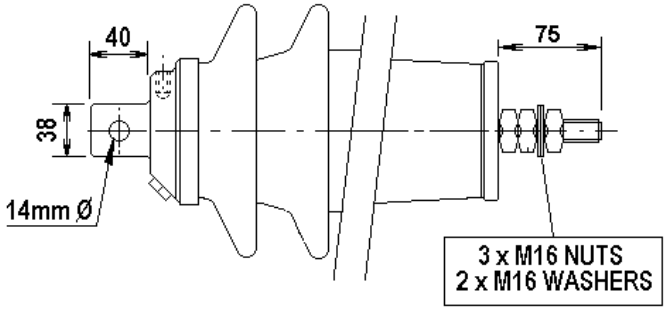


Table 1. *(Electrical characteristics)*

ZEP TYPE No.	Nominal Voltage	Nominal Current	Wet Power Frequency withstand Voltage	Impulse Level (BIL) Rating	Creep Distance (mm)	Arcing Distance (mm)
FHD1G300	11kV	300A	35(kV)	95(kV)	305	190
FHD1G500	11kV	500A	35(kV)	95(kV)	305	190
FHD1G800	11kV	800A	35(kV)	95(kV)	305	190
FHD1G1050	11kV	1050A	35(kV)	95(kV)	305	190
FHD1G2000	11kV	2000A	35(kV)	95(kV)	305	190
FHD1G2650	11kV	2650A	35(kV)	95(kV)	305	190
FHD1G3150	11kV	3150A	35(kV)	95(kV)	305	190
FHD2G300	22kV	300A	50(kV)	150(kV)	470	280
FHD2G500	22kV	500A	50(kV)	150(kV)	470	280
FHD2G800	22kV	800A	50(kV)	150(kV)	470	280
FHD2G1050	22kV	1050A	50(kV)	150(kV)	470	280
FHD2G2000	22kV	2000A	50(kV)	150(kV)	470	280
FHD2G2650	22kV	2650A	50(kV)	150(kV)	470	280
FHD2G3150	22kV	3150A	50(kV)	150(kV)	470	280
FHD3G300	33kV	300A	70(kV)	200(kV)	670	400
FHD3G500	33kV	500A	70(kV)	200(kV)	670	400
FHD3G800	33kV	800A	70(kV)	200(kV)	670	400
FHD3G1050	33kV	1050A	70(kV)	200(kV)	670	400
FHD3G2000	33kV	2000A	70(kV)	200(kV)	670	400
FHD3G2650	33kV	2650A	70(kV)	200(kV)	670	400
FHD3G3150	33kV	3150A	70(kV)	200(kV)	670	400
FHD4G300	33kV	300A	70(kV)	200(kV)	900	485
FHD4G500	33kV	500A	85(kV)	200(kV)	900	485
FHD4G800	33kV	800A	85(kV)	200(kV)	900	485
FHD4G1050	33kV	1050A	85(kV)	200(kV)	900	485
FHD4G2000	33kV	2000A	85(kV)	200(kV)	900	485
FHD4G2650	33kV	2650A	85(kV)	200(kV)	900	485
FHD4G3150	33kV	3150A	85(kV)	200(kV)	900	485
FHD5G300	33kV	300A	85(kV)	200(kV)	1200	550
FHD5G500	33kV	500A	85(kV)	200(kV)	1200	550
FHD5G800	33kV	800A	85(kV)	200(kV)	1200	550
FHD5G1050	33kV	1050A	85(kV)	200(kV)	1200	550
FHD5G2000	33kV	2000A	85(kV)	200(kV)	1200	550
FHD5G2650	33kV	2650A	85(kV)	200(kV)	1200	550
FHD5G3150	33kV	3150A	85(kV)	200(kV)	1200	550

Note: *The FHD1 series and FHD4/FHD5 series were tested at 35kV and 85kV Wet Power frequency Withstand Voltage respectively to meet a customer's specific requirement – Test Report available.*

Gaskets:

The gasket material supplied by ZEP on the assemblies is suitable for continuous use in mineral oil at a maximum temperature of 120º C and minimum temperature of -20ºC.

Table 2. *(Recommended **Minimum** Cold oil Levels)*

Assembly Type	Mounted Vertically or to within 30º of Vertical	Mounted Horizontally
FHD1 – 11kV	Height above Tank Face (25mm)	Fully Filled
FHD2 – 22kV	Height above Tank Face (200mm)	Fully Filled
FHD3 – 33kV	Height above Tank Face (310mm)	Fully Filled
FHD4 – 33kV	Height above Tank Face (300mm)	Fully Filled
FHD5 – 33kV	Height above Tank Face (300mm)	Fully Filled

Routine Tests

All units supplied are Routine Tested as follows:
Tests carried out prior to delivery are:

1. Thermal Shock Test
2. Tightness test on Liquid insulated bushing
3. Visual and dimensional check

Test reports are only available should they be requested at time of order.
Conformance certificates are also available on request.

Tightening of the FHD assemblies:

The units as supplied by ZEP are tightness tested and all assemblies are tightened in accordance with ***Table 3*** below

Table 3. *(Assembly tightening torque)*

Current rating	Stem Diameter	Conductor	Torque Setting
300 & 500A	**16mm**	**Brass 300A/Copper 500A**	**60Nm**
800A	**24mm**	**Copper**	**100Nm**
2000A	**36mm**	**Copper**	**135Nm**
2650A	**45mm**	**Copper**	**150Nm**
3150A	**48mm**	**Copper**	**180Nm**

Notes: *On Assembly*

a) The tank hole should be free from burrs and the tank face where the bushing mates should be flat and free from lumps and scratches that may result in a poor seal.

b) Should a bushing be used in the horizontal plane the breather plug should be uppermost on the bushing during assembly onto the transformer tank.
The breather plug allows the bushing to be easily flooded with oil, by releasing the breather plug to allow the air inside the bushing to escape as it is filled with oil.
On completion of oil filling to the required level the breather plug should be carefully tightened. The breather plug has an "O" ring seal and should not be over-tightened. We recommend the breather plug be tightened to 10Nm + or – 1Nm.

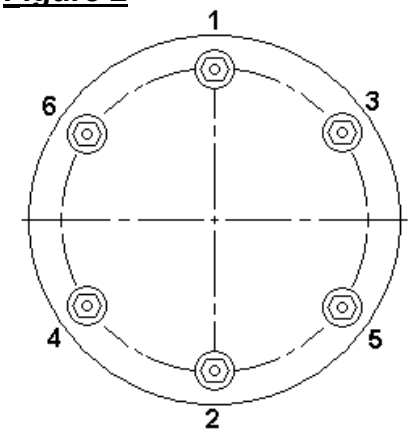
c) On installation onto the tank the unit should be located as centrally as is possible within the tank hole.

d) The recommended stud size for locating both the HD and FHD range of units to the tank is 12mm diameter.
The fixing nuts should be tightened in accordance with the sequence shown in Figure 2.

e) Any connections made to the bushings internally or externally: ie: flexible cables or busbars must be fully supported so that the bushing is not carrying any unreasonable mechanical load from these connections. Such loads could cause failure of the bushing seal.

The recommended stud size for locating both the HD and FHD range of units to the tank is 12mm diameter.
The fixing nuts should be tightened in accordance with the sequence shown in Figure 1 below.

Figure 2



Assembly Tightening Torque:

Firstly all nuts should be finger tight.
Secondly nuts should be tightened to 20Nm before final tightening of the unit.
Thirdly finish tightening nuts to **40Nm** for an **M12** stud.

Palms, Flags and Split Clamps:

ZEP can supply a comprehensive range of connectors for attaching conductors internally and externally to the bushings.
Please contact ZEP for information on options available.

Drawings:

Drawings are available for all units, as are individual component drawings should they be required, there are many more variations available that will fill special requirements for customers – contact ZEP for special requirements.

Type Test Reports:

Type Test results are available for the FHD range of bushing assemblies as these are to a ZEP design and were fully type tested prior to release in onto the market. Contact ZEP office for pdf copies if required.

Should additional information be required or clarifications of any of the above information please contact ZEP.

Information subject to change without notice

Last updated 3rd February 2015