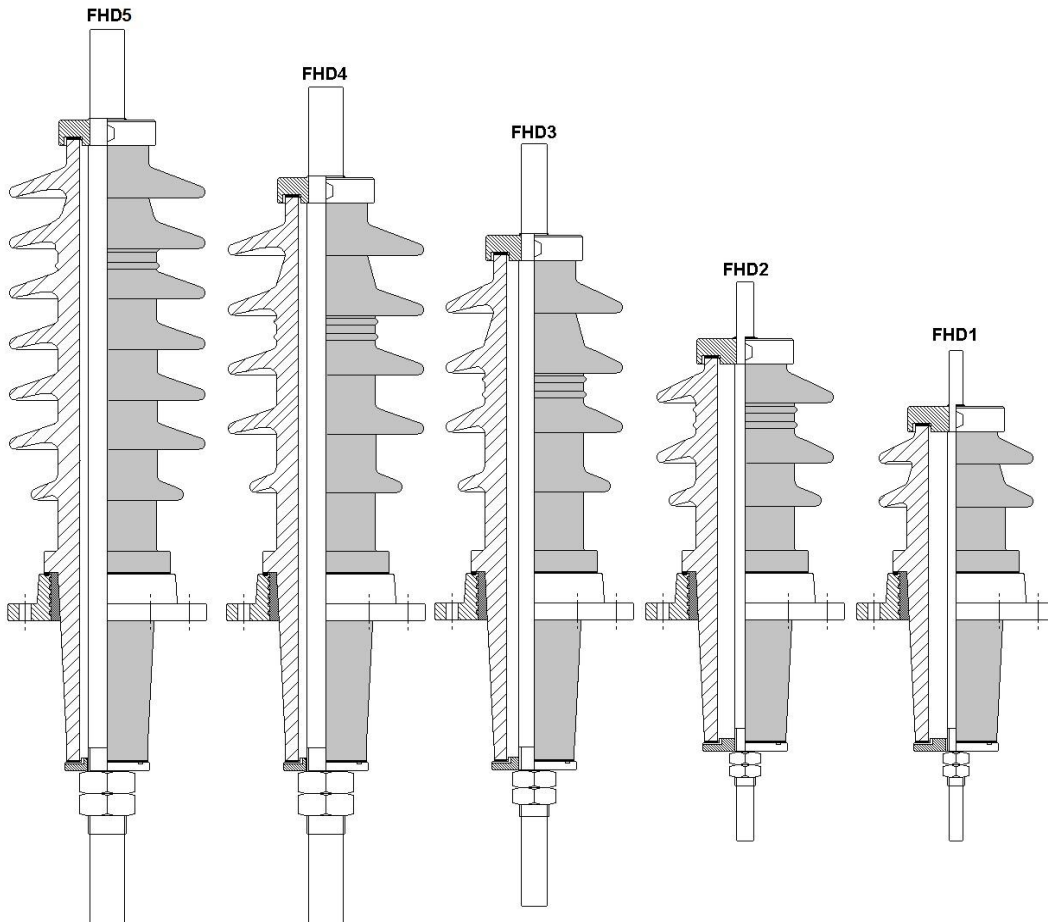


FHD range of Transformer Bushings manufactured by ZEP. These bushings conform to IEC - AS/NZ 60137



General

The FHD units are derived from the ESAA 2/3/16 series of bushings that have been used extensively in the Australian market since the 1950's.

They are designated Oil / Air outdoors but are also extensively used in cable box applications where space allows.

They are a Free Flow design utilising the transformers own dielectric fluid.

The FHD range consists of a one-piece porcelain insulator cemented to an aluminium flange for mounting directly to the transformer.

The benefit of the FHD units with the aluminium flange is that the units are **partial discharge free ($\leq 10\text{pc}$)** at nominal voltages right through the range.

Standard porcelain colour is Munsell Grey - Brown is available on request - check with our office for lead times.

Pollution Performance 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 = 22kV Very Heavy Pollution - 33kV Heavy Pollution (200kV BIL)

FHD5 = 33kV Very Heavy Pollution (200kV BIL)

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

Standard Nominal Current ratings for each bushing type are as follows:

300A, 500A, 800A, 1050A, 2000A, 2650A and 3150A

Types with current ratings of 800A and higher are generally supplied with plain round terminals on each end enabling connection via flags, palm, or block connectors – contact ZEP for details. Lower current versions are usually supplied with external palm for bolted connection and internal threaded connection to accept standard cable lugs.

See Figure 1

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)	Cantilever Withstand Horizontal & Vertical
FHD1G300	11kV	300A	35(kV)	95(kV)	305	190	2kN
FHD1G500	11kV	500A	35(kV)	95(kV)	305	190	2kN
FHD1G800	11kV	800A	35(kV)	95(kV)	305	190	2kN
FHD1G1050	11kV	1050A	35(kV)	95(kV)	305	190	2kN
FHD1G2000	11kV	2000A	35(kV)	95(kV)	305	190	2kN
FHD1G2650	11kV	2650A	35(kV)	95(kV)	305	190	2kN
FHD1G3150	11kV	3150A	35(kV)	95(kV)	305	190	2kN
FHD2G300	22kV	300A	50(kV)	150(kV)	470	280	2kN
FHD2G500	22kV	500A	50(kV)	150(kV)	470	280	2kN
FHD2G800	22kV	800A	50(kV)	150(kV)	470	280	2kN
FHD2G1050	22kV	1050A	50(kV)	150(kV)	470	280	2kN
FHD2G2000	22kV	2000A	50(kV)	150(kV)	470	280	2kN
FHD2G2650	22kV	2650A	50(kV)	150(kV)	470	280	2kN
FHD2G3150	22kV	3150A	50(kV)	150(kV)	470	280	2kN
FHD3G300	33kV	300A	70(kV)	200(kV)	670	400	2kN
FHD3G500	33kV	500A	70(kV)	200(kV)	670	400	2kN
FHD3G800	33kV	800A	70(kV)	200(kV)	670	400	2kN
FHD3G1050	33kV	1050A	70(kV)	200(kV)	670	400	2kN
FHD3G2000	33kV	2000A	70(kV)	200(kV)	670	400	2kN
FHD3G2650	33kV	2650A	70(kV)	200(kV)	670	400	2kN
FHD3G3150	33kV	3150A	70(kV)	200(kV)	670	400	2kN
FHD4G300	33kV	300A	70(kV)	200(kV)	900	485	2kN
FHD4G500	33kV	500A	85(kV)	200(kV)	900	485	2kN
FHD4G800	33kV	800A	85(kV)	200(kV)	900	485	2kN
FHD4G1050	33kV	1050A	85(kV)	200(kV)	900	485	2kN

FHD4G2000	33kV	2000A	85(kV)	200(kV)	900	485	2kN
FHD4G2650	33kV	2650A	85(kV)	200(kV)	900	485	2kN
FHD4G3150	33kV	3150A	85(kV)	200(kV)	900	485	2kN
FHD5G300	33kV	300A	85(kV)	200(kV)	1200	550	2kN
FHD5G500	33kV	500A	85(kV)	200(kV)	1200	550	2kN
FHD5G800	33kV	800A	85(kV)	200(kV)	1200	550	2kN
FHD5G1050	33kV	1050A	85(kV)	200(kV)	1200	550	2kN
FHD5G2000	33kV	2000A	85(kV)	200(kV)	1200	550	2kN
FHD5G2650	33kV	2650A	85(kV)	200(kV)	1200	550	2kN
FHD5G3150	33kV	3150A	85(kV)	200(kV)	1200	550	2kN

Gaskets:

The bushing gasket material used by ZEP on the assemblies is Amorim NBR Cork Composite grade TD1049 suitable for temperature range of +120° C and minimum temperature of -20°C.

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

Assembly Type	Mounted Vertically to Horizontal
FHD1 – 11kV	Fully Filled
FHD2 – 22kV	Fully Filled
FHD3 – 33kV	Fully Filled
FHD4 – 33kV	Fully Filled
FHD5 – 33kV	Fully Filled

Routine Tests:

All units supplied are Routine Tested as follows:

Tests carried out prior to delivery are:

1. Thermal Shock Test on porcelain and flange
2. Tightness test on Liquid insulated bushing at 22psi for 10 minutes
3. Visual and dimensional check

Note: Routine Electrical Tests are not offered.

The units as supplied by ZEP are assembled ready for immediate assembly onto the transformer They are tightened in accordance with Table 3

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

General Notes: For Bushing Handling and Assembly onto Transformer

- a) 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 / wedged to ensure they cannot roll off a table or bench or roll into one another and cause damage.
- b) The tank hole should be free from burrs and the tank face where the bushing mates should be flat and smooth and free from scratches or zinc lumps that will result in a poor seal.
- c) On installation onto the tank the unit should be located as centrally as is possible within the tank hole.
- d) Should a bushing be used in the horizontal plane the breather plug should be uppermost on the bushing during assembly onto the transformer tank for ease of bleeding.
- e) The recommended stud size for fixing the units to the tank is M12 x 65mm Long. The tightening sequence shown in **Figure 2** should be adopted along with the recommended torque setting sequence.
- f) 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. Excessive loads could cause failure of the bushing seal.
- g) The breather plug on the bushing cap 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
- h) On filling look for oil weep at the breather plug, this sign shows that the unit is full of oil. At this point 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.**

Figure 1

TYPICAL CONNECTION ARRANGEMENT FOR 300A & 500A UNITS

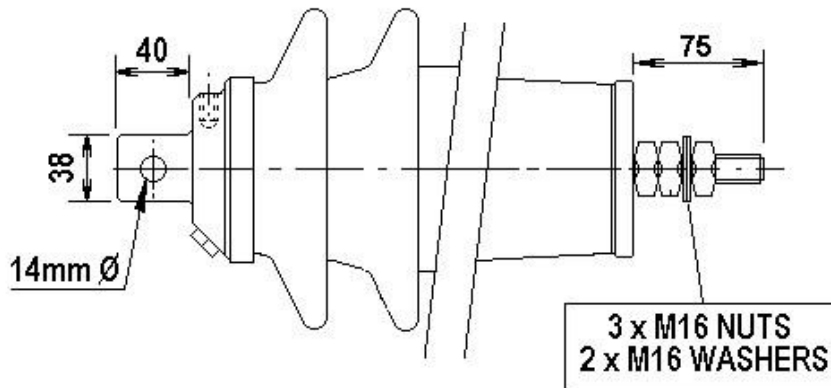
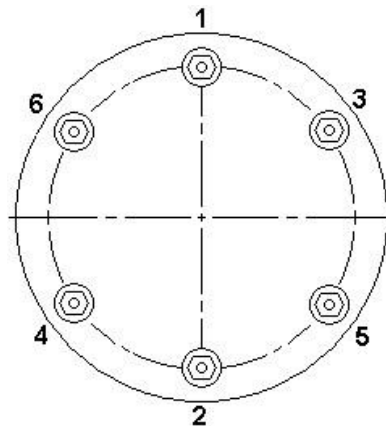


Figure 2



Assembly Tightening Torque Sequence:

- Step 1** all nuts should be put on finger tight in number sequence as shown
- Step 2** all nuts should be tightened to 20Nm in number sequence as shown
- Step 3** finish tightening nuts to 40Nm when using an M12 stud in number sequence as shown.

Palms, Flags, Split and Block Clamps:

ZEP offers a comprehensive range of connectors for attaching conductors internally and externally to this bushing range.

Please contact ZEP for information on options available.

Tank Gaskets:

Pre-cut tank gaskets are available on request made from top quality Amorim brand cork composite sheet type TD1049 (NBR Cork) in either 4.8mm thick or 6.4mm thick, depending on your preference. Gasket price available on request.

Drawings:

Drawings are available for all units, as are individual component drawings should they be required.

We also design and manufacture to customer specific requirements around the standard porcelain flange arrangements. Contact ZEP for assistance.

Type Test Reports:

Type Test have been conducted across the range of units to prove compliance with the standards and these results are available on request.

Wet Power Frequency Withstand Voltage Tests
Impulse Tests (BIL)
Partial Discharge
Short time Current Withstand Test
Temperature Rise Tests
Cantilever Load Tests

For specific unit information contact ZEP

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