**March 2017 Blog**

**Do You Have a Bushing Replacement Program – Part 2**

Continuing with the topic of bushing replacements and the challenges of replacing vintage style oil-filled bushings with current standard bushings, the following is an example of how the RIF® dry type bushing technology could meet the non-standard dimensional requirements of a COTA bushing replacement.

**Replacement of a COTA 138 kV, 800 A, 650 kV BIL Bushing**

The COTA bushing design was first developed by Haefely in the 1990’s. The basis behind the COTA Type C design was to provide the standardization that OEMs and users were looking for in their bushing applications. This concept of standardization was actively promoted and in combination with an aggressive pricing strategy these bushings became a favourite of users and OEMs for many years with thousands installed. When COTA bushings started failing violently in larger than acceptable numbers many utilities decided to fast track their COTA bushing replacements. However, replacing these bushings was not as straight forward as first thought as the COTA bushing uses a smaller diameter oil end condenser body. This makes for smaller bushing turret and bushing CT window openings through which a standard bushing cannot pass through.

New direct replacement designs therefore needed to be developed. The RIF® direct replacement solution was to design a condenser with a thin wall central tube and an optimized condenser foil layer design. Two prototypes rated 126 kV, 630 A and 252 kV, 630 A were built and tested to validate the new design.

In 2016, a request was received for a direct replacement of a COTA 650-H014-23-AG3-01 (138 kV, 800 A, 650 kV BIL) bushing. With our new optimized thin wall, central conductor design we could meet all the critical dimensions for a direct replacement. Also, to facilitate the replacement a special adaptor was designed for connecting to the original COTA draw lead stud.

Since then a direct replacement RIF® design has also been developed for a 230 kV, 900 kV BIL COTA bushing (Style # 900-H016-23-AG3-01).

The following table shows a comparison between the original oil-filled COTA bushing and the new dry type replacement bushing:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Bushing Ratings** |  |  |  |  |
| Catalogue Number | COTA 900-H016-23-AG3-01 | RHM International  FGRBLW-230/800-3  TR2287 | COTA 650-H014-23-AG3-01 | RHM International  FGRBLW-138/800-3  TR2137 |
| Rated kV | 230 | 230 | 138 | 138 |
| Rated BIL (kV) | 900 | 900 | 650 | 650 |
| Bushing Connection | Draw Lead | Draw Lead | Draw Lead | Draw lead |
| Rated Amps (Draw Lead) | 800 | 800 | 800 | 800 |
| Standard bushing built to | IEEE | IEEE C57.19.01 | IEEE | IEEE C57.19.01 |
| **Bushing Dimensions** |  |  |  |  |
| Length above flange (mm) A | 2828 | 2828 | 1865 | 1865 |
| Length above flange to draw pin (mm) B | 2616 | 2500 | 1656 | 1656 |
| Safe Oil Level (mm) - C | 584.2 | 584.2 | 584.2 | 584.2 |
| Length below flange (mm) - D | 1276 | 1276 | 1188 | 1188 |
| Maximum diameter below flange (mm) | 198 | 210  (Note: CT window opening was confirmed to be 265mm) | 140 | 140 |
| Upper Stud Length (mm) | 63.5 | 75 | 63.5 | 70 |
| Upper Stud Diameter - Threads per inch | 1.5-12 | 1.5-12 | 1.5-12 | 1.5-12 |
| Creepage Distance (mm) | 6160 | 6160 | 3500 | 3450 |
| **Bushing Mounting** |  |  |  |  |
| Diameter of Bolt Circle mounting holes (inches) | 21 | 21 | 14.25 | 14.25 |
| Number of mounting bolt holes | 12 | 12 | 6 | 6 |
| Diameter of mounting holes (mm) | 31.75 | 31.75 | 31.75 | 31.75 |
| Inner gasket seat diameter (mm) | -- | -- | 327 | 327 |
| Outer gasket seat diameter (mm) | -- | -- | 276 | 276 |

In summary when embarking on a bushing replacement program the large variety of bushing types that will be encountered will be one of the most challenging aspects of the program. Being able to get economical “like for like” bushing designs in a timely manner should not be underestimated.

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