



GCC POWER 2021

A401_2021

Condition assessment of bushings in the field

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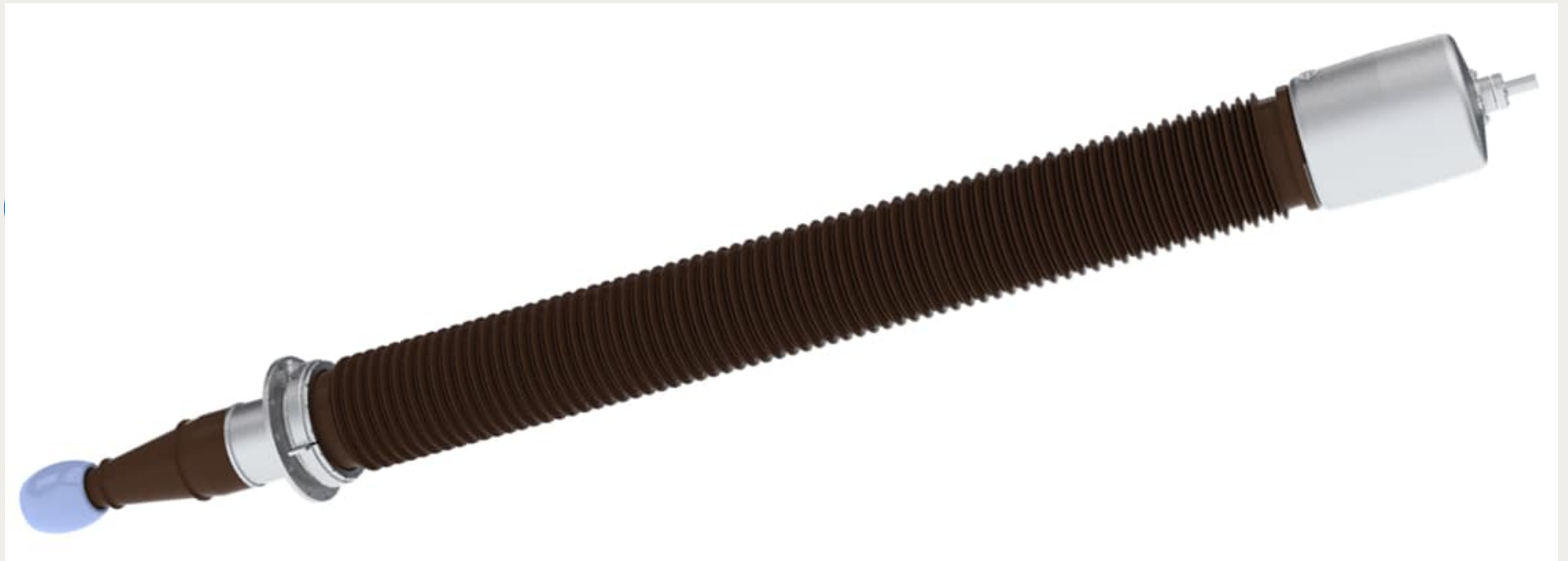
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Slide 1

High voltage capacitance graded bushings

Critical components found in all electrical networks



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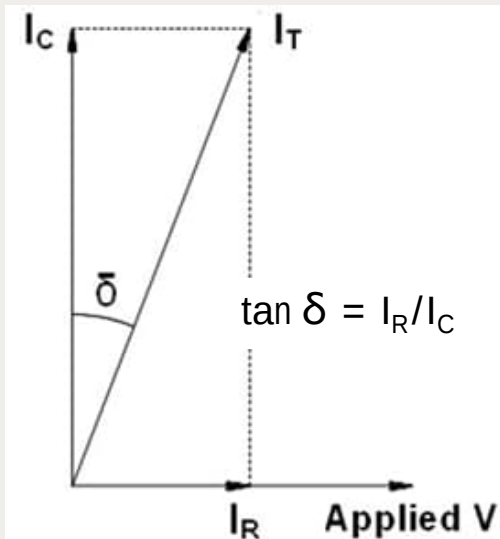
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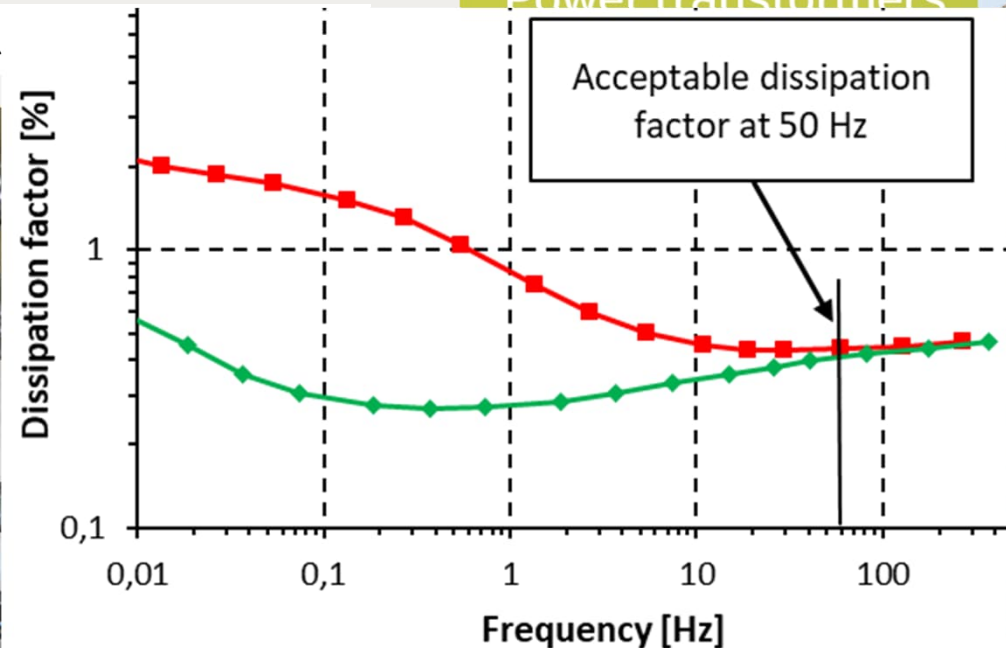
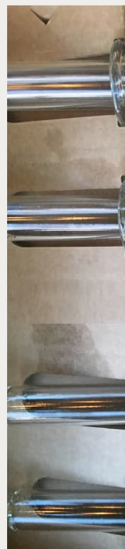
Condition assesment

Most commonly used diagnostic methods

Capacitance and $\tan \delta$



DGA



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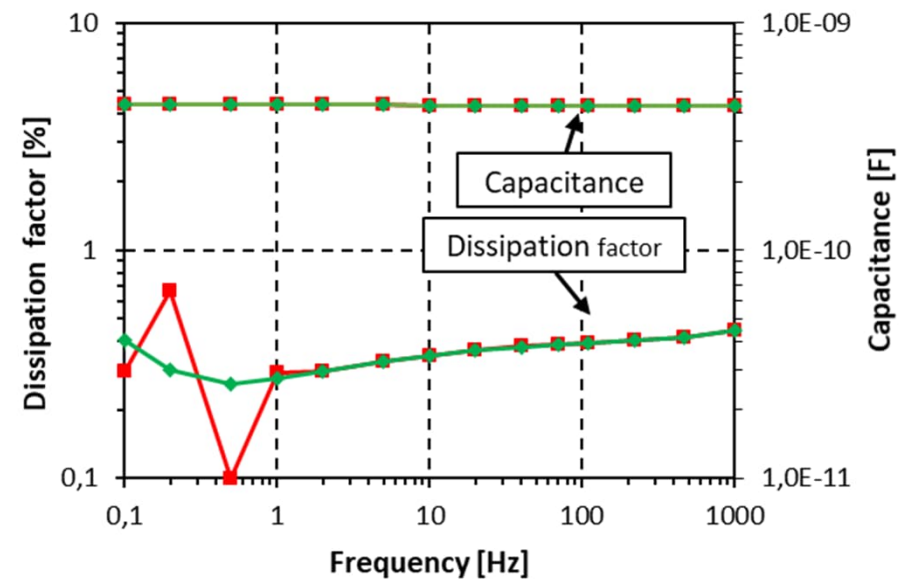
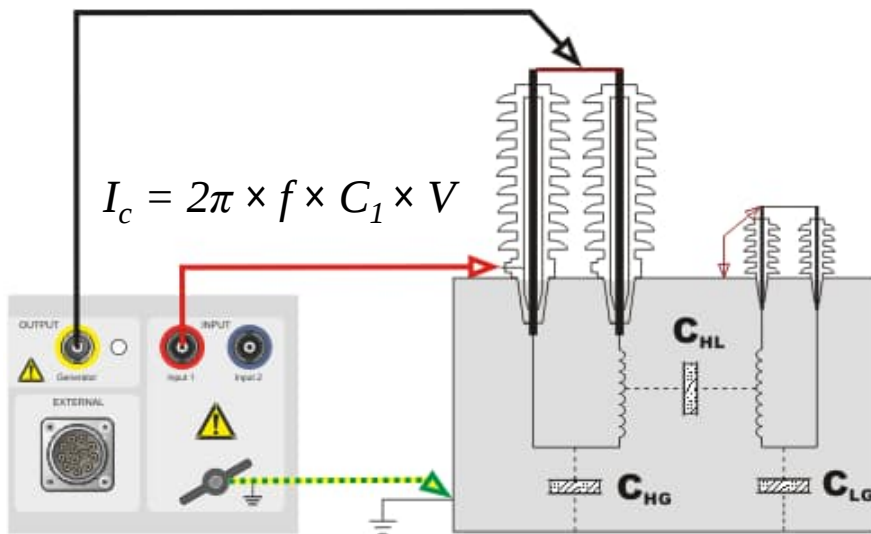
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DFR analysis for bushing diagnostics

A series of Capacitance and $\tan \delta$ measurements at multiple frequencies



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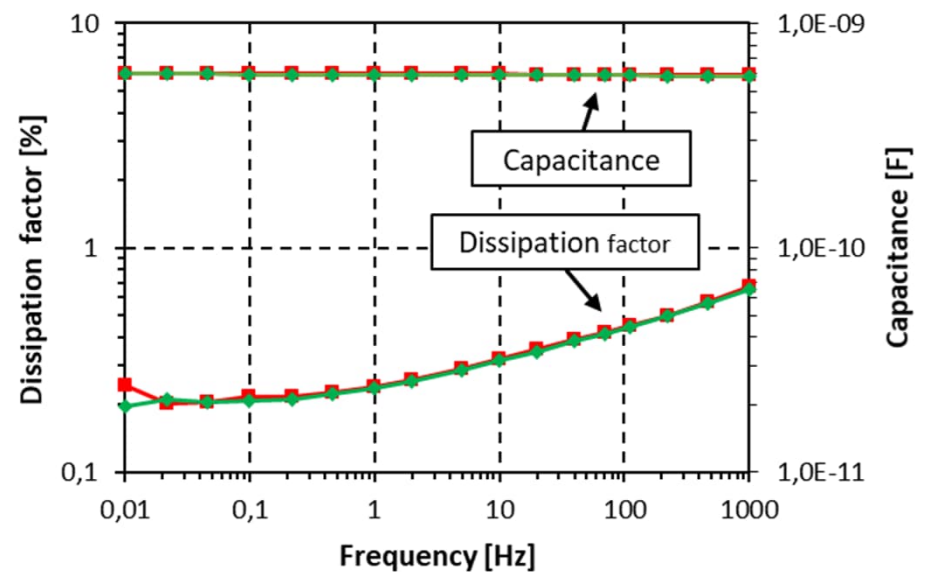
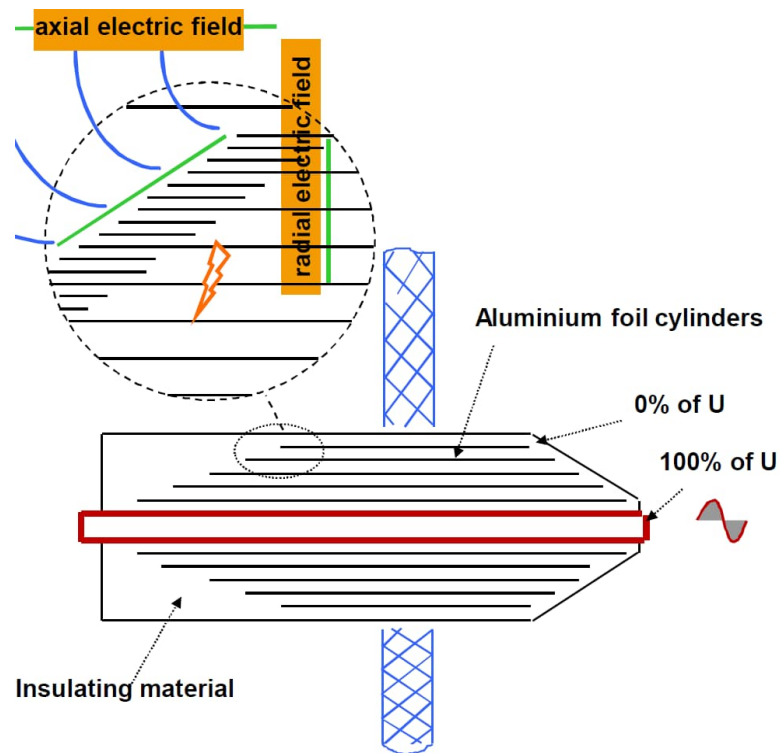
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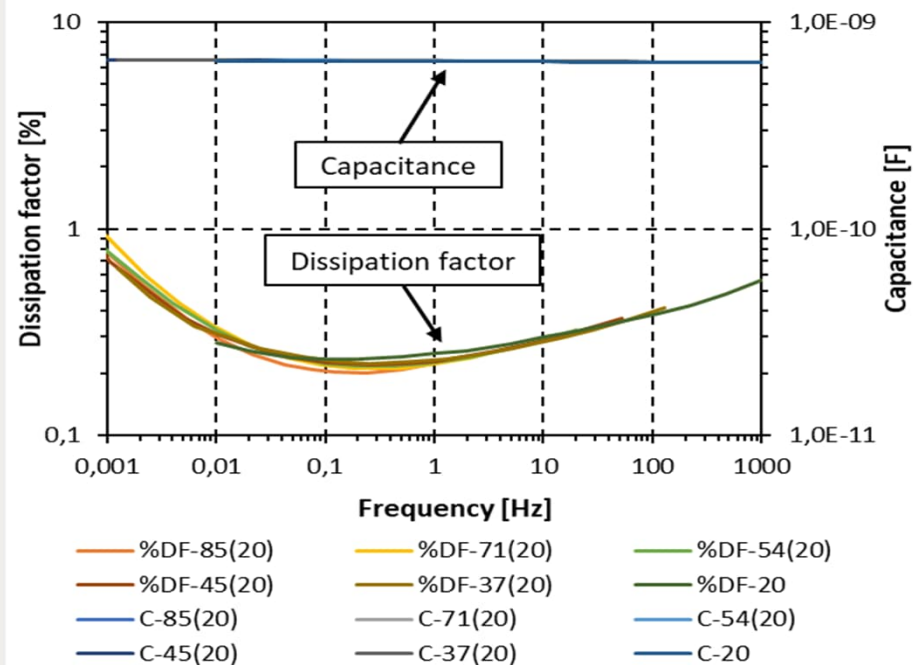
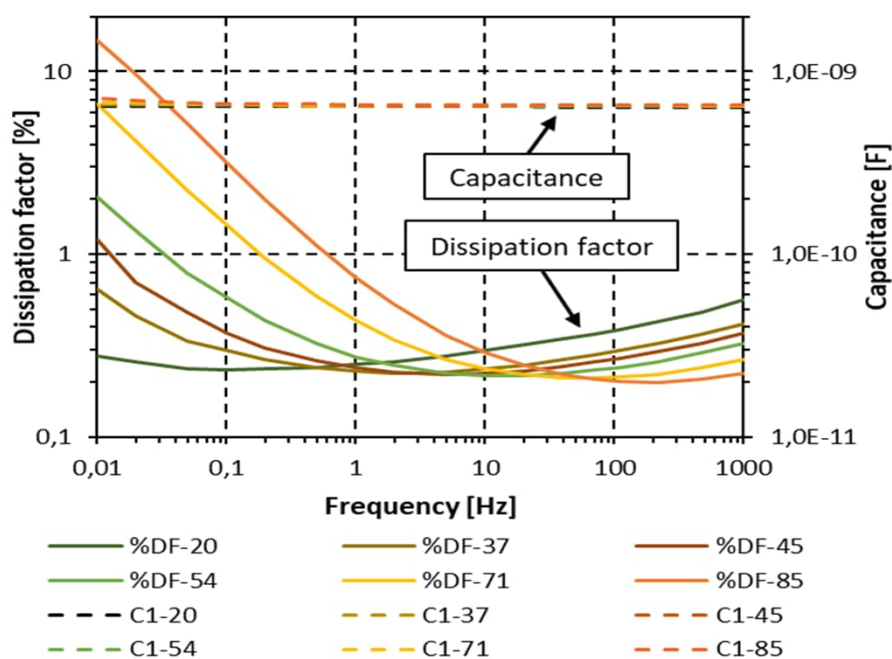
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DFR analysis for bushing diagnostics



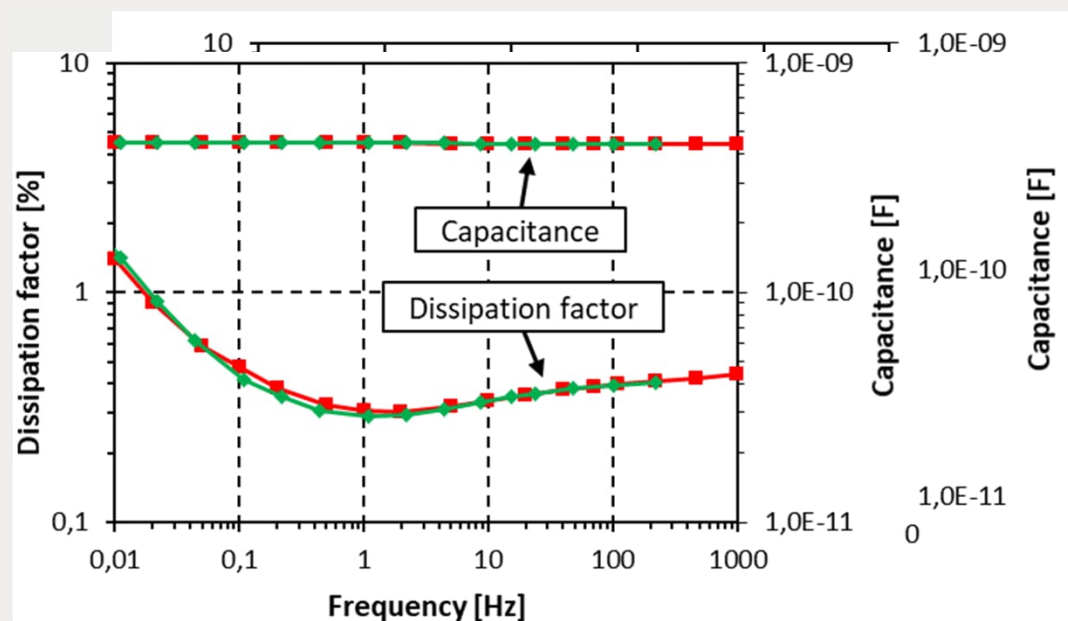
Temperature correction of the DFR traces



$$L = \ln f_2 - \ln f_1 = -\frac{E_a}{k_B} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

DFR analysis for bushing diagnostics

Time-based, type-based and phase-based comparison of DFR results



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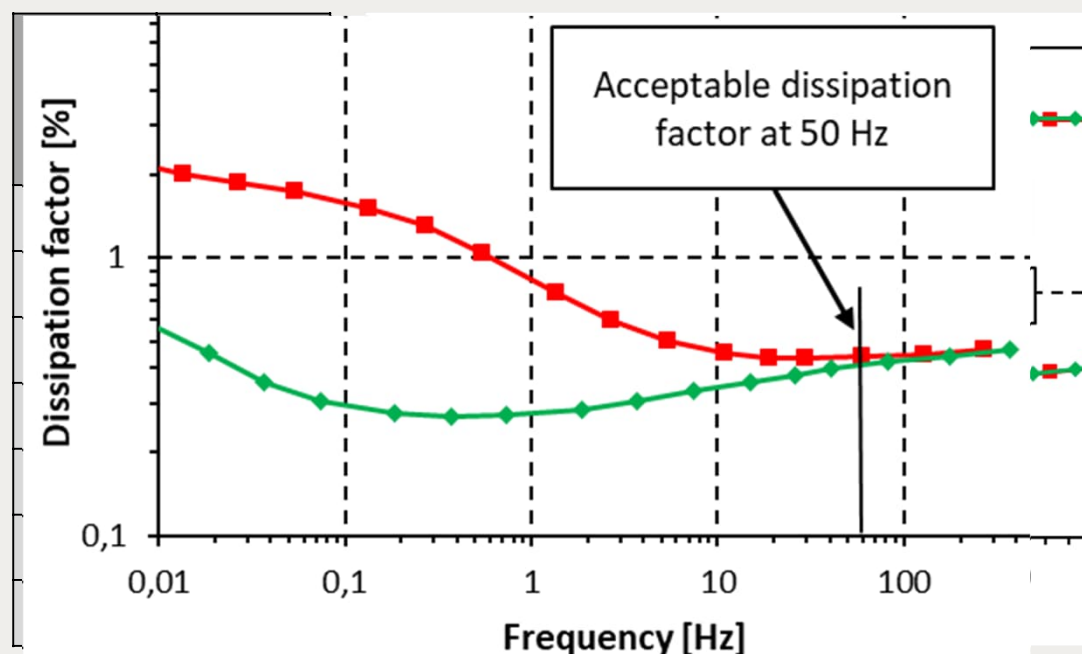
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DFR analysis for bushing diagnostics

Cases



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Conclusion

- Basing decisions solely on the capacitance / dissipation factor measurement at power frequency, the degradation process could be missed.
- The most sensitive diagnostic method to identify abnormality in capacitance graded bushings is DFR
- For OIP bushings the combination of DFR and DGA becomes a very powerful tool for bushing condition assessment

Thank you for your attention!

Questions?



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