

Paris Session 2022



Air is better than SF6
in case of abnormal gas leakage in MV switchgear

A3_PS2_Q7

C. PREVE - FRANCE



Leakage rate of air MV switchgear at 0.25 MPa : similar to SF6 one at 0.15 MPa

« Normal » leakage are driven by 2 phenomena

- *Permeation: diffusive flow of gas through gasket*

- Permeation is strongly dependent of gasket material
- Suitable material (chlorobutyle) enables very low level of permeation with air : 0.004%/year at 20°C

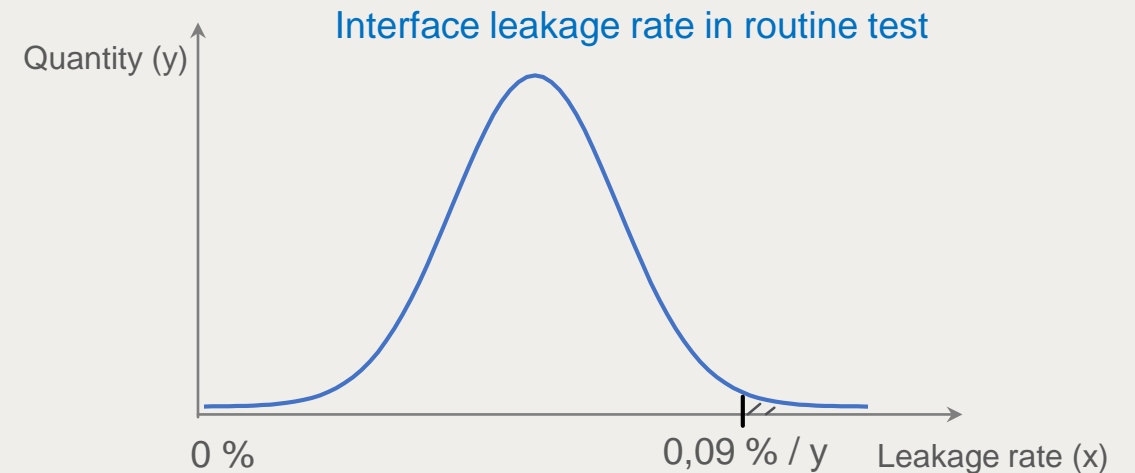
$$V = \frac{A \times d \times \Delta P}{t} \times Pe$$

- *Leakage at interfaces measured as routine test with He in manufacturing plant and Poiseuille's equation*

- Careful design enables to insure air leakage at interface < 0.09%/year at 20°C

$$Q_{l,air} = \frac{P_{air,in}^2 - P_{atm}^2}{P_{He\ test,in}^2 - P_{He\ test,out}^2} \times \frac{\eta_{He}}{\eta_{air}} \times Q_{l,He}$$

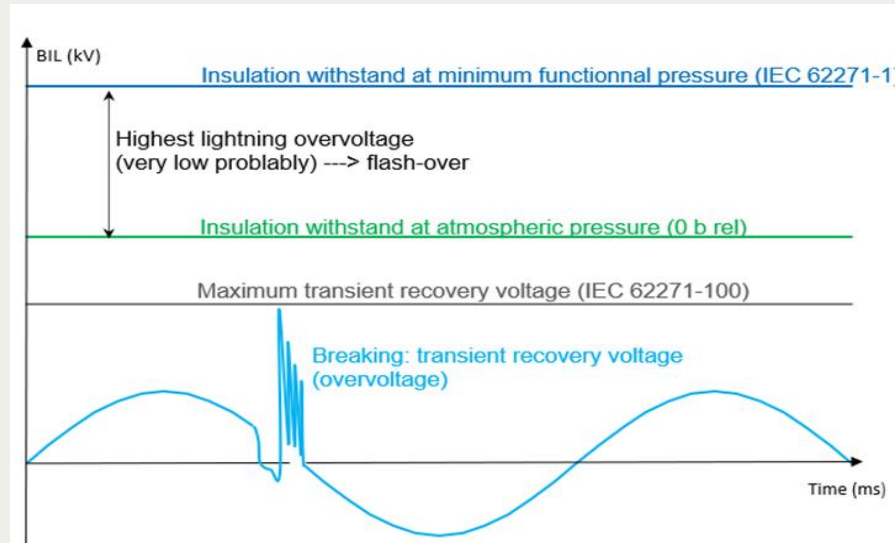
With suitable materials for gaskets and careful design, pure air MV switchgear at 0.25 MPa abs has total leakage rate < 0.1 % / year at 20°C



Group Discussion Meeting

MV switchgear filled with air can be operated at atmospheric pressure (0 bar rel)

- In an unlikely event of leakage down to atmospheric pressure
 - Switchgear is designed for no partial discharge at 0 bar rel
 - Breaking capacity at 0 bar rel is maintained thanks to vacuum breaking
 - insulation voltage withstand at 0 bar relative is higher than maximum overvoltage during breaking (maximum transient recovery voltage of breaking).
 - insulation level of switchboard is sufficient for normal conditions (without high lightning overvoltage).



Nota : with SF6 or F-gas, in case of leakage down to atmospheric pressure, ambient air is entering inside the tank
Insulation withstand and breaking capacity are then strongly reduced with risk of internal arc at service voltage

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