COUNTRY : GERMANY
REGISTRATION NUMBER : 10843
GROUP REF. : A3
PREF. SUBJECT : PS1
QUESTION N° : 5

# Experience of Composite Insulators on HV Substation: Some French Examples

## 1. SUMMARY

Composite housings are nowadays a solution implemented in electric grids worldwide for their performance in polluted environment, safety and reduced maintenance costs. RTE specifies composite hollow core insulators for some HV station equipment housing, such as cable termination or instrument transformers. Thousands of composite insulators are installed since more than 20 years in French grid with a very good return of experience.

RTE has been an early precursor to experiment the use of composite insulators in the HV equipment with silicone composite insulators for the housing of HV Circuit Breaker 72,5 kV class since 1993, in the substation of Balaruc in the south of France. Since 1980s EDF and later RTE, decided to submit the composite insulators to be installed on network to the 5000 hours accelerated ageing test according to IEC 62730. Furthermore, to gain long term experience and verify the consistency with laboratory tests, two composite insulators for 245KV cable termination with same material and technology were placed in the outdoor EDF Research Station near Martigues (south of France) and monitored since 1998. The test was performed during more than 10 years under extreme environmental conditions and completed in 2008 with very positive results.

A second long term ageing test started at Martigues EDF Station on 2008 and 2016 is still ongoing on 400 kV insulators with different designs and silicone housing materials (HTV, LSR), creepage distance and shed profile).

The performance of composite insulators is strongly related to the selection of the materials, the manufacturing process and the electrical and mechanical design in relation to the specific application. Composite insulators housing are available with different technologies and silicone compounds: each type of silicone compound (LSR/HTV) has a different formulation.

The physical and chemical characteristics therefore differ resulting in different electrical and mechanical insulating performances. Raw materials evolve over the time, the implementation of the environmental regulations REACH «Registration, Evaluation and Authorization of Chemicals», oblige to align all chemicals to the environmental regulation and therefore updated qualifications to follow the evolution of materials and design become necessary. IEC 61462 standard for Hollow Core Composite Insulators that is currently under revision will not include any specifics for the HV equipment application. IEC standards for material and design qualification may not be sufficient to assure the long-term performances and should be integrated by additional specifications for material selection and qualification according equipment manufacturers (OEM) and utility requirements. Material fingerprinting according to CIGRE TB 595 as silicone identity of qualification should be required for record of the qualified materials.

The paper analyzes the different experiences and relevant results and compare IEC standard tests and utility accelerated ageing test with natural test station experiences. The future perspective is to perform a larger study on the composite insulators for various HV applications installed on the French Network and eventually develop in situ diagnostic of the external housing and improved apparatus monitoring.

## 2. Answer to Q5: Service Experience in other Harsh Environments and at HVDC Stress

The given values and statistics are valid for two suppliers that merged in 2017. During the last 25 years HCI with HTV and LSR houing were applied also for HVDC installation. **Fig. 1** shows the main apparatus where these components are applied. Main applications are HVDC transformer and wall bushings, cable terminations, voltage dividers and disconenctor switches.

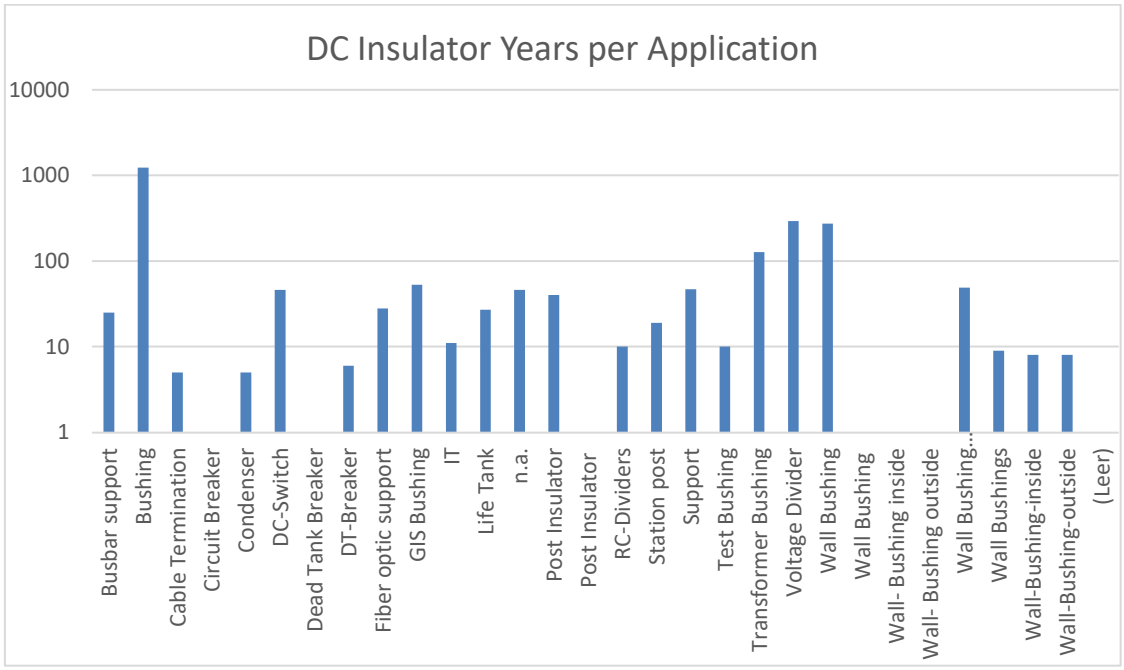


**Fig. 1:** Insulators x Years by Apparatus for HVDC applications

**Fig. 2** shows the experience by countries of installations. Many of them have harsh service environments like the coastal line where HVDC converter station for marine cables are installed.

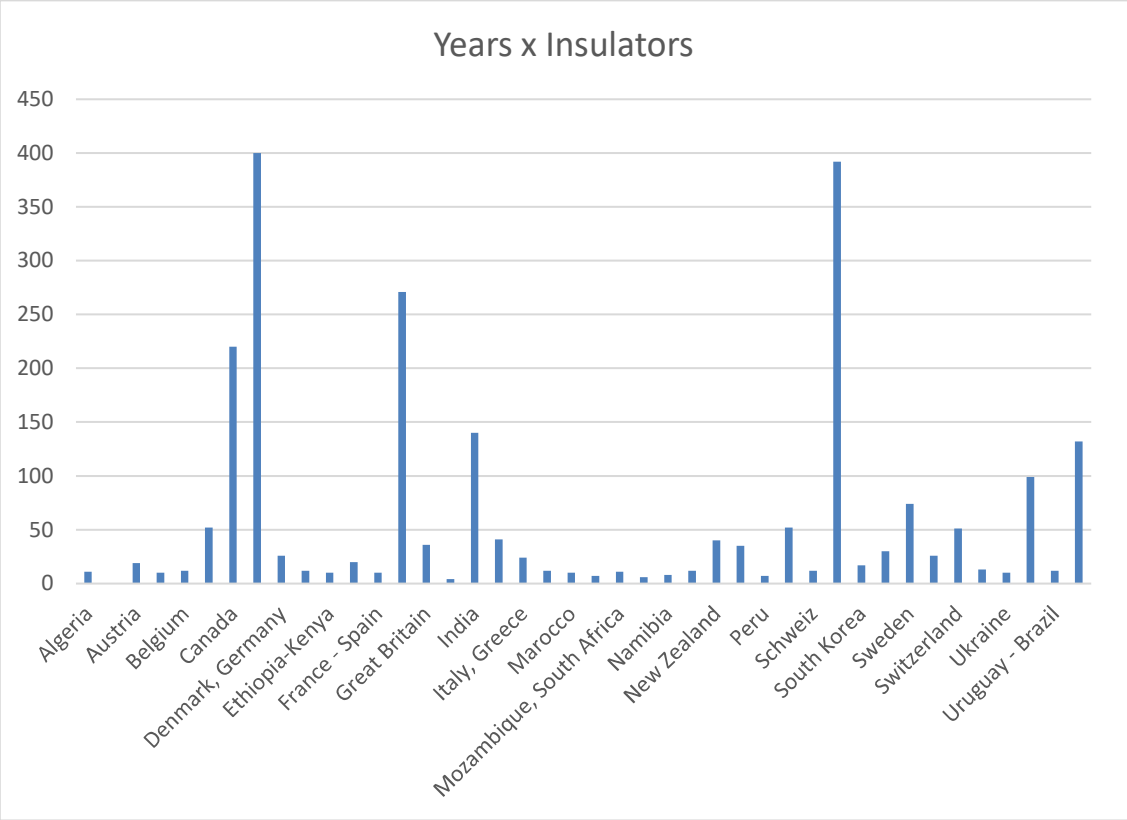


**Fig. 2:** Insulators x Years by Country for HVDC applications

**Fig. 3** shows the experience by voltage class. Most of the installations are for DC voltages larger than 300 kV. 500-800 kV DC transmission systems are today's state of the art. UHVDC with tansmission voltages >800 kV are presently under development and/or in trial installations.

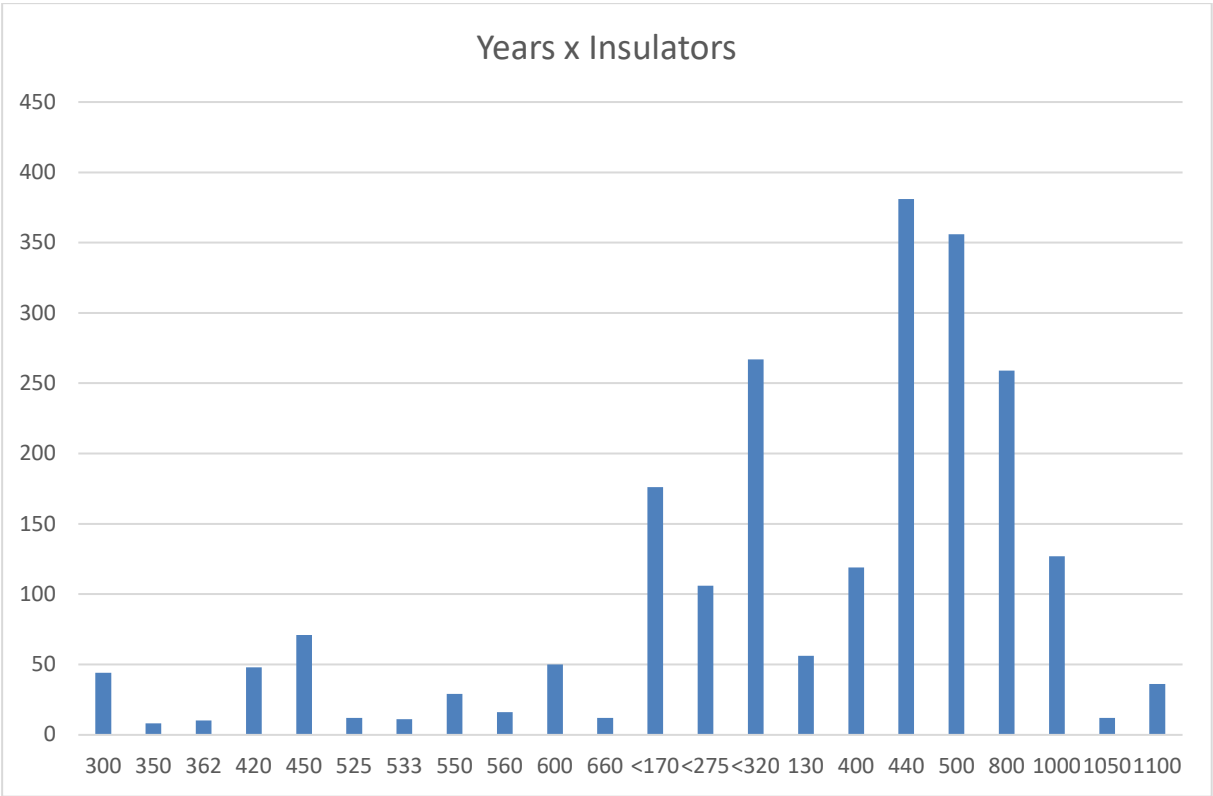


**Fig. 3:** Insulators x Years by Sevice Voltage for HVDC applications