Paris Session 2022

Gas management with SF_6-free gas mixtures

A3 - PS2 – Q12

In different projects, different practices of mixing gas components are reported. Authors of 10102 prefer off-site mixing, whereas authors of 10656 describe on-site mixing as “most beneficial”. Can specialist (e.g., authors of 10799, 10966) report on experiences in other projects?

Arnaud Ficheux, France

Methods of filling HV equipment with gas mixtures

•Methods of filling gas into HV equipment on site depends of different factors
- Type of gas used
- Quantity of gas to be used
- Facility to manipulate the various gases on site

– Example with SF_6 based gas mixture, like SF_6-N_2:
  – for long GIL, gas mixing on site was widely used
  – for short GIL connections (typically used for low temperature for instance) pre-mixed gas is used

- SF_6-free solutions are commonly based on gas mixtures
  → Filling HV equipment with gas mixtures will increase significantly in the coming years
  → Today, more than 25 utilities have already adopted gas mixtures based on fluoronitrile solutions.
  → First 420 kV GIL and 145 kV GIS references have been filled with pre-mixed gases
  → Manufacturers must facilitate the use of gas mixtures during the life of the equipment

Ease of gas handling process on site

- User's expectation (as defined in paper A3-10102)
  - Unique identification of mixtures and no use of manufactures' brand or trade names
  - Explicit labelling with details of the gas or gas mixture used (type, ratio)
  - Mandating types of filling point with proposed following table (in discussion within IEC TC 17 committee)
  - Always possible to obtain pre-mixed bottles for maintenance / top-up activities

Gas / Gas Mixture	**Colour**	**RAL**	**Connection**
N_2 / O_2 mixtures	Light Blue	5012	DN20 with M50 thread
Mixtures containing C4-FN (C_4F_7N)	Yellow Green	6018	DN8 with M28 thread or DN20 with M48 thread
Mixtures containing C5-FK ($C_5F_{10}N$)	Telemagenta	4010	DN8 with M24 thread or DN20 with M43 thread
CO_2 / O_2 mixtures	Dusty Grey	7037	Malmquist valve with M32 thread

Ease of gas handling process on site

- Manufacturer's solutions (as defined in paper A3-10102)
  - For C4-FN solution, adoption from the beginning of a unique type of filling valve with different color and thread compared to SF_6
  - Work with manufacturers of gas cart to simplify the process of mixing:
    - From manual control of filling → move to full automatic control
    - Solutions also for top-up which are different to initial filling
  - Development in progress with gas cart manufacturers of specific QR code and labelling to facilitate site operations

Conclusion

- The transition from SF_6 to SF_6-free is definitely expanding
- SF_6-free has now more than 5 years in service (from 145 kV to 420 kV levels), using pre-mixed solutions
- Tools and procedures are constantly improving to make life easier for users
- Take benefit of CIGRE 2022 to update your knowledge on SF_6-free HV equipment OEM and gas handling tool OEM.

Thank you for your attention !