

Electric switchgear SF₆

and sustainable development

What you need to know

Reduced maintenance

Increased reliability

Safety of people

Greenhouse effect hazard controlled

 \sum [*Benefits*]
Customer; Planet

What regulations exist for SF₆?

During 1990/2000, the Electrical Distribution market, particularly in Europe, experienced a major controversy concerning use of SF₆. Focused on the risks associated with the handling of switchgear containing SF₆ at the start of the 1990s, the controversy then turned to the contribution made by SF₆ to climatic change. SF₆ is one of the 6 greenhouse gases mentioned in the 1997 Kyoto Protocol and as such its emissions must be reduced.

Despite a high warming potential (GWP = 22,200¹), contribution of SF₆ emissions from MV and HV electrical switchgear to climatic change is marginal. It accounts for approximately 0.1% of world greenhouse gas emissions and this figure is dropping². In the European community, SF₆ emissions have dropped by two-thirds since 1995³.

The latest conclusions of the European Commission working group for fluorinated gases authorize SF₆ use without any restriction in electrical switchgear⁴.

Sources:

1. Intergovernmental Panel Climate Change (IPCC)
2. SF₆ in the Electric Industry, Status 2000, CIGRE Working Group 23.02
3. www.capiel-electric.com
4. European regulation draft: COM (2003) 0492-2003/0189/ (COD)

What is SF₆ used for?

Since 1960, SF₆ has been used as an arc quenching and insulating medium for High & Medium Voltage switchgear. SF₆ is an alternative to other conventional insulating and quenching media such as oil and air. The use of SF₆ gas considerably increases the efficient utilisation of resources in energy transmission and distribution with respect to technology, finances and people. An overall evaluation considering all ecological, economic, safety and technological aspects has proven that SF₆ is an excellent choice of insulating medium. The existing SF₆ technology in the field of energy transmission and distribution is the result of decades of optimisation and contributes essentially to the further development of economically efficient power distribution.

SF₆ is also used in certain industrial processes (micro-electronics, metallurgy), sound proofing of double-glazed windows and in some manufactured products such as sports footwear.

Technological advantages

Sources:

Schneider Electric "Cahier Technique" no. 188, Properties and use of SF₆ in MV and HV devices

Schneider Electric "Cahier Technique" no. 193, MV breaking techniques

What technical performance does SF₆ offer?

- Reduction of insulation volumes (SF₆ is twice as effective as air).
- Better heat dissipation than air equipment.
- High breaking capacity and low operating energy (SF₆ quenching properties are 100 times higher than air).
- Excellent durability.
- In its pure state, SF₆ has no toxicity and is non-flammable.
- High protection against ambient conditions due to "Sealed Pressure System" technology.

What are the advantages of MV electrical switchgear containing SF₆ during installation?

- Very limited space required for installation.
- Favourable ergonomic conditions, due to the small volume and relatively light weight.
- Choice of site installation is independent of altitude.
- Recommended use in severe climatic conditions (coastal, heavy industrial pollution, etc.).

What are the advantages during use?

- Extremely low probability of failure, due to the good performance level, and the protection of the insulating system from any degrading influence.
- Maintenance free.
- Long service life.
- Low operating energy, making it easy to implement remote control and/or automation schemes. This contributes to a fast restoration of the service after a fault on the network.
- Soft breaking, with very low creation of transient voltage disturbances.

What are the social & economic advantages?

- The design of our products containing SF₆ lead to minimum consumption of material resources (plastic, metals, etc.).
- Relatively low cost of first installation and operation.
- High continuity of service.
- Low visual impact, which makes social acceptance of the substation easier.
- Safety for the public and property, due to the low probability of serious failures, limitation of fire hazard, etc.

Conditions for use

Is SF₆ a toxic gas?

No. SF₆ (sulphur hexafluoride), in its pure state, is an odourless, non-toxic and chemically inert synthetic gas. It is not classed as a hazardous substance by legislation on chemicals. It does not contain pollutants and it is non-flammable.

Source:

Standard IEC 60376

Does SF₆ and by products present a risk for people?

The studies conducted by the Electrical Industry, including Schneider Electric, show that there is no health risk associated with normal leakage of used SF₆ from switchgear.

Source:

Schneider Electric "Cahier Technique" no. 188, Properties and use of SF₆ in MV and HV devices

What precautions must be taken when installing and handling MV switchgear containing SF₆?

MV switchgear containing SF₆ uses a "Sealed Pressure System". Consequently, during transport, installation and handling, no specific precaution to SF₆ need to be taken.

At the end of life, MV switchgear containing SF₆ must be entrusted to competent professionals. Schneider Electric and inter-professional organisations from the electrical industry such as EURELECTRIC, CAPIEL and CIGRE have drawn up proper procedures intended for distributors, users and recyclers of devices containing SF₆ in order to limit emission hazards.

Source:

Guide for the preparation of customised "practical SF₆ handling instructions", International Council on Large Electric Systems (CIGRE)

Are there any regulations restricting use of SF₆ in electrical switchgear?

No, there are no restrictions on use of SF₆. The only limitations envisaged concern use of SF₆ in consumer products and open processes.

Source:

European regulation draft: COM (2003) 0492-2003/0189/ (COD)

Commitments and initiatives

What steps have been taken by Schneider Electric to reduce emissions of SF₆?

Schneider Electric has voluntarily introduced plan to reduce SF₆ emissions on its sites producing MV electrical switchgear and from its products throughout their life cycle.

Industrial handling of SF₆ is concentrated on 7 sites, all ISO 14001 certified. The aim is to eliminate all emission of SF₆ during the manufacturing phase.

The "Sealed Pressure System" has been extended to all MV switchgear using SF₆. This technology ensures that there is no further need to refill with SF₆.

To improve traceability and end of product life management, Schneider Electric mentions the presence of SF₆ on all its product manuals and describes the relevant dismantling procedure. Schneider Electric continues the development of its services for the follow-up and recovery of electrical switchgear containing SF₆ at the end of life.

Source:
Schneider Electric 2003
Sustainable Development
report

Have any voluntary initiatives been undertaken by producers and users of SF₆?

Since the time the high warming potential of the SF₆ became known, the Worldwide electrical industry has taken voluntary actions to reduce emissions as much as is technically possible.

For instance, the European associations of switchgear manufacturers (Coordinating Committee for the Associations of Manufacturers of Industrial Electrical Switchgear and Control gear, CAPIEL) and electrical utilities (Union of the Electricity Industry, EURELECTRIC) agreed to reduce measures as follows:

Manufacturers of switchgear:

1. Continuous improvement in switchgear design: minimising the amount of SF₆ per unit; maximising gas tightness of enclosures thus minimising leakage in service; simplifying gas handling in service.
2. Reduction of emissions during development, manufacture and testing (improved processes).
3. Improved procedures on site for initial filling, where necessary.
4. Use of "Sealed Pressure System" technique, where possible (mainly in Medium Voltage equipment).

Users of switchgear:

1. Improved filling procedures on site.
2. Use of sealed pressure systems, where available.
3. Better monitoring in service (for closed pressure systems).
4. Target older existing equipment with known leakage problems for repair/replacement.
5. Improved maintenance procedures, including RCM (Reliability Centred Maintenance).
6. Improved end-of-life recovery and recycling (in co-operation with specialised disposal/recycling entities).

Points to remember

- There is no restriction on use of SF₆ in electrical switchgear.
- In its pure state SF₆ is a non toxic gas. It is not hazardous for people and contains no pollutants. It is non-flammable.
- Emission of SF₆ generated by the MV and HV electrical industry makes only a marginal contribution to global emissions of greenhouse gasses. It accounts for approximately 0.1% of world emissions and this figure is dropping.
- SF₆ technology currently offers the best possible compromise in terms of cost, used of natural resources, efficiency, safety and compactness of MV electrical switchgear.
- Schneider Electric has voluntarily introduce plan to reduce SF₆ emissions on its sites producing MV electrical switchgear and from its products throughout their life cycle.
- Worldwide, SF₆ users & producers & professional institutions & competent authorities commit themselves to continuously minimise the environmental impact of SF₆ used in electrical equipment.
- The information contained in this document conforms to the positions assumed by CAPIEL and EURELECTRIC.

+ *Reduced maintenance*
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+ *Greenhouse effect hasard controlled*

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