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Engineering Recommendation G69

Issue 3 2013 + Amendment 1 2016

Guidance on working with Sulphur Hexafluoride

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PUBLISHING AND COPYRIGHT INFORMATION

Operations Directorate
Energy Networks Association
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52 Horseferry Rd
London
SW1P 2AF

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Issue	Date	Amendment
Issue 3 + Amendment 1	2016	Amended in light of changes to the Fluorinated Greenhouse Gases Regulations 2015 [2] and Ofgem requirements for SF_6 reporting. This amendment includes the following principal technical changes. Throughout: leaks to be repaired without undue delay. Section 1. Scope: Deleted "gas" and clarified to include mixtures containing SF_6. Section 2. Normative references: Added BS EN 62271-4, *High-voltage switchgear and controlgear*. *Handling procedures for sulphur hexafluoride (SF_6) and its mixtures*. Added note that PD CLC/TR 62271-303 is still current but is replaced by BS EN 62271-4. Updated footnote 3) accordingly. Section 4.2.5 Regulations of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases: Updated to reflect changes in 517/2014. Section 4.2.6 The Fluorinated Greenhouse Gases Regulations 2009: Title amended to reflect the 2015 Regulations. Fully updated with changes in the Regulations including the following: • New duty to prevent leakage of SF_6 from HV switchgear.

Issue	Date	Amendment
		• Requirement to carry out leak checks on certain switchgear, which may be achieved by monitoring pressure or density monitoring devices, monitoring alarms from falling pressure contacts or by use of SF6 leak detector devices / systems. • Frequency of leak checking for switchgear where leak detection systems are not fitted. • Requirement that any SF_6 filled equipment installed after the 1 January 2017 that contains more than 22 kg of SF_6 shall be fitted with a leak detection system that alerts the operator if a leak is detected. • Reference to The Fluorinated Greenhouse Gases Regulations (Northern Ireland) 2015 that apply in Northern Ireland. • Requirement to check leak detection systems fitted to compartments including > 22 kg of SF_6 at least every 6 years. • Requirement that any high voltage switchgear that is found to have an abnormally high leakage rate is repaired without undue delay. • Awareness that Intentional release of SF_6 into the atmosphere, where not technically necessary, is a direct criminal offence under the Regulations. • New requirement for persons that check leakage / repairs to be certified personnel. • Clarification that requirements for certified personnel apply to filling, topping-up or SF_6 gas testing operations associated with high voltage switchgear. • Amended 4.2.6.4 to include new recording requirements including need to keep records for 5 years. • Amended 4.2.6.5 for label to include 'leakage rate < 0.1% per year, where applicable' and for label to include weight in CO_2 equivalent. Annex J Minimum Knowledge and Skills Required for Certification of Personnel Involved in Recovery of SF_6: Added additional requirement for knowledge and skills in emission prevention, safe handling of equipment and information on relevant technologies to replace or reduce the use of SF_6. Clarified that requirements of Regulation (EC) No. 842/2006 have been replaced by Regulation (EU) No. 517/2004 although the requirements of Regulation (EC) No.305/2008 on which Table J.1 are based remain unchanged.
Issue 3	March, 2013	Minor revision of Issue 2 to incorporate remnant information from ENA Engineering Recommendation G72. This issue includes the following principal technical changes. Section 6.7.2: New section on the effects of low pressure (density) on switchgear capability. Section 6.7.3: New section on pressure (density) monitoring devices. Section 6.7.4: New section on operational action under loss of gas conditions. Section 6.7.5: New section on remedial measures following loss of gas including live topping up.

Issue	Date	Amendment
		Bibliography: Deleted reference to ENA Engineering Recommendation G72, which has been withdrawn.
Issue 2	February, 2012	Major revision of Issue 1 including updated references and requirements principally arising from publication of the following legislation and Standards: • Fluorinated Greenhouse Gases Regulations 2009 • The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 • PD CLC/TR 62271 – 303: 2008, *High-voltage switchgear and controlgear – Part 303: Use and handling of sulphur hexafluoride (SF_6)* This issue includes the following principal technical changes. Section 1 Scope: Reference to 36kV removed from scope. Specific exclusions and variations made in the main text for voltage levels. Section 3: Modified definition of "Evacuation" and added the following note: "This definition is a modification of 3.1 of IEC/TR 62271-303." The correct term for removal of SF_6 from gas compartments is recovery. The wording of Section 4.3.2 has been amended as necessary. All other uses of the term "evacuation" have been reviewed for consistency and amended, where appropriate. Section 4.2.6.1: Reworded last para before note as follows: "However, in order to reduce the environmental impact and cost associated with topping up it is important to rectify SF_6 leaks as soon as possible." Section 4.2.6.5: Reworded last para of main text concerning labelling of mass of SF_6 at the rated gas pressure/density. Section 4.3.4: Changed GWP to be 23,900. Reworded footnote. "Source: Intergovernmental Panel on Climate Change (IPCC) SAR (100 year)." Section 6.1.7: Penultimate para. Reworded as follows: "The mass of gas used during the filling process should be measured and recorded in accordance with company procedure. The mass of gas used can be determined by weighing the bottle prior to and after use or by filling the compartment via a mass flow meter." Section 6.7.1: First para. Replaced "1% or 3%" with "0.5% or 1%". Section 7.4: Aligned tests with Clause 6.6.7. Clarified why oil content is not normally tested. Section 7.7: Reworded sentence in 7.7 as follows: "The dew point is the temperature at which the water vapour in a gas begins to deposit as a liquid or ice, under standardized conditions." Section 7.1.6: Second sentence relating to "6 g". Included cross-reference to Clause 11.3.1 of PD CLC/TR 62271-303:2009. Section 8.1 (e): Deleted bullet pt (e). Added reference to best practice in introductory sentence of 8.1. Section 8.9: Deleted reference to CIGRÉ recycling guide CIGRÉ Brochure No. 117 *SF_6 recycling guide* and replaced with CIGRÉ Brochure No. 234 *SF_6 Recycling Guide* (Revision 2003). Details of all other technical, general and editorial amendments are included in the associated Document Amendment Summary for this Issue (available on request from the Operations Directorate of ENA).

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Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (ENA) and comes into effect from the date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is "EREC G69", which replaces the previously used abbreviation "ER G69".

This Engineering Recommendation replaces and supersedes Engineering Recommendation G69 Issue 2 2012.

Since Engineering Recommendation G69 was revised in 2005, new European and UK legislation concerning fluorinated greenhouse gases, including sulphur hexafluoride (SF_6), has come into force. These changes in legislation and subsequent revision of related standards and reference documents have led to the revision of the guidance provided in this Engineering Recommendation. This Issue incorporates updated recommendations relating to operational actions to be taken in the event of SF_6 gas loss, which were previously contained within ENA Engineering Recommendation G72.

Since Issue 3 of this Engineering Recommendation [EREC G69] was revised in 2013, European and UK legislation concerning fluorinated greenhouse gases has changed. Regulation (EC) No. 842/2006 [10] has been repealed and replaced by Regulation (EU) No. 517/2014 of the European Parliament and of the Council of 16 April 2014 on Fluorinated Greenhouse Gases [12]. The Fluorinated Greenhouse Gases Regulations 2009 [11] have been revoked by The Fluorinated Greenhouse Gases Regulations 2015 [13]. This Amendment addresses the resultant changes in the Regulations.

This amendment recognises that PD CLC/TR 62271 – 303 is still current but has been republished as BS EN 62271-4. Opportunity will be taken as part of the next issue to update the consequent changes in references.

Although the guidance in this Engineering Recommendation is primarily concerned with switchgear applications, certain common aspects of working with SF_6 are applicable to other applications, such as SF_6-filled transformers.

1 Scope

The guidance in this Engineering Recommendation addresses the procedures for Storage, Handling, Testing and Disposal of Sulphur Hexafluoride (SF_6) associated with distribution switchgear. Where guidance is only applicable to switchgear operating at specific voltages then the voltage level is explicitly stated in the text.

The scope of this Engineering Recommendation includes SF_6 and mixtures containing SF_6.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 5415-2.2, *Safety of electrical motor-operated industrial and commercial cleaning appliances. Particular requirements. Specification for type H industrial vacuum cleaners for dusts hazardous to health*

BS EN 166, *Personal eye protection. Specifications*

BS EN 14387, *Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking*

BS EN 60335-2-69, *Household and similar electrical appliances. Safety. Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use*

BS EN 60376[1)], *Specification of technical grade sulfur hexafluoride (SF_6) for use in electrical equipment*

BS EN 60480[2)], *Guidelines for the checking and treatment of sulphur hexafluoride (SF_6) taken from electrical equipment and specification for its re-use*

BS EN 62271-4, *High-voltage switchgear and controlgear. Handling procedures for sulphur hexafluoride (SF_6) and its mixtures*

PD CLC/TR 62271 – 303[3)], *High-voltage switchgear and controlgear – Part 303: Use and handling of sulphur hexafluoride (SF_6)*

NOTE: PD CLC/TR 62271-303 is still current but is replaced by BS EN 62271-4.

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1) BS EN 60376 is the UK implementation of IEC 60376. It is identical to IEC 60376.

2) BS EN 60480 is the UK implementation of IEC 60480. It is identical to IEC 60480.

3) PD CLC/TR 62271 – 303 is the UK implementation of CLC/TR 62271-303:2009. It is identical to IEC/TR 62271-303:2008. IEC/TR 62271-303:2008 has been republished as IEC 62271-4 Ed. 1.0.

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-100, *High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers*

IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-203, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

Other publications

[N1] ENA ER S38, *Reporting of SF_6 Banks, Emissions and Recoveries*

[N2] CIGRÉ Brochure No. 430, *SF_6 tightness guide*

[N3] CIGRÉ Brochure No. 234, *SF_6 Recycling Guide (Revision 2003)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
Abnormal release of sulphur hexafluoride (SF_6)
release of SF_6 from equipment in service due to a failure in the pressure system

NOTE 1: An abnormal SF_6 release is usually an unwanted and continuous emission of gas. Where abnormal SF_6 leakage is detected, appropriate measures to address the leakage should be arranged as soon as possible.

NOTE 2: This definition reproduces 3.1 of PD CLC/TR 62271 – 303.

3.2
Closed pressure system
volume which is replenished only periodically by manual connection to an external gas source

NOTE: This definition reproduces 3.6.6.3 of IEC 62271-1.

3.3
Controlled pressure system
volume which is automatically replenished from an external compressed gas supply or internal gas source

NOTE 1: Examples of controlled pressure systems are air-blast circuit-breakers or pneumatic operating mechanisms.

NOTE 2: A volume may consist of several permanently connected gas-filled compartments.

NOTE 3: This definition reproduces 3.6.6.2 of IEC 62271-1.

3.4
Distribution switchgear
switchgear used on the distribution system up to and including a rated voltage of 145 kV