Electricity Distribution

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Company Directive

STANDARD TECHNIQUE : SP1N/1

Heating, Dehumidification and Ventilation of Switch Rooms and Control Rooms at Grid, Primary and Major Network Substations

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Implementation Date: **February 2025**

Approved by

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Date: **29th January 2025**

Target Staff Group	**Purchasing, Primary system design and Engineering design, Major Projects**
Impact of Change	**Green**
Planned Assurance checks	**Issue of successful contracts and first orders for new primary S/S buildings or major refurbishments**

IMPLEMENTATION PLAN

Introduction

This Standard Technique outlines the requirements for Heating, Dehumidification and Ventilation of Switch Rooms and Control Rooms at Grid, Primary and Major Network Substations

Main Changes

This document has been revised to change the standard temperature in a substation switch house to avoid rapid temperature changes for the switchgear.

Impact of Changes

Electrically heated oil, storage or tubular heaters are acceptable and preferred over the traditional convector type which are still suitable but consideration is now required on life usage of units due to failure.

Implementation Actions

Team Managers shall advise their appropriate staff of the requirements of this Standard Technique.

ST: SP1N/1 Changes

Implementation Timetable

This Standard Technique shall be implemented with immediate effect.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
February 2025	• 4.1.1 – dehumidification ‘or equivalent ‘ • Temperature in control room and switch room changed from 10 to 16 degrees C • Provision allowing use of various heaters • Guide on building ‘U’ values added	G Budd/Anthony Smith
November 2013	• Page 5(4.1.1) – EBAC CD30 dehumidifier reference changed to “CD30E” as a heated condensate tube is required	G Budd / S Hennell
October 2013	• New document	G.Budd / S.Hennell
November 2013	• Page 5(4.1.1) – EBAC CD30 dehumidifier reference changed to “CD30E” as a heated condensate tube is required	G Budd / S Hennell

Contents

1.0 SCOPE

This document sets out the policy guidelines for the heating and ventilation of switch rooms and combined switch/control rooms at 11kV and 33kV for Primary, Grid and major network substations; and for separate control rooms at all voltages in particular where fixed pattern GIS switchgear is in use.

The guidelines apply to the design and construction of all new Primary and Grid substations. Where existing substations are extended or upgraded then the principles of the guidelines should be applied where reasonably practicable. The guidelines do not mean removal of existing heating is needed.

Application of the guidelines may also be appropriate where there are issues with discharge from existing installed switchgear that are due to a high humidity environment within the switch room.

Where the term “shall” or “must” is used in this document, it means the requirement is mandatory. The term “should” is used to express a recommendation. The term “may” is used to express permission.

2.0 INTRODUCTION

High relative humidity (RH) is known to promote the development of partial discharge in switchgear.

The three common sources of humidity within switch rooms are:

- Ambient air with high humidity being drawn in from external sources through gaps
- Water leaks into the substation
- Water in cable trenches.

One important factor is to avoid rapid variations in temperature, which in conditions of high humidity may drop below the dew point causing condensation, as air inside the switchgear is at the same temperature and relative humidity as the ambient air in the substation.

It is also important to minimize the air exchange to outside of the switch room, which can introduce high humidity air, dust and other contamination.

Low thermal mass buildings, such as containers, are more susceptible to large temperature swings and therefore to the generation of condensation.

The proposed solutions for heating and humidity control require that the building elements have appropriate insulation levels (‘U’ values). The enclosure shall be designed to deliver a thermal conductivity of the walls between 0.18 and 0.35W/m2K. Any risk of condensation build-up at cold-bridging points shall be mitigated. The switch room also needs to be effectively sealed for any dehumidifiers to operate correctly.

Solar shading should be considered to avoid excessive solar gain, foil faced insulation shall be incorporated into the wall and roof construction of the switch room to mitigate interstitial condensation build up within the fabric building. External colour should be considered to avoid excessive heat gain and consideration given to locating the switch room to take advantage of natural shading.

All ducts should be sealed with an NGED approved sealing system e.g. RISE or ROXTEC and trenches fitted with solid covers, and doors fitted with weather-seals. Sites that are known to have issues with water ingress into trenches then addition of a sump pump may be necessary.

Significant improvement works may be necessary to existing buildings to achieve the required standard. The use of dehumidifiers may not therefore be an appropriate solution in certain situations but the use of air conditioning should be avoided.

3.0 DESIGN

The outline design and specification of the various elements has been developed taking into account the:

- Environmental requirements of the switch and control equipment
- Comfort and safety of people working at the site
- Energy efficiency of the installation
- Costs associated with the initial installation
- Requirements for periodic inspection and maintenance
- Costs of on-going operation of the system.

4.0 HEATING AND DEHUMIDIFICATION

The operation of electrical and electronic equipment within substations requires that certain parameters are met for control of temperature and relative humidity. The optimum solution for switchgear at 11kV and 33kV is to maintain a consistent ‘low temperature, low relative humidity’ environment.

For control equipment at low voltages the recommended approach is to provide temperature control only for the environment, with no requirement for humidity control.

For other substation rooms (W.C., store, etc.) background heating at 10°C is considered sufficient.

Heaters and Dehumidifiers shall be connected via metal clad fused spur with a flex outlet, and wired with 3 core heat resistant flex.

4.1 Switch Room or Common Switch/Control Room

A switch room or common switch/control room should have a combined heating and dehumidification system set to provide optimum environmental conditions for the switchgear, operating in a 'sealed room' environment.

As this is a 'low temperature, low relative humidity' design additional facilities may be provided for 'comfort heating' as required when the building is occupied for inspection and maintenance.

4.1.1 Dehumidification

The system should comprise:-

- Sufficient dehumidifiers (e.g. Calorex DH30 or EBAC CD30E (or equivalent)) based on the switch room volume but a minimum of 2 dehumidifiers is always required. Some flexibility (approximately 10%) should be incorporated into this requirement. [For example, based on EBAC CD30E covering a nominal 100m^3 of switch room volume, a switch room with a total of 210m^3 would be expected to have 2 dehumidifiers, not 3.]

  Where more than one unit is installed then they should be positioned at different levels in the switch room (for example, one a high level and one half room height). This will ensure that the units work to their optimum.

  Units will be controlled by variable remote wall mounted humidistats, one per unit. Humidistats should be set at 55% RH.

- Heated condensate drain tube for each dehumidifier unit shall be fitted with an internal heating element rated at 25 watts/metre and, where possible, the drain tube shall be connected to the site drainage system. If this is not possible, care must be taken that the discharge location does not allow the condensate to freeze in cold weather.

- Fixed remote humidistat to form the basis of an alarm system indicating failure of the dehumidification system. Alarm humidistat to be set at 70% RH.

  Dehumidifier indicator panel (mounted in the control room where separate from the switch room) to give the following indications:

  - Power On
  - DH1 Drying - indicates dehumidifier number 1 is in drying mode
  - DH2 Drying - indicates dehumidifier number 2 is in drying mode
  - (Repeat above for any additional dehumidifiers)
  - High RH - indicates fixed humidistat has registered a high humidity

- So as to provide a non-urgent indication of high humidity an alarm should be taken from the indicator panel and connected to the tele-control system.

In order to prevent nuisance alarms the remote alarm indication should only indicate to telecontrol when the high RH has been present for 24hrs.

The alarm should be auto-resetting so as to prevent the need for unnecessary visits to site.

4.1.2 **Heating**

The system should comprise:-

- Wall mounted heaters sized to suit the switch room. These should be capable of providing a minimum normal operating temperature of **16°C**.

  The normal ‘background heaters may be electrically heated oil, storage units or tubular (for smaller spaces) but basic convector heaters shall be avoided due to their tendency to fail.

  Heaters should be of the ‘no thermostat’ type or, if a thermostat is fitted, this shall be set to maximum allowing control by a separate dual thermostat.

  The minimum number of heaters provided shall be two, so as to provide some heating in the event of a failure of a heater.

- Single remote wall mounted thermostat with a “dual temperature” facility (if required) to provide control of the convector/electrically heated oil/storage heaters.

4.2 **Control Room**

Where the control room is separate from the switch room; then a heating system only is required consisting of:

- Wall mounted convector heaters sized to suit the Control Room. These will provide a normal minimum operating temperature of **16°C**

  The normal ‘background heaters may be electrically heated oil, storage units or tubular (for smaller spaces) but basic convector heaters shall be avoided due to their tendency to fail.

  Heaters should be of the ‘no thermostat’ type or, if a thermostat is fitted, this shall be set to maximum allowing control by the separate thermostat.

- Single remote wall mounted thermostat with a “dual temperature” facility to provide control of the heaters.

4.3 **Battery Room**

A separate battery room may be present on some existing sites, with new sites having the battery/charger accommodated in the switch/control room.

Battery rooms only require background heating to prevent deterioration of the battery and building structure. This can be achieved by providing wall mounted tubular convector heaters sized to produce a nominal temperature of 10C. Sizing of the heaters shall make allowance for any existing natural ventilation of the room.

A wall mounted tamper-proof thermostat suitable for use in hazardous areas shall be provided to control the tubular heaters.

5.0 BUILDING OVER-PRESSURE RELIEF AND SWITCHGEAR INTERNAL ARC VENTING

Modern switchgear is designed to provide controlled release of any electric arc and arc products in the event of an internal failure such that a person at the operator position should not receive any life-changing injury.

The correct operation of the internal arc venting requires sufficient space around the switchgear and certain minimum distances to walls and ceiling need to be achieved. [This minimum space requirement is often referred to as the vent volume.] Where the minimum space requirements cannot be achieved, then direct venting of the arc and arc products to the outside of the building is required.

As well as achieving the vent volume requirements, the construction of the building containing a switch room must be sufficient to withstand the expected mechanical force and the internal pressure caused by an arc, and sufficient for absorbing any static and dynamic forces which may occur during normal operation of the switchgear. This may require the provision of over-pressure relief panels as an integral element of the switch room design.

6.0 GENERAL

Heaters in each switch room and control room shall be switched as one circuit per room.

Where heating load exceeds the capacity of the control equipment then a suitable contactor shall be used to switch the circuit.

All wiring installations shall make use of galvanized metal trunking, and suitable galvanized metal or plastic conduit systems.

Doors between switch rooms and separate control rooms should have self-closing doors.

To reduce the dust in a low RH switch room then all floors, wall and ceiling surfaces should be sealed and painted.

7.0 STANDARDS

All equipment, design and installation work shall comply with all relevant British/European Standards, Electricity Industry Standards including the current issue of BS7671 “Requirements for Electrical Installations” (The IET Wiring Regulations).

APPENDIX A

SUPERSEDED DOCUMENTATION

This document supersedes ST: SP1N dated October 2013 which has now been withdrawn.

APPENDIX B

RECORD OF COMMENT DURING CONSULTATION

ST: SP21N/1 - Comments

APPENDIX C

ASSOCIATED DOCUMENTATION

POL: SP2 - Relating to Routine Inspection, Maintenance of Distribution Plant
ST: SD3A - LVAC Supplies at Primary Substations
BS7671 “Requirements for Electrical Installations

APPENDIX D

IMPACT ON COMPANY POLICY

The guidelines should be applied for new substations and substantially modified substations. No retrospective application at existing substations is required.

APPENDIX E

KEY WORDS

Heating, Ventilation, Dehumidification.