

## **Company Directive**

### **STANDARD TECHNIQUE : SP1N**

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

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**Implementation Date:** October 2013

**Approved by**



**Policy Manager**

**Date:** 9 October 2013

<b>Document Revision &amp; Review Table</b>		
<b>Date</b>	<b>Comments</b>	<b>Author</b>
October 2013	<ul style="list-style-type: none"> <li>New document</li> </ul>	G.Budd / S.Hennell
<b>Date</b>	<b>Comments</b>	<b>Author</b>
November 2013	<ul style="list-style-type: none"> <li>Page 5(4.1.1) - EBAC CD30 dehumidifier reference changed to “CD30E” as a heated condensate tube is required.</li> </ul>	G.Budd/S.Hennell

## **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.

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.

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.

## **2.0 INTRODUCTION**

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

The three common sources of humidity within switch rooms are:

- Ambient air with high humidity
- 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.

Any ventilation in switch rooms should be kept to the minimum required to dissipate heat. This should not be oversized, or generate large temperature variations within the switch room. Forced ventilation increases the likelihood that the dew point will be reached and condensation formed.

The proposed solutions for heating and humidity control require that the building elements have appropriate insulation levels ('U' values). The switch room also needs to be effectively sealed for any dehumidifiers to operate correctly.

All ducts should be sealed, trenches fitted with solid covers, and doors fitted with weather-seals.

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.

### **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 '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 are to 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 will be provided for 'comfort heating' when the building is occupied for inspection and maintenance.

#### 4.1.1 Dehumidification

The system should comprise:-

- Sufficient dehumidifiers (eg Calorex DH30 or EBAC CD30E) based on the switch room volume. Some flexibility (approximately 10%) should be incorporated into this requirement. [For example, based on EBAC CD30E covering a nominal 100m<sup>3</sup> of switch room volume, a switch room with a total of 210m<sup>3</sup> would be expected to have 2 dehumidifiers, not 3.]

Where more than one unit is installed then ideally 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 unit, fitted with an internal heating element rated at 25 watts/metre. Where possible, the drain tube is to be connected to the site drainage system. If this is not possible, consideration must be given to the discharge location due to the risk of the condensate freezing 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

*Page amended November 2013*

- So as to provide a non-urgent indication of high humidity an alarm should be taken from the indicator panel and connected to the telecontrol 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 convector heaters sized to suit the switch room. These should be capable of providing a normal operating temperature of 10°C and a boost temperature of 18°C.

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 should 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 to provide control of the convector heaters.

This shall be fitted with an override timer to activate the heating boost facility, and shall be of touch or push button design.

The boost facility shall be set to provide 2 hours of additional heating when operated. [eg Prefect PRE5000 Touch Activated Dual Thermostat or similar.]

#### **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 operating temperature of 10°C and a boost temperature of 20°C.

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 convector heaters.

This shall be fitted with an override timer to activate the heating boost facility, and shall be of touch or push button design.

The boost facility shall be set to provide 2hours of additional heating when operated. [eg Prefect PRE5000 Touch Activated Dual Thermostat or similar.]

### **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 10°C. 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 galvanised 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**

None

## **APPENDIX B**

### **ASSOCIATED DOCUMENTATION**

POL:SP2 - Relating to Routine Inspection, Maintenance of Distribution Plant  
ST:SD3A - LVAC Supplies at Primary Substations

## **APPENDIX C**

### **IMPLEMENTATION OF POLICY**

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

## **APPENDIX D**

### **KEY WORDS**

Heating, Ventilation, Dehumidification.