Part of Energy Queensland

Substation Standard

Standard for Substation Ventilation & Air Conditioning

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The aim of this document is to establish guidelines for substation ventilation systems within Energy Queensland, with the objective of providing safety to personnel, plant and equipment from the environment and heat generated by substation plant and equipment.

Keywords: Ventilation, air conditioning, protection, standard, substation

Standard for Substation Ventilation & Air Conditioning

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Standard for Substation Ventilation & Air Conditioning

1 Overview

1.1 Purpose

This document describes requirements and considerations to be taken in the design of natural, mechanical and other ventilation for substations and substation switchrooms, including associated battery and sanitary rooms.

The designer should assess both the minimum applicable Authority and code requirements and the risks of fire and consequential risks to Energy Queensland operations should the equipment or facility be lost to a fire event (either internally or externally generated).

1.2 Scope

This standard shall be applied to new zone substations or major refurbishment. It does not include Customer and Industrial (C&I) substations covered by the C&I Substation Manual.

2 References

2.1 Legislation, regulations, rules, and codes

Australian Building Codes Board - National Construction Code

Queensland Electrical Safety Act, 2002 (Queensland Government)

Queensland Work Health and Safety Act, 2011 (Queensland Government)

Queensland Work Health and Safety Regulation, 2011 (Queensland Government)

The Building Act, 1975 (Queensland Government)

Building Regulation 2021 (Queensland Government)

2.2 Energy Queensland controlled documents

Standard for DC Supplies (STNW3022) - 3062917

2.3 Other sources

AS 1324.1-2001	Air filters for use in air conditioning and ventilation Part 1: Application, performance and construction
AS 1530.1-1994	Methods for fire tests on building materials, components and structures, Part 1:Combustibility test for materials
AS 1530.3-1999	Methods for fire tests on building materials, components and structures Part 3 - Simultaneous determination of ignitability, flame propagation, heat release and smoke
AS 1530.4-2014	Methods for fire tests on building materials, components and structures Part 4 -Fire-resistance tests for elements of construction

AS 1668.1:2015	The use of ventilation and air conditioning in buildings - Part 1. Fire and smoke control in buildings
AS 1668.2-2012	The Use of Ventilation and Air Conditioning in Buildings Part 2: Mechanical ventilation in buildings .
AS 1668.4-2012	The use of ventilation and air conditioning in buildings - Part 4. Natural ventilation of buildings
AS 1682.1:2015	Fire, smoke and air dampers Part 1: Specification
AS 1682.2:2015	Fire, smoke and air dampers Part 2: Installation
AS 1890-1999	Thermally released links
AS 2067:2016	Substations and high voltage installations exceeding 1 kVac.
AS 2676.1:2020	Guide to the installation maintenance testing and replacement of secondary batteries in buildings - Part 1. Vented cells
AS 2676.2:2020	Guide to the installation maintenance testing and replacement of secondary batteries in buildings - Part 2. Sealed cells
AS 2865-2009	Confined spaces
AS 4086.1-1993	Secondary batteries for use with stand-alone power systems - Part 1. General requirements
AS 4254.1:2021	Ductwork for air-handling systems in buildings, Part 1: Flexible duct
AS 4254.2-2012	Ductwork for air-handling systems in buildings, Part 2: Rigid duct
AS/NZS 5139:2019	Electrical installations - Safety of battery systems for use with power conversion equipment
Energy Networks Association [ENA] DOC 01-2008	National Electricity Network Safety Code

3 Definitions, abbreviations, and symbols

3.1 Definitions

For the purposes of this standard, the following definitions apply:

Active system	A system that has moving parts or relies on mechanical, chemical or electrical controls in order to function. Examples of active systems include mechanical fans and fire protection systems such as fire dampers and smoke detection systems.
Air conditioning	A system that uses a heat exchanger to provide the necessary temperature differential to enable cooled air to be delivered to the required locations.
Building class	Classification of building as defined in NCC 2019 Vol 1 Part A6. IN general new masonry buildings are considered as Class 8 Factory or Laboratory, whilst transportable buildings are classified as Class 10A.
Dehumidifying	A system that uses a heat exchanger to provide the necessary temperature differential to enable dehumidified air to be delivered to the required locations.
Mechanical ventilation	Mechanically assisted airflow utilising motorised fans to provide the necessary pressure differential to deliver the required air flow.

Natural ventilation	Non-assisted airflow caused by a decrease in air density as temperature is raised. The decrease in air density causes a pressure differential which provides the energy to drive the natural ventilation system.
Passive system	Describes a system with no moving parts which does not rely on other external controls in order to function as intended. Examples of passive systems include natural ventilation and fire rated building elements such as fire barrier walls etc.
shall	Denotes a requirement that is mandatory
should	Denotes a guideline or recommendation whenever noncompliance with the specification is permissible
Substation	Part of a power system, concentrated in a given place, including mainly the terminations of transmission or distribution lines, switchgear and housing and which may also include transformers. It generally includes facilities necessary for system security and control (e.g. the protective devices).
Switchroom	A **room** containing **switching, control** and distribution equipment for a substation. The room may be within a single dedicated building, or part of a non-dedicated building.

3.2 Abbreviations and symbols

The following abbreviations appear in this standard.

CBD	Central Business District
DDF	Dielectric dissipation factor
GIS	Gas insulated switchgear

4 Ventilation Requirements

4.1 General

The purpose for ventilation in substations is to:

- Provide cooling to dissipate heat generated by equipment, as well as the heat entering the building from outside.
- Minimise contamination from dust and airborne particles
- Provide suitable fresh air to maintain adequate air quality for personnel.

For reasons of simplicity, reliability and low maintenance, natural air ventilation to the outside of the building will be used. Forced ventilation should be used where natural ventilation is not practicable.

4.2 Temperature and humidity requirements

Under AS2067 Clause 2.4.2, indoor substations shall have the following normal conditions:

- The ambient air temperature does not exceed 40°C and its average value, measured over a period of 24 h, does not exceed 35°C.
- The average value of the relative humidity, measured over a period of 24 h, does not exceed 95%.

There are certain components within the substation that are affected by elevated temperature and humidity. The environmental conditions around these items of plant should be controlled to prolong the life of the equipment. The following guide is a recommendation for various plant items – actual design shall be based on the requirements in the Substation Design Building Specification for the project.

Table 1 - Temperature limits for equipment

Plant	Operating Range (^{0}C)	Set Point (^{0}C)	Relative Humidity (%)
Transformer main tank (i.e in an enclosure)	Up to 40	35	
Capacitor bank	Up to 45	35	
Cable tunnel	Up to 40	35	
Air insulated switchgear	Up to 40	27	55 max ±5 change
Gas insulated switchgear	Up to 40	35	
Protection & control room	Up to 30	Summer – 25 Winter – 20	
Battery banks	20-30	25	

Battery banks shall also require ventilation to disperse hydrogen that may be vented during overcharging. Designers shall calculate the build-up of hydrogen and determine sufficient ventilation opening requirements, as per AS2676 part 1 & 2 and AS 4086 part 1 & 2.

4.3 Heat loads and calculations

Ventilation studies shall take account of the following heat loads:

- Heat entering roof, walls and floors by a combination of conduction, convection and radiation
- Transformer losses (load and no load)
- Capacitor losses (DDF)
- Heating from power cables (W/m)
- I^2R losses in switchgear busbars based on internal resistance readings, or heat loads from manufacturer's watt-loss measurements from temperature rise tests.
- Losses in relays and electronic equipment.
- Losses generated by battery charger and internal resistance of batteries.
- Heating from lighting.
- Personnel – need to consider heat load generated by up to 4 workers

For switchgear heat loads, the two hour emergency rating of the incoming transformer should be used as the incoming current, and the feeder loads should be evenly proportioned across each outgoing feeder. The rated current heat loads shall be proportioned according to the ratio $\left(\frac{I_{calc}}{rated}\right)^2$. Appendix A provides an example calculation.

4.4 Humidity

Ventilation studies shall take account of relative humidity at the site and ability of air conditioner/dehumidifier to reduce average daytime RH in switchgear rooms and control rooms below 50%.

4.5 Fresh Air Requirements

Ventilation studies shall consider the fresh air requirements for up to a maximum of 4 workers within switchrooms and control rooms in accordance with AS 1688.2 Clause 2.2.2(a).

Ventilation to all rooms and accessible locations within the building should be sufficient to ensure that confined spaces are eliminated.

4.6 Ventilation Design

Ventilation design shall consider the local environment for the substation.

- High pollution environments where the intake air is likely to be highly corrosive (eg around mine sites, within close proximity to the coastline) – consider ducted systems that can highly filter the incoming air, and create a pressurised room that keeps out the unfiltered air.
- Large multi-level buildings or substations as part of a larger building may also have ducted ventilation systems.
- Split system air conditioning systems may be acceptable in most other applications.
- Increased ventilation may be necessary at a later stage if equipment inside the substation is found to be more susceptible to humidity and corrosion.
- Enclosed transformers will require mechanical ventilation to avoid over temperature and aging of the transformer.
- Ventilation around hydrogen build up for VRLA batteries is to comply with AS 2676.1 & 2.
- Mechanical or flexible seals around cables in conduits, and plugging spare conduits with water proof bungs, will reduce intake of water and issues around humidity in MV switchgear.

5 Natural Ventilation Requirements

5.1 Requirements

To harness the thermal effects and maximise the performance of a natural ventilation system air inlet openings shall be as low as possible, and exhaust openings shall be as high as possible. Substantial vertical separation is required between inlet and outlet openings. Inlet and outlet openings should preferably be clear of pedestrian areas and must be located to prevent entry of noxious gases such as vehicle exhausts, pollutants such as smoke, soot, dust, ash etc. Air being removed from an internal substation must be directly and independently ducted to outside air.

Because the pressure differential developed is relatively low, natural ventilation louvres and grilles need to be of a design that offers little resistance to air flow. Where possible the benefits of wind effects should be maximised by placing inlet openings on the windward side of buildings or enclosures.

The position of the vents should be directly to outside air, if this is not achievable then forced ventilation is required. Vermin proof, storm proof louvered vents as detailed in section **Error! eference source not found.** shall be provided in the walls and/or doors in order to achieve natural ventilation. Position of vents should provide cross ventilation across the equipment.

The areas outside the louvers shall not be subjected to fire risk. In some cases, where the roof of the substation is external, storm proof roof ventilators may be specified.

The required ventilation opening surface areas S and S' for rooms with an average yearly temperature of 20ºC can be estimated using the following formulae:

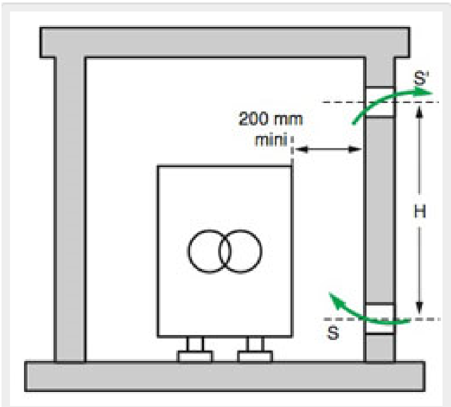

Figure 1 - Natural Ventilation Areas

Equation 1 – Surface Area – natural ventilation

$$S = \frac{1.8 \times 10^{-4} P}{\sqrt{H}} \qquad S' = 1.10 \times S$$

where:

S = Lower (air entry) ventilation opening area [m^2] (grid surface deducted)

S'= Upper (air exit) ventilation opening area [m^2] (grid surface deducted)

P = Total dissipated power by all equipment in the room [W]

H = Height between ventilation opening mid-points [m]

6 Forced Ventilation Requirements

6.1 General

Mechanical ventilation systems are to be designed in accordance with the requirements of AS 1668.2 – Mechanical ventilation in buildings.

6.2 Fans

Fans are to be thermostatically controlled and in accordance with section **Error! Reference source ot found.**. When thermostatically controlled fans are used, an “On/Off/Auto” switch shall be mounted inside the room. The sound pressure level of fans is not to exceed recommendations of the Australian Building Code and in accordance to the Environmental Act, which recommends noise produced must be less than 3dB above ambient level, as measured as the receiver. An acoustic study at the planning stage may assist with the decision on mitigation options. Where noise requirements cannot be met, sound attenuators may be installed, or alternatively ducted systems or air conditioning units may be installed.

6.3 Fan Settings

For thermostatically controlled fans, ventilation fan control is to be set to operate at design temperatures calculated from information provided on the room data sheets. Settings to ramp up to prevent on/off cycling damaging the blades. Temperature sensors are to be located inside the room and positioned so that they are able to detect the temperature of the outgoing airflow.

6.4 Air Source Requirements

Incoming air shall be clean outside air and inlets shall be located away from all substantial known heat sources, including substation outlet vents. External outlet vents should open to fresh air, but may vent to indoor areas such as carparks, provided that sufficient airflow is available to safely remove hot and potentially smoke-filled air from that area. Outlet vents must not terminate in areas where heat or smoke dissipation will cause inconvenience or are subject to fire risk. Areas such as those under awnings, under carpark ramps or adjacent to foyers or lobbies, shall be avoided. Where it is impossible or impractical to directly vent outlet air from the room, ducting must be provided to redirect the air to a suitable location.

Basement substations shall be provided with dedicated inlet and outlet ventilation ducts terminating outside the building.

Incoming air shall be filtered as specified in section 7.4. The level of filtration may be increased where the air source used is likely to contain corrosive or conductive substances, such as cement dust, salt deposits or coal dust. Increased filtration may only be a requirement during the substation building works or immediately after when there are ongoing building works on nearby sites.

Rain or moisture shall be prevented from entering the substation with the intake air. Where a concrete plenum is to form part of the ventilation system, the inside concrete surfaces are to be sealed with a concrete sealer. Rain and ground water shall be diverted away from the plenum.

6.5 Airflow Requirements

Where possible the airflow should be drawn into the substation through a low vent and exhausted through a high vent. Where possible, a dedicated inlet should be provided for each transformer, so that air will be move across/through the transformer. Where this is not possible, shared ventilation may be used, provided that vanes are fitted to direct the airflow from a single duct across multiple transformers.

6.6 Fire Damper

Fire dampers (as specified in section **Error! Reference source not found.**), shall be fitted to all inlet uct openings into the substation and to the outlet duct openings in the case of suburban type substations. In the case of CBD type substations, the outlet damper is to be part of the fan unit. Where dampers project into the substation chamber, they must be provided with guards sufficient to provide protection from personal injury. Such guards must not impair the operation of the damper or reduce the required equipment clearance limits stated in this manual.

Dampers must be connected to a mechanically operated tripping system that holds open against a spring during normal operation. The tripping mechanism must be activated by fire in the substation chamber and be arranged so that moving parts do not fall onto live equipment.

6.7 Noise

The ventilation fan plant room walls, and sections of ventilation ductwork shall be acoustically lined, where necessary, to reduce noise to acceptable levels. Silencers are to be used where required.

The final sound pressure level of the completed installation is to be in accordance with AS/NZS 2107 “Acoustics – Recommended design sound levels and reverberation times for building interiors”, and also with the recommendations of any acoustic studies undertaken for the site.

6.8 Wiring

Where possible, the ventilation system shall be fed from the Mechanical Services Main or Sub Board. It should be ensured that the fans can be electrically isolated from the Mechanical Services Switch Board, to safely allow for maintenance on fans and filters without disabling other essential electrical systems. All wiring shall be to AS3000.

It is preferable that any ventilation be linked to the light switch such that turning on the lights in a particular room turns the ventilation fan on automatically, and that turn off is automatic after 8 hours through a timer (if not already off).

6.9 Alarms

The ventilation system shall have voltage free alarm contact that is operated by any of the following:

- Loss of incoming AC supply to the Mechanical Services Switchboard
- Operation of any circuit breaker suppling ventilation fans.

6.10 Control

Individual sections of the ventilation system shall be shut down by a signal from the fire system.

For confined spaces, consideration shall be given to incorporating a time of day control to cycle air through the confined space, as well as automatic startup of the ventilation in the confined space on the turning on of a light switch in the confined space.

7 Ventilation System Components

7.1 General

The main components of ventilation systems used in major substations include the following:

- Ductwork
- Fire dampers
- Air filters
- Louvres and grilles

7.2 Ductwork

All ductwork and any composite material employed in the construction of ductwork shall conform with the requirements of AS 4254 Ductwork for air handling systems in buildings.

The materials used for the construction of ductwork are to have a smoke developed index not greater than three (3) and a spread of flame index not greater than zero (0) when separately tested in accordance with AS 1530.3 Simultaneous determination of ignitability, flame propagation, heat release and smoke release.

Flexible connections having a minimum width of 100mm are to be provided at the intake and discharge connections of all fans. Flexible connections are to be manufactured from heavy duty, waterproof, fire retardant material in accordance with AS 1668.1 Fire and smoke control in multicompartment buildings and are to be airtight.

Sheet metal ductwork and fittings are to be fabricated from steel, machine bent and free from waves and buckles. All burrs and sharp edges are to be removed. The material for sheet metal ductwork, either galvanised steel or stainless steel, is to be selected to suit the particular application and conditions on site.

The thickness of ductwork is to be suitable for the pressure class in accordance with AS 4254.

Rectangular sheet metal ductwork is to be reinforced in accordance with the requirements of AS 4254

All joints in ductwork shall be sealed and airtight.

Fire dampers shall be installed where ductwork passes through fire rated construction. Where fire dampers are installed, suitable access panels shall be provided in the ductwork, where necessary, to allow access for inspection and servicing.

All bends shall be fitted with approved turning vanes.

All ductwork inside the substation shall be continuously bonded and earthed to the substation earth grid.

7.3 Fire dampers

Fire dampers shall be installed where ductwork passes through fire rated construction.

Fire dampers shall be manufactured in accordance with AS 1682 Fire dampers and shall be installed in all openings provided for the passage of air or ducts through fire rated construction.

Fire dampers shall be of the multi-blade type, steel blades housed in a welded steel frame, suitable for the particular application. Damper blades shall pivot on stainless steel shafts in self aligning bearings and be held in the open position by a fusible link arranged to lock on closure.

Curtain type fire dampers shall not be used.
The material for the fire damper, either galvanised steel or stainless steel, shall be selected to suit the particular application and conditions on site.

Fire dampers are to have a free area of not less than 85% of the face area of the damper and are to be installed in accordance with AS 1668 The use of ventilation and air conditioning in buildings and the manufacturer's instructions.

Fusible links are to be marked with the maximum working load, year of manufacture and the manufacturer's name or identifying symbol and fully comply with the requirements described in AS 1890 Thermally released links. The load applied in service is not to exceed the marked working load of the link and is to take into account the dynamic loading due to airflow.
Fusible links shall be as manufactured by Archer, Elsie or other approved equivalent.

As per AS1682.2 clause 6.1(d) – "Convenient access shall be provided for commissioning and maintenance (inspection, release and reset), both internally and externally." Special consideration should be given to, working at heights and exclusion zones around high voltage equipment

Where ductwork is installed or access to the fire damper is via a fire rated ceiling, suitable access panels are to be provided to allow inspection and servicing of the bearings, blades and fusible link.

7.4 Air filters

Supply air ventilation systems shall be provided with fabric type, disposable air filters manufactured in accordance with AS 1324.1 Air filters for use in air conditioning and ventilation: Part 1: Application, performance and construction.

Filters are to be of the pleated panel type having a thickness not less than 25mm and be supported by a wire grid. All filters are to be housed within a supporting frame and suitably sealed to prevent air leakage using gaskets and spring type fasteners.

All filters shall be located to comply with AS 1668.1 with filter media approved in compliance with AS 1530 Methods for fire tests on building materials, components and structures.

All filter media shall have a minimum performance rating of F5 when tested in accordance with AS 1324.1.

7.5 Ventilation louvres and grilles

7.5.1 Storm proof louvres

Storm proof louvres shall be of the fixed horizontal blade type designed to prevent the ingress of rain under varying wind and rain conditions. All rainwater collected by the louvre is to be discharged to the weather side.

The louvres shall be manufactured from extruded aluminium using extruded aluminium blades in an extruded aluminium frame. Each set of blades is to be nominally 100mm depth and incorporate a minimum of two (2) rain traps in the blade extrusion. Louvre finish is to be anodised aluminium, baked enamel or powder coating as required.

All louvres are to incorporate vermin mesh screens.

The free area of the louvre must not be less than 55% of the face area.

7.5.2 Supply air diffusers

Supply air diffusers shall be of the horizontal and/or vertical blade type, extruded aluminium blades in an extruded aluminium frame. The frame shall form a border with neatly mitred corners and shall incorporate concealed fixings.

Supply air diffuser finish is to be anodised aluminium, baked enamel or powder coating as required.

Supply air diffusers are to be properly adjusted to give the required air flowrate without the introduction of excessive noise.

7.5.3 Inlet and exhaust grilles

Inlet and exhaust air grilles installed inside the building shall consist of a 12mm x 12mm grid, 12mm deep, egg crate type aluminium core fixed in an extruded aluminium frame. The frame shall form a border with neatly mitred corners and shall incorporate concealed fixings. Finish is to be anodised aluminium, baked enamel or powder coating as required.

Inlet and exhaust grilles are to be fitted with vermin screens.

7.5.4 Relief air grilles

Relief air grilles shall be of the horizontal blade type, extruded aluminium blades in an extruded aluminium frame. The frame shall form a border with neatly mitred corners and shall incorporate concealed fixings. Finish is to be anodised aluminium, baked enamel or powder coating as required.

Relief air grilles are to have a minimum free area of 80% of the face area.

Relief air grilles are to be fitted with vermin screens.

7.5.5 Vermin screens

Vermin screens shall be installed at the rear of each inlet, relief or exhaust grille and on all storm proof louvres.

Vermin screens are to be of grade 316 stainless steel welded mesh, 12.7mm pitch, wire diameter 1.2mm minimum.

7.5.6 Bush fire ember guards

In bush fire prone areas all ventilation openings shall be fitted with ember guards made from stainless steel wire mesh having a maximum aperture size of 2mm.

Ember guards shall be close fitting such that any gaps between the steel wire mesh and the ventilation opening does not exceed 2mm.

8 Air Conditioning Systems

8.1 General

The need for an air conditioning and/or dehumidifying system shall be based on a site specific ventilation assessment and shall only be adopted as a last resort where adequate control of temperature and/or air quality cannot be achieved cost effectively by any other means.

Alternative design approaches shall be considered to demonstrate that the required equipment design criteria cannot be otherwise satisfied. This should include an options assessment typically using the following hierarchy:

- Natural ventilation
- Mechanical ventilation
- Additional building insulation and thermal mass
- Strategic vent positioning and protection
- Alternative vent filtration methods
- Local protection of critical equipment components
- Alternative equipment design
- Planned refurbishment / replacement of affected equipment
- Other aspects.

Protection and control rooms, and air insulated switchgear are likely locations where air conditioning may be required.

8.2 Key design criteria

The system shall aim to maintain the internal temperature within the acceptable limits for the equipment specified and/or stabilise the humidity at a required level to address any condensation issues.

The key design criteria for air conditioning systems shall incorporate the following aspects:

- Temperature control to maintain the room within the range specified
- Relative humidity controlled to the level required to address condensation.
- A heating cycle is not required.
- Filtered fresh air to be incorporated where required.
- Ductwork to be provided to distribute conditioned air if required.
- Ductwork, plant and equipment not to be located above major electrical equipment or enclosures. Drip trays to be installed underneath internal head units if electrical equipment installed below (in case of blockage of drain)
- Condensate trays and drains not to be located above electrical equipment.
- All condensate to be drained by gravity to an external location.
- Plant and equipment to be located to allow for ready access.
- Suitable treatment for all penetrations to maintain the required fire rating of building elements.

- Internal and external (data only) temperature monitoring, including alarms, via the data communications network.
- Remote system access for interrogation, reporting and alarms via the data communications network.
- Fully adjustable thermostatic control for automatic operation.
- Manual over-ride function for up to 8 hours operation.

Dehumidifying systems shall have the same design criteria but without the requirement for significant cooling of the space. In this case, temperature control shall be maintained by other means to the requirements of this Standard.

8.3 Main system components

For most applications, air conditioning and dehumidifying systems are expected to consist of a split or split ducted air cooled refrigeration system. All systems installed shall provide conditioned air only to selected and approved locations within the substation.

Individual split systems shall be sized and designed to meet the separate requirements of individual rooms. Alternatively, “multi-head” systems with one outdoor unit and multiple indoor units can be used provided that reliability and maintenance issues associated with a single unit are addressed. There shall be sufficient redundancy in the system to maintain temperature requirements in an N-1 situation, with one unit out of service.

The main system components of a typical split ducted air cooled system are as follows:

- Indoor fan evaporator coil unit(s).
- Outdoor condensing unit(s) with anti-corrosion treatment for the coils.
- Ductwork as detailed in section 7.2**Error! Reference source not found.**, complete with angers, supports, anti-vibration mountings and air grills.
- Interconnecting refrigeration pipework (to outdoor unit).
- Safety tray and condensate gravity drain to outside.
- Power and control cabling including separate temperature sensor(s).
- Self-contained unit control and safety systems with remote access.

Suitable ductwork shall be provided tif required o distribute the conditioned air throughout the space. Internal ductwork and fan coil units shall not be located directly above major electrical equipment or control cabinets. If internal units are positioned above electrical equipment, drip trays shall be installed below the unit in the event of water build up due to blocked pipes. During 6 monthly maintenance checks, substation staff shall check condensate drain lines do not become blocked.

Where required, an outside fresh air component can be introduced to ensure a nominal positive airflow pressure within the conditioned space. Supply air systems draw outside air, and shall be provided with filters to minimise the amount of dust that is allowed to enter the conditioned space. Associated ducting is to be provided to the indoor fan-coil unit.

Fresh air intakes shall be leeward facing where practicable and located clear of exhaust openings or other sources of pollution that may reduce the quality of the air entering the system.

Fresh air intake plenums and ducts shall be maintained dry in service. Provision should also be made for inspection and cleaning of the internal surfaces.

AC power requirements for the air conditioning shall be taken into account when sizing local supply transformer requirements. Only split system units in buildings with fire suppression systems require an automatic shutdown as a result of a fire detection signal being generated.

8.4 System control

The air conditioning units shall have a fully adjustable thermostatic control for automatic operation.

The units shall restart automatically after an interruption of electrical supply.

Annex A

(informative)

Example Calculation Heat Load 11kV Switchboard

Table 2 - Example Calculation Building Heat Load

Normal Rating	ECC	Extra	(Normal x ECC)+12	Current
25 MVA	1.2 x	12 MVA	42 MVA	2,204 A

Make	Model
Schneider	Genie-Evo

Details	
1250 Feeder CB Thermal rating	119 W/Ø
2000A TFMR CB Thermal rating	285 W/Ø

	FDR1	FDR2	FDR3	TFMR	FDR4 +Capacitor	FDR5	FDR6
Nominal Current Rating	1,250 A	1,250 A	1,250 A	2,000 A	1,250 A	1,250 A	1,250 A
Resistance ($W=I^2R$)	228.48 µΩ	228.48 µΩ	228.48 µΩ	213.75 µΩ	228.48 µΩ	228.48 µΩ	228.48 µΩ
CB Thermal @ Rated	357 W	357 W	357 W	855 W	357 W	357 W	357 W
Actual Load	367 A	367 A	367 A	2,204 A	367 A	627 A	367 A
CB Thermal Actual (I^2R)	31 W	31 W	31 W	1,039 W	31 W	90 W	31 W

Assumptions

1. Even split of loads across feeders
2. No load through bus section
3. Thermal load is directly proportional to current. (this won't be true but is a simplifing assumption for low loads)

Annex B

Revision history

Revision date	Version number	Author	Description of change/revision
11/02/2019	1.0	J.Lansley	Initial issue.
15/02/2021	2.0	J.Lansley	Section 7 Include option for ducted system ad air conditioning where acoustic issues in residential areas. Fan settings to ramp up/down operation. Remove requirement to come from dedicated Fire Services board. Change louvres to Stormproof rather than weatherproof.
03/08/2022	3.0	J.Lansley	Comments from S.Fichera, Update Table Section 5.2, new sections 5.4-5.6, corrected references.
08/08/2022	4.0	J Lansley	Minor amendments for formatting.
June 2023	5	J Lansley	Template update for ECM audit