

**PLANT NOISE ATTENUATION**

**TS 2.10.07**

**GENERIC ELECTRICITY SUBSTATION DESIGN MANUAL**  
**FOR CIVIL, STRUCTURAL AND BUILDING ENGINEERING**

**SECTION NO : 07**

**TITLE : PLANT NOISE ATTENUATION**

## **PLANT NOISE ATTENUATION**

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## 1 INTRODUCTION

### 1.1 Purpose and scope

- 1.1.1 This technical specification TS 2.10.07 defines National Grid's requirements in respect of plant noise attenuation at new and existing (i.e. retrofit) electricity substations and other relevant operational sites. It shall also apply, as appropriate and via agreement, to third party assets installed on National Grid owned land.
- 1.1.2 This specification forms part of a suite of documents, TS 2.10.xx, which define design requirements (including mandatory prescriptive and functional requirements and/or performance characteristics) relating to new build and existing 'Civil, Structural and Building Engineering' assets forming part(s) of substation construction projects. Refer to TS 2.10.00 for general introduction and description of the respective parts of the series.
- 1.1.3 These design requirements shall be used in conjunction with the construction specification which is included in the TS 3.10.xx series of documents. Refer to TS 3.10.00 for general introduction.
- 1.1.4 This specification shall be applied in conjunction with all relevant National Grid standards as appropriate. The Level 1 and 2 Specifications for substations, TS 1 and TS 2.01, cover high level requirements which are mandatory for all design and construction.

### 1.2 Statutory requirements

- 1.2.1 The Construction (Design and Management) Regulations 2015 (CDM 2015) applies to building works including noise attenuation structures. When preparing or modifying designs, designers shall eliminate, reduce or control foreseeable risks that may arise during:
- Construction; and
  - The maintenance and use of a building once it is built.
- They shall provide information to other members of the project team to help them fulfil their duties.
- 1.2.2 As the works are for a Statutory Undertaker, they are technically exempt from the requirements of the Building Regulations however notwithstanding this or any other exemptions that may be applicable and unless specified to the contrary in this document, all building work shall be in accordance with the appropriate requirements of the Building Regulations. Where literal compliance is not possible the work shall be to an agreed standard that takes the Building Regulations as its basis.
- 1.2.3 The Equality Act 2010 applies to National Grid works. However, plant noise enclosures should not be made fully accessible.

**INFORMATIVE:** The Equality Act 2010 brought together and replaced previous equalities legislation including the Disability Discrimination Act 1995 (DDA). The Equality Act requires reasonable adjustments to be made in relation to accessibility. In practice, this means that due regard must be given to any specific needs of likely building users that might be reasonably met.

**INFORMATIVE:** Due to the generally physical and potentially hazardous nature of the majority of operational tasks necessary in substations it is considered unsafe and impractical to assign such work to individuals having certain types of disability. Moreover the broad spectrum of conditions covered by the Equality Act make it unviable to make advance provision for every potential employee. Consequently the Switch Hall, Ancillary Plant Room Buildings, Storage Unit and Workshop Unit shall not be required to include any specific or general provision for disabled users.

Where it is reasonable, and it can be confirmed that they will not endanger themselves or their colleagues, employees with disability may be asked to work in an operational substation environment. In such instances an assessment of the designated place of work will be carried out and the necessary building modifications made retrospectively to facilitate this.

It is assumed that all visitors who are identified as disabled will be escorted by National Grid personnel while on site to ensure they are fully aware of the areas into which they may safely go.

- 1.2.4 In all instances consultation with the appropriate planning authority in accordance with the Town and Country Planning (General Permitted Development) Order shall be necessary with respect to the external appearance of the building.

- 1.2.5 Noise attenuation structures shall comply with the requirements of the Construction Products Regulation (EU) No. 305/2011.

INFORMATIVE: Annex I of the Construction Products Regulation defines basic requirements for construction works against the following headings:

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health and the environment
4. Safety and accessibility in use
5. Protection against noise
6. Energy economy and heat retention
7. Sustainable use of natural resources

## **PART 1 – PROCEDURAL**

### **2 BUILDING TYPES**

#### **2.1 Applicable buildings**

- 2.1.1 Work carried out by the Central Electricity Generating Board (CEGB) – see TDM 10/3 (CIVIL), ‘Suppression of Transformer Noise’ - concluded that a 3 sided enclosure without a roof “should be considered the minimum effective method of attenuating transformer noise.” Four sided enclosures without a roof were “not recommended” while four sided enclosures with a roof were “the most effective means of attenuating transformer noise”.
- 2.1.2 Notwithstanding this it is not mandatory that plant noise be attenuated via a four sided enclosure with a roof as these have a number of inherent problems;
- Makes access for tap-changer maintenance more complex and potentially hazardous
  - Necessitates additional lighting and escape routes
  - Complicates the build sequence which will often impact on the critical path
- 2.1.3 The design shall consider isolating the necessary sources using the most cost effective methods in a selective manner rather than adopting blanket measures. Roofless or single wall systems, absorber and/or deflectors are preferable to a full enclosure provided these are substantiated with appropriate acoustic designs, specifications and noise surveys carried out before and after transformer installation. Consideration shall be given to reflected noise and other transmission sources.
- 2.1.4 Other types of noise mitigation that do not involve building an enclosure may be acceptable. The supplier will need to provide National Grid with a technical specification of the alternative solution including detailed drawings. A Technical Deviation will also need to be raised.

### **3 BASIS OF DESIGN**

#### **3.1 Applicable standards**

- 3.1.1 Design work shall comply with this standard and where appropriate, the suite of National Grid Technical Specifications (NGTSs and TSs), European Standards and National Annexes, British Standards and Codes of Practice as appropriate. Where the requirements of this document or any other relevant project specifications are in conflict those specifically detailed within this document shall take precedence otherwise National Grid shall be informed and will instruct accordingly.
- 3.1.2 Design work shall be in accordance with recognised analytical methods.
- 3.1.3 Structural design shall be in accordance with the suite of structural Eurocodes BS EN 1990 to BS EN 1999 and associated documents including National Annexes and relevant BSI Published Documents.
- 3.1.4 Plastic composite or other types of structural material not covered by the structural Eurocodes shall be in accordance with a recognised national or agreed international standard or, by agreement, a bespoke specification based on the appropriate complimentary or analogous national or international standards.
- 3.1.5 Geotechnical design and the design of foundations shall be in accordance with TS 2.10.03 Piling and Foundations. This requires the use of BS EN 1997, the associated National Annexes and where appropriate BSI Published Documents. For design of the foundation structural elements the relevant material design codes listed above shall also be applied.
- 3.1.6 The design of strengthening, alterations and repairs to existing elements where possible should satisfy Structural Eurocodes. However, the designer may need to consider additional or amended provisions outside the scope of the structural Eurocodes in order to justify the retention or reuse of existing structures. This may include, for example, the use of historic or superseded standards which were used in the original design.
- 3.1.7 This specification contains supplementary information to the Eurocodes giving specific application to plant noise attenuation structures.

#### **3.2 Design Working Life**

- 3.2.1 JR steel shall be acceptable for the construction of the noise enclosure structure.
- 3.2.2 The enclosure, its components and associated infrastructure shall have a minimum design life of 40 years. This shall be achievable via an inspection and maintenance regime which is consistent with that of the associated HV plant and equipment - i.e. does not necessitate electrical outages specifically for the enclosure - as follows;
- 'General Maintenance' - Not less than 3 yearly intervals
  - 'Major Maintenance' - Not less than 20 yearly intervals

#### **3.3 Supplementary Environmental Conditions**

- 3.3.1 Where necessary icing conditions shall be designed in accordance with the guidance provided in CP 3: Chapter V-2:1972, 'Code of basic data for the design of buildings. Loading. Wind loads', Appendix F, 'Ice formation on structures'.

INFORMATIVE: The relevant Eurocode (BS EN 1991-1-4) and the related National Annex does not give specific guidance on the effects of ice on the geometry of a structure.
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### 3.4 Acoustic performance

- 3.4.1 The enclosure shall achieve an insertion loss of 20dB at 100Hz. This insertion loss shall be provided by the completed enclosure in accordance with the requirements of BS 4142:1997 – ‘Method for rating industrial noise affecting mixed residential and industrial areas’ and BS 8233:1999 – ‘Sound insulation and noise reduction for buildings. Code of practice’. The acoustic performance shall be stated for the enclosure as a whole entity and shall include adjustments for internal reverberative build up, weaknesses in doors and access panels and transmission through openings (e.g. air vents) and protrusions (e.g. oil balancing fittings).

### 3.5 Materials

- 3.5.1 For general material requirements refer to TS 3.10.02 Generic Technical Specification for Civil, Structural and Building Engineering- Section 02 - Materials
- 3.5.2 Materials for the enclosure shall be chosen on the basis that they can, in combination, deliver the key requirements of Acoustic Performance, Design Life and Operability.

INFORMATIVE: Steel has historically been the main specified constituent of prefabricated acoustic enclosures however in application it has proven problematic in achieving the required Design Life and Operability characteristics. Consequently whilst the use of steel is not prohibited it is also not mandatory and the development of alternative products (plastics etc) is encouraged not least because these may also offer long term health and safety and environmental benefits.

- 3.5.3 All components of the enclosure shall be inert, non-hygroscopic, vermin-proof, rot-proof and shall not support bacteriological growth.

### 3.6 Fire protection

- 3.6.1 Refer to TS 2.10.06 for general requirements for limitation of fire risk at substations. This section provides requirements for plant noise enclosures.

INFORMATIVE: TS 2.10.06 provides fire design requirements and information on the relationship between fire resistance and test requirements.

- 3.6.2 Building materials shall meet the minimum criteria specified in Table 3-1 when tested in accordance with BS 476, except where greater fire resistance is required, for example where:

- The elements of a building are required to act as a Fire Barrier;
- A Fire Hazard is contained within the building or compartment (refer to TS 2.10.06);
- There is a boundary condition in accordance with the Building Regulations.

Element	Requirement
Noise enclosure	½ hour fire resistance
Surfaces of walls, doors, ceilings, floors (where provided)	Class O as defined by the Building Regulations

**Table 3-1 – Fire resistance requirements**

- 3.6.3 All trenches or cable ducts shall be effectively sealed to prevent the spread of fire, smoke, CO<sub>2</sub> etc, into adjoining compartments. Those entering a building shall be effectively sealed whether or not cables have been installed. Where ducts and trenches pass under, over or

through compartment walls, the sealing of the opening shall have a Fire Resistance equal to that of the compartment wall.

### 3.7 Design drawings

3.7.1 Enclosure fabrication/assembly drawings shall include or reference the following information.

- Installation and dismantling procedure and sequence;
- Fabrication and erection tolerances;
- Details of supporting structure and panel construction;
- Co-ordination of the mechanical and electrical service requirements;
- Foundation requirements;
- Panel construction details including material grades and thicknesses and acoustic infill material;
- Component connections showing method of sealing against ingress of water.

3.7.2 The location and size of doors, service accommodation and turret openings through the enclosure, dimensional tolerances, setting-out and any necessary integration with the HV equipment components shall comply with the details shown on the drawings

## 4 ACOUSTIC ENCLOSURES AND BARRIERS

### 4.1 Building Layout

#### Preferred construction

4.1.1 Modular construction (see Figure 1 below) which avoids the need for 'wet trades' (i.e. brick layers) shall be considered wherever appropriate.

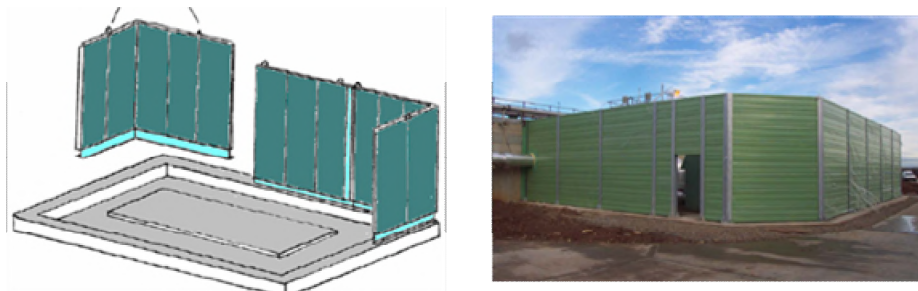


Figure 1 – Modular Acoustic Barriers

#### Interface with Oil Retaining Area

- 4.1.2 Where necessary, noise enclosures shall preferably be constructed within the Oil Retaining Area and be independent of the Oil Retaining Area walls. Where this is not possible and an enclosure is integral with the Oil Retaining Area walls, it shall be of concrete construction up to the height required to provide full oil containment.
- 4.1.3 The determination of the need for a noise enclosure is outside of the scope of this document and will be decided on a scheme specific basis.



### Interface with operational equipment

- 4.1.4 Design shall be carried out taking due note of the operational requirements of the HV equipment as supplied by the manufacturer. Detailed requirements shall be as shown on the manufacturers drawings.
- 4.1.5 The enclosure shall be detailed such that it can be fully installed and dismantled without the need to remove any part of the transmission system (including any part of the enclosed equipment).
- 4.1.6 Demountable access panels shall be provided to facilitate plant maintenance in accordance with the equipment manufacturer's drawings and recommended maintenance regimes. Panels provided to allow access to equipment tank covers shall be sized to permit easy removal of the covers.

INFORMATIVE: Wherever practicable demountable/removable covers shall be sized and configured to allow manual handling in accordance Manual Handling Assessment Charts (MAC), HSE Publication INDG383.

- 4.1.7 The configuration of the enclosure shall not cause or necessitate infringement of National Grid electrical safety clearances during the normal operation of the enclosed HV equipment or any adjacent or associated equipment forming part of the HV transmission system.
- 4.1.8 Minimum internal clearances between the frame or cladding of the enclosure and the enclosed equipment shall be as shown in Table 4-1 below:

Element	Requirement
Tap-changing equipment (to facilitate operation)	750mm horizontally to frame 860mm horizontally to cladding
Any projection from the enclosed equipment (to facilitate general access)	750mm horizontally 2000mm vertically (from floor level)
Highest point of tank cover (to facilitate visual Inspections)	75mm vertically

**Table 4-1 – Internal clearances between plant and enclosure**

- 4.1.9 Where an Active Automatic Fire Protection System is fitted around the enclosed HV equipment these minimum distances shall be increased as necessary to maintain the stated functionality. Compliance with this clause shall be demonstrated with a composite drawing.

## **Notice**

- 4.1.10 The following warning notice shall be provided and fixed in a prominent position on the outside of the enclosure doors, or adjacent to them:

**NO SMOKING**  
**NAKED LIGHTS AND WELDING PLANT**  
**SHALL NOT BE USED IN THIS**  
**HOUSING EXCEPT BY PERMISSION**  
**OF AN AUTHORISED PERSON**

Lettering shall be black on a white background, minimum 30mm high in Arial font.

## **4.2 Building Frame and Cladding**

- 4.2.1 Refer to TS 3.10.06 Building Works for installation requirements.
- 4.2.2 Refer to TS 3.10.02 for material requirements.
- 4.2.3 The building frame shall be design to resist all relevant actions in accordance with Section 3.
- 4.2.4 Where the external wall of an enclosure forms part of a substation site boundary – i.e. is not contained within a perimeter security fence – additional measures shall be taken to ensure the level of security at that interface is not less than that of the adjacent substation perimeter security fence(s).
- 4.2.5 All buildings and enclosures shall be appropriately sealed to prevent vermin entry. Additionally trench and/or cable entry points shall be designed to facilitate the prevention of water and vermin ingress without compromising the capacity of that system for future cable installation.
- 4.2.6 A stainless steel plate detailing the enclosure manufacturers name and address and the acoustic performance characteristics of the enclosure shall be fixed to the external face of the external wall in an accessible and viewable location.

### **Acoustic panels**

- 4.2.7 The enclosure shall comprise suitably supported and configured acoustic panels. The panels shall have an acoustically absorptive inner surface which shall minimise internal reverberation. The overall amount of absorption and hence the amount of reverberative build up shall be shown in the calculations where the overall acoustic performance of the enclosure is defined.

**INFORMATIVE:** If reverberation is not dealt with effectively at source (by absorption of the internal structure) then the resultant reverberative build up shall be dealt with by the acoustic transmission performance of the enclosure as a whole.

- 4.2.8 The enclosure shall comprise four walls and a roof and shall be structurally independent with no reliance on connections to the enclosed equipment for its stability and integrity. It shall be physically isolated from any vibrating parts of the HV equipment.

**INFORMATIVE:** To achieve structural independence and vibration isolation the configuration of the enclosure shall pay particular attention to any supporting structural steelwork, pipework, bushings and tap-changer turrets which may pass through the roof or walls.

- 4.2.9 'Weathertight' seals shall be made around all projections through the roof or walls.

#### **Cladding**

- 4.2.10 The enclosure shall be completely 'weathertight'. It shall be designed to avoid rainwater accumulation or entry at the interface of the wall panels and doors and supporting plinth or foundation.
- 4.2.11 The 'weathertightness' shall be an intrinsic part of the enclosures design and construction and shall not rely on the use of products that are applied post installation such as membrane systems and sealants.

**INFORMATIVE:** For the purposes of this specification the term 'weathertight' shall include resistance to rainwater and its damaging effects.

The requirement for 'weathertightness' is related to the long term integrity of the enclosure rather than the enclosed equipment which is generally designed for an outdoor installation. Uncontrolled rainwater penetration and moisture ingress are two of the most common threats to the structural integrity and performance of any building and National Grid has had a number of partial failures of prefabricated acoustic enclosures due to rainwater ingress into the acoustic panels and other component parts.

Notwithstanding this it is accepted that the provision of a 100% 'weathertight' seal is not totally viable in practice at the locations where oil filled parts (for example transformer bushings) by operational necessity pass through an enclosure or barrier particularly where they are subject to thermal movement and/or dynamic vibration. At such positions some minimal rainwater ingress is permissible when the enclosure is 'in service' provided this does not compromise the structural integrity, durability (e.g. by entering the acoustic panels or causing general corrosion) or overall acoustic performance of the system.

**INFORMATIVE:** The prevention of rainwater accumulation and entry is a function of the plinth on which the enclosure is installed and the method of connection to this. It is imperative therefore that the designs are complimentary and that each designer ensures their assumptions and requirements are communicated to all parties, for example flashing details, minimum/maximum acceptable plinth heights and sloped horizontal surfaces for drainage.

#### **Roof**

- 4.2.12 The roof shall be designed in accordance with the minimum requirements for a "roof not accessible except for normal maintenance and repair with access" as detailed in Table NA.7 of the NA to BS EN 1991-1-1 Actions on Structures - General actions — Densities, self-weight, imposed loads for buildings, i.e. a maximum uniform load of  $0.6\text{kN/m}^2$  and a concentrated load of  $0.9\text{kN}$ . Additionally it shall allow external access over its complete area without the use of crawler boards. It shall facilitate inspection and maintenance to any equipment adjacent to or directly above it.

#### **Earthing**

- 4.2.13 Where required earthing systems and connections shall be designed in accordance with NGTS 3.1.2, 'Earthing'.
- 4.2.14 All the metallic parts of the enclosure shall be connected to the substation earthing system in an approved manner (i.e. by soldering or by means of a proprietary welding system) via an

appropriately sized copper tape or cable. Flexible anti fatigue connectors shall be used at all doors.

**INFORMATIVE:** Metallic components may, by virtue of their structural connections, achieve a level of electrical interconnection that is suitable for earthing purposes however this cannot be assumed and appropriate checks shall be made to ensure all such components are connected to the substation earthing system. If necessary suitable earth bonding shall be installed to achieve this.

- 4.2.15 Connections at doors shall generally be tapes of braided fine copper wire.
- 4.2.16 Connections to the enclosure shall be via 12mm (minimum) diameter bolts or studs. Copper earth tape shall be tinned prior to bolting. The design shall prevent currents from circulating within the metallic components of the enclosure structure and shall minimise the effects of electrostatic erosion and corrosion. See NGTS 3.1.2, 'Earthing' for more information.

### **4.3 Foundations and Floor Slabs**

- 4.3.1 Refer to TS 2.10.03 Piling and Foundations for foundation design requirements.
- 4.3.2 Details of the foundation requirements shall include supporting frame centres, foundation loads, base plate sizes and fixings, wall foundation loads and width of wall base rail. The Contractor shall provide and install all fixings and holding-down bolts necessary for the enclosure.

### **4.4 Drainage**

- 4.4.1 Site drainage design shall be in accordance with TS 2.10.09 Site Drainage.
- 4.4.2 Internal guttering and rainwater pipes shall not be permitted.
- 4.4.3 The roof shall comprise a non-slip oil resistant surface free draining to a guttering system that discharges through down pipes into the 'Oil Retaining Area' (see TS 2.10.01 Oil Containment for definition, to contain any Oil resulting from a turret bushing failure. Maximum and minimum roof gradients shall be 1:10 and 1:80 respectively. The drainage system shall be suitable for/resistant to oil and water at 80°C.
- 4.4.4 Where necessary the enclosure shall incorporate a system that permits the free draining (minimum flow rate of 7000 litres per minute with a fluid head of 150mm) of hot hydrocarbon oil (at 80°C) into the Oil Retaining Area, in accordance with TS 2.10.01. This shall be detailed so there is no loss of acoustic performance and shall incorporate anti-vermin screens.
- 4.4.5 Where the noise enclosure is situated in an area protected by an Active Automatic Fire Protection System – Water Spray Type, the gutters to the noise enclosure shall be fire resistant and shall be suitably sized to ensure that fire-water run-off is directed back into the Oil Retaining Area.

### **4.5 Doors**

- 4.5.1 For general requirements for doors, refer to TS 3.10.02 Section 2.32. All doors, frames and linings for enclosures shall comply with Clause 2.32 unless contradicted in this Clause, when this Clause shall take precedence.
- 4.5.2 Two personnel access doors shall be provided in the side walls. One door shall be positioned adjacent to the tap change operating mechanism and the other door diagonally opposite.

- 4.5.3 Doors shall open outwards and shall not be lockable. They shall be located such that they are able to open fully (i.e. 90 degrees minimum) and permit clear, unimpeded routine and emergency access routine and emergency from inside and outside.
- 4.5.4 Doors shall provide a minimum clear opening of 825mm wide by 2000mm high.
- 4.5.5 Doors shall be equipped with luminous internal push (panic) bars and heavy duty, stainless steel door stays which lock automatically in the open position.
- 4.5.6 A low profile stainless steel threshold (nominally 20mm deep) shall be provided at each door position. This shall provide an effective acoustic seal to the door when it is closed.
- 4.5.7 Doors shall close on resilient seals along all meeting faces.

#### **4.6 Building Finishes**

- 4.6.1 The external colour of the building shall be agreed to suit local planning restrictions. There is no standard NG colour.
- 4.6.2 Details of the external paint finish shall include type, manufacturer, application procedure, dry film thickness and 'Major Maintenance' intervals.

#### **4.7 Building Services Distribution**

- 4.7.1 Refer to TS 3.10.13 for Minor Electrical Works for general requirements for distribution and the other headings below.
- 4.7.2 All equipment, switches, sockets, distribution boxes, junction boxes, etc. shall carry a permanent label identifying their function in accordance with TS 3.10.13 Minor Electrical Works. Any necessary warning labels shall be fixed directly, or adjacent to them in an easily visible location.

#### **4.8 Small power**

- 4.8.1 General requirements are provided in TS 3.10.13 for Minor Electrical Works.
- 4.8.2 Wiring shall be Low Smoke Zero Halogen (LSZH) in galvanised conduit.
- 4.8.3 A double 13 amp 240 volt switched socket outlet shall be provided inside the enclosure adjacent to each door.
- 4.8.4 Each socket outlet shall be protected by a Residual Current Circuit Breaker and shall be fully sealed type to IP55 in accordance with BS EN 60529.

#### **4.9 Lighting**

- 4.9.1 Luminaires, switches and consumer units shall be of the fully sealed type to IP55 in accordance with BS EN 60529 unless an Active Automatic Fire Protection System is fitted in which case their rating shall be IP66.
- 4.9.2 Internal lighting shall be fluorescent, quick start type with a minimum maintained illuminance of 150 lux at floor level.
- 4.9.3 3-hour self-contained maintained emergency lighting fittings shall be provided to achieve a minimum of 2.5 lux at floor level within the enclosure.
- 4.9.4 The lighting shall be instant start and the circuit shall be connected to the 240V mains supply extended from the designated marshalling kiosk.

- 4.9.5 External 60 watt bulkhead lights shall be fitted above each personnel access door. Filament lamps shall not be used.
- 4.9.6 Local lighting switches and emergency lighting test key-switches shall be provided.
- 4.9.7 An external light switch controlling internal and external lighting systems shall be installed adjacent to each personnel access door.
- 4.9.8 Luminaires, lamps and their fittings shall be vibration and shock resistant.

#### **4.10 Telephone points**

- 4.10.1 No telephone points shall be provided in plant noise attenuation enclosures.

#### **4.11 Heating and Ventilation**

- 4.11.1 The enclosure shall incorporate natural ventilation to provide fresh air for breathing, to dilute and exhaust pollutants and odours, to prevent excessive heat gains affecting people and damaging equipment and to minimise condensation to a level that does not promote corrosion of the noise enclosure elements, nor cause nuisance or hazard to operation and maintenance of the plant.
- 4.11.2 Ventilation shall be designed in accordance with The Chartered Institution of Building Services Engineers (CIBSE) Guide B2, 'Ventilation and Air Conditioning' particularly the section on Plant Rooms and the relevant part of the Building Regulations Approved Document F, 'Means of Ventilation' specifically that relating to Buildings other than dwellings.
- 4.11.3 The size and position of air inlets and outlets shall not compromise the overall acoustic performance of the enclosure.
- 4.11.4 All rooms and areas in which people shall be required to work – either long or short term – and mess room facilities or similar shall have sufficient heating and/or ventilation to provide an acceptable zone of 'thermal comfort' of between 13°C (56°F) and 30°C (86°F) without compromising the operation of any plant or equipment also contained therein.

INFORMATIVE: The term 'thermal comfort' is as used by the Health and Safety Executive specifically in their publication HSG194, 'Thermal comfort in the workplace, Guidance for employers'.

#### **4.12 Plumbing**

- 4.12.1 No plumbing is required in noise enclosures.

#### **4.13 Fire detection, alarm systems and extinguishers**

- 4.13.1 Fire detection, alarm systems and extinguishers are not required in noise enclosures, unless as part of an Active Automatic Fire Protection System where this is fitted around the enclosed HV equipment.

#### 4.14 Brick Built Acoustic Enclosures

INFORMATIVE: Constructing acoustic enclosures in brick is both labour intensive and requires specialist trades that typically make such installations more costly, and liable to expose site operatives to greater health and safety risks, than the pre-fabricated alternatives. Consequently brick enclosures are not a preferred solution and the following section is included mainly for consistency with earlier standards, specifically if an existing installation is to be modified or, as is very unlikely, a new build in brick is the most viable solution.

- 4.14.1 All the preceding clauses of this section shall apply where relevant and/or appropriate to this form of construction.
- 4.14.2 Walls shall be of solid brickwork construction and shall be fully bonded.
- 4.14.3 Any openings through walls for pipework shall be front faced in matching brickwork after installation of the pipe, and the remainder backfilled with C16/20 concrete.
- 4.14.4 The roof shall be of precast concrete with the size of individual units maximised to reduce the overall length of joints. Steelwork support members shall be provided to support the precast units as necessary.
- 4.14.5 The roof shall be designed and constructed to fail first in the event of fire or explosion.
- 4.14.6 The roof shall be fully waterproofed using a suitable oil resistant membrane system
- 4.14.7 Facing bricks shall be used to the external face of the enclosure.

## **PART 2 – REFERENCES, DEFINITIONS AND DOCUMENT HISTORY**

### **5 REFERENCES**

This specification makes reference to, or should be read in conjunction with, the following documents:

#### **5.1 Her Majesty's Stationary Office**

CDM 2015 Construction (Design and Management) Regulations 2015

The Construction Products Regulation (EU) 305/2011

Building Regulations

Equality Act 2010

Health and Safety (Safety Signs and Signals) Regulations 1996

Town and Country Planning (General Permitted Development) Order

The Control of Substances Hazardous to Health (COSHH) Regulations

#### **5.2 British Standards Institution**

Note: The date of issue of the standards listed below is purposely omitted. This is to allow designers to use the version of the document which is current at the commencement of the project.

BS 476	Fire Tests on Building Materials and Structures
BS 5266-10:2008	Guide to the design and provision of emergency lighting to reduce the risks from hazards in the event of failure of the normal lighting supply
BS 5720	Code of practice for mechanical ventilation and air conditioning in buildings
BS 5839-1	Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises
BS 8233	Sound insulation and noise reduction for buildings. Code of practice
BS 9999:2008	Code of practice for fire safety in the design, management and use of buildings
BS EN 54-20	Fire detection and fire alarm systems - Part 20: Aspirating smoke detectors
BS EN 1886	Ventilation for buildings. Air handling units. Mechanical performance.
BS EN 1990	Eurocode – basis of structural design (and UK National Annex)
BS EN 1991	Actions on structures (and UK National Annexes)
BS EN 1992	Design of concrete structures (and UK National Annexes)
BS EN 1993	Design of steel structures (and UK National Annexes)



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BS EN 1994	Design of composite steel and concrete structures (and UK National Annexes)
BS EN 1995	Design of timber structures (and UK National Annexes)
BS EN 1996	Design of masonry structures (and UK National Annexes)
BS EN 1997	Geotechnical design (and UK National Annexes)
BS EN 50272	Safety requirements for secondary batteries and battery installations
BS EN 60309-2	Plugs, socket-outlets and couplers for industrial purposes. Dimensional interchangeability requirements for pin and contact-tube accessories
BS EN 60529	Degrees of protection provided by enclosures (IP code)
<b>5.3 National Grid</b>	
TS 1	Ratings and General Requirements for Plant, Equipment, Apparatus and Services for the National Grid System and Connection Points to it
TS 2.01	Substations
TS 2.10.XX	Generic Electricity Substation Design Manual for Civil, Structural and Building Engineering
TS 3.10.XX	Generic Technical Specification for Civil, Structural and Building Engineering
TS 3.01.02	Earthing
<b>5.4 Others</b>	
CP 3	Code of basic data for the design of buildings. Loading. Wind loads
HSG194	Thermal comfort in the workplace, Guidance for employers
	Manual Handling Assessment Charts (MAC), HSE Publication INDG383.
LG1	CIBSE Lighting Guide LG1, The Industrial Environment
	Central Electricity Generating Board (CEGB) – TDM 10/3 (CIVIL), 'Suppression of Transformer Noise'

## 6 AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Author(s)	Approved By (Inc. Job Title)
1	May 2017	New Document to replace DH 10 & to comply with Eurocodes and General updates	Gibson Bhunu	EEPIG

## 7 IMPLEMENTATION

### 7.1 Audience Awareness

Audience	Purpose Compliance (C) / Awareness (A)	Notification Method Memo / letter / fax / email / team brief / other (specify)
Electricity Transmission Owner	A	e-mail
UK Construction	A	e-mail/Eurocodes Launch
Construction Delivery Units	C	Eurocodes Launch

### 7.2 Training Requirements

Training Needs N/A / Informal / Workshop / Formal Course	Training Target Date	Implementation Manager
Eurocodes Launch	25 May 2017	Phil Clements

### 7.3 Compliance

This document is essentially a reproduction of existing information previously available in DH10 Substation Design Handbook. Consequently compliance is generally regarded as ongoing and retrospective application unnecessary in the main. Minor exceptions to this principle shall be incorporated into the works wherever possible and where not National Grid shall be advised via the appropriate project design management routes.

### 7.4 Procedure Review Date

5 years from publication date.

## PART 3 – GUIDANCE NOTE AND APPENDICES

No appendices

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