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# NSP/007/019 - Guidance on Substation Design: EHV Substation Drawing Policy

## 1. Purpose

The purpose of this document is to outline the Northern Powergrid requirements for new drawings for primary and supply point substations.

The guide details the numbering system to be used, drawing title requirements and gives details of the drawings required for a Northern Powergrid substation.

This document supersedes the following documents, all copies of which should be destroyed;

Document Reference	Document Title	Version	Published Date
NSP/007/019	Guidance on Substation Design: EHV Substation Drawing Policy	1.1	Feb 2015

## 2. Scope

This design guide shall be applied to all primary and supply point substations on the Northern Powergrid network.

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### 3. Northern Powergrid Substation Drawings

#### 3.1. General

On all Northern Powergrid produced drawings, in the bottom right hand corner of the drawing there shall be a title block containing the following details:

Northern Powergrid name, registered address and logo

Drawing Title

Document Details

Drawing Reference Number

Historical Drawing Number

Revision Details

Scale

Drawn and checked names and dates.

On all externally produced drawings, the title block shall contain the following details:

Company name and logo

Client - Northern Powergrid

Drawing Title

Company Drawing Number

Northern Powergrid Drawing Reference Number

Northern Powergrid Historical Drawing Number

Revision Details

Scale

Drawn and checked names and dates.

#### 3.2. Title

The title block should contain no more than 4 lines. If one of the lines is not required then the following lines will move up as appropriate.

Line 1: Substation Name and Voltage.

Line 2: Circuit number and voltage as per (a) and (b) below.

Line 3: Purpose of drawing as per (c) below.

Line 4: Other information as per (d) below.

- (a) The circuit(s) reference number(s) for 11kV, 20kV, 33kV and 66kV circuits will be the circuit number on the Diagram of Main Connections and Protection (e.g. 301, 503, and 607) which corresponds with the circuit breaker reference in the plant record system. For 132kV circuits the reference number will be the circuit breaker number which is shown on the Diagram of Main Connections and Protection (e.g. 305, 805). Where there is no 132kV circuit breaker, as at most transformer end sites, the reference number will be the associated 132kV disconnector reference (e.g. 113, 213).

- (b) The circuit voltage.

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(c) The purpose of the drawing (e.g. control, alarms and indications) or the type of plant (e.g. control panel).

(d) Other information (e.g. layout or schedule).

Wherever possible a drawing should be associated with an individual circuit or circuits e.g. 302,304,314 11kV feeder IDMT/SEF circuit breaker.

### 3.3. Drawing Reference Number

#### 3.3.1. General

The drawing reference number is generated automatically at the time of entry into Meridian (Northern Powergrid's drawing management database). The drawing reference number is a chronologically issued number starting with the letter 'C'. Whilst being unique to the drawing, the drawing reference number has no intelligent base to identify the properties of the drawing.

These numbers can be allocated prior to the production of the drawings by creating a blank entry in Meridian which would be populated with the drawing file by the appropriate drawing office representative once completed.

The Meridian database is segregated into levels as described below.

The appropriate database level 3 and 4 names should appear in the 'Document Details' section of the title block.

#### 3.3.2. Meridian Database Levels

Drawings filed in the Meridian drawing management database require to be filed within set vaults or levels.

There are four levels as follows:

##### Level 1 – 'Top Level'

This level contains only one section which is for all Northern Powergrid drawings.

##### Level 2 – 'Document Type'

This level contains five sections as follows:

- (C) – CAD – This section contains all drawings covered by this document and provides the 'C' prefix for the drawing reference number. It is divided into further levels as indicated in Section 3.3.3 below.
- (D) – Development documents.
- (L) – Library Documents.
- (M) – Maps.
- (W) – Wayleave documents.

##### Level 3 - 'Document Class'

##### Level 4 - 'Document Subclass'

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### 3.3.3. Levels 3 & 4 Sub Sections

LEVEL 3 DOCUMENT CLASS	LEVEL 4 DOCUMENT SUBCLASS
Construction	Layouts
	Buildings
	Compound
	Site
	Standards
Legacy	Sites
	Photographs
	Other
Legal Drawings	Plans
	Agreements
	Consents
	Other
Overhead	Towers
	Poles
	Lines
	Standards
Planning	System
	Other
Protection and Control	Standards
	Technical Documents
	C & P and Logic Drawings
Safety	Equipment
	Notices
	Standards
Scheme Drawings	Turnkey
	Major Projects
	Capital
	Temporary
Substation Operational Diagrams	Northern Powergrid (Northern)
	Northern Powergrid (Yorkshire) OI10 Drawings
ESI	ESI
Switchgear	Arrangements
	Details
	Standards
	General
System Diagrams	HV
	Northern Powergrid (Northern) Protection
Telecoms	Data & Radio
	Telecontrol
	Standards
	Security
Transformers	Distribution
	Primary
	Supply Point
	Other
Underground	Jointing
	Standards
	Cables
Plant Diagrams	Wiring
	Circuit

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Other Plant	General
	Relay Panel General Arrangements
	Metering
	Earthing
	Auxiliary Cables
	Auxiliary Equipment

### 3.4. Historical Drawing Number

#### 3.4.1. General

The historic drawing number should be constructed in accordance with section 3.4.2 below. The construction of this number is such that it is easy to identify the substation and the type of information shown on the drawing from the number.

For details of historic numbering practices employed within the former NEDL area prior to the introduction of Meridian in 2006 please refer to the Northern Powergrid (Northeast) drawing office in Shiremoor.

The historic drawing number can be created prior to the production of the drawing. A database is maintained within Major Projects, Northern Powergrid (Yorkshire) at Castleford which stores details of historic drawing numbers and should be used to determine the next available historic drawing number.

Contractors wishing to allocate historical drawing numbers should submit a request to Northern Powergrid drawing office (see Section 3.6). Requests should be submitted using the attached drawing template excel spreadsheet. The format of this spreadsheet is such that the database can be auto populated directly from the spreadsheet without the need to enter drawings individually in to the database.

#### 3.4.2. Historical Drawing Number Details

The historic drawing number is made up of six parts:

##### i. Prefix Letter

The prefix letter indicates the licence operator.

Numbers beginning with 'Y' are for drawings in the Northern Powergrid (Yorkshire) area.

Numbers beginning with 'N' are for drawings in the Northern Powergrid (Northeast) area.

##### ii. Reference Number

After the prefix letter is the three digit reference number. These three digits are dependent on the drawing group.

For a substation drawing, the reference number is a unique number allocated to an individual substation. These numbers are allocated by the Substation Design Engineer within Major Projects at Castleford. The drawing reference number does not have any connection with the operational substation number which is found on the mains records or on the substation door. This substation number is issued by control and care should be taken not to confuse the two.

For standard drawings, the reference number relates to a particular group of standard drawings. Most of these are no longer in use.

##### iii. Group Letter

After the reference number is the group reference.

A – Operational Project Drawings. This group is for substation drawings.

Several other group letters have been used in the past but these are no longer in use.

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**iv. Section Number**

After the group letter is the section number. This is a single digit ranging from 0 to 9. See below for details.

**v. Subsection Number**

After the section number is the sub section number. This is a single digit ranging from 0 to 9. See below for details.

**vi. Serial Number (Individual Drawing Number).**

The final two digits are a unique number allocated to the specific drawing. These are issued chronologically starting from 01. On rare occasions for large sites where there are a large number of drawings of a particular type it may be necessary to use 3 digits in this section.

For example, a typical historic drawing number would be constructed as follows:

Prefix Letter	Reference Number	Group Letter	Section Number	Subsection Number	Serial Number
Y	087	A	4	2	40

Drawing number is – Y087A4240

The title is - Queens Road 33/11kV S/S  
302,304,314 11kV feeders  
IDMT/SEF circuit breakers  
Circuit Diagram

### 3.4.3. Section and Subsection Numbers

The Section and Subsection numbers for substation drawings in the 'A' group are listed below.

Section	Subsection
1. Construction Drawings	0. Site and External Works
	1. Equipment Layouts
	2. Building Details
	3. Building Foundations
	4. Compound - Arrangements
	5. Compound – Supports and Foundations
	6. Compound – Other Details
2. Plant Drawings	0. Transformers & Associated Equipment
	1. Switchgear – Arrangements (Including LVAC)
	2. Switchgear – Details (Including LVAC)
	3. Control & Relay Panels
	4. Auxiliary Equipment & Earthing
	5. Telecommunication / Telecontrol
3. Mains & Multicore Cables	0. Easement Plans
	1. Underground Cables and Associated Equipment
	2. Overhead Lines and Associated Equipment
	3. Multicore Cables, Block Diagrams & Schedules.
4. Diagrams – (circuit diagrams and wiring diagrams/schedules except multicore)	0. Connections, Main Protection, Phasing Operation, Interlocking Key Diagrams
	1. Telecommunication / Telecontrol
	2. 66, 33, 20, 11kV Plant – Circuit & Schematic Diagrams, Mag Curves, Logic Diagrams
	3. 66, 33, 20, 11kV Plant – Wiring Diagrams, Diagram of Connections, Wiring Schedules
	4. Auxiliary Equipment – Battery Circuit & Wiring,

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	General Arrangements, Wiring Diagrams, LVAC Circuits
	5. 132kV Plant –Wiring Diagrams
	6. 132kV Plant – Circuit Diagrams
5. Drawings in Transit – Temporary Drawings	0. Diagrams
	1. Site Drawings
	2. Other Drawings – Schedules, Structure Drawings...
	3. Redundant Power Stations
6. Other Drawings	4. Explosion (Investigation Drawings)
	0. Incident Investigations
	1. Reports & Manuals
	2. Photographs

### 3.5. Drawing Revision Policy

When a drawing is revised, the drawing should retain the existing drawing number(s) and the revision should be advanced alphabetically. The first revision of a drawing should be set at 00. Further revisions should continue from A to Z then AA to ZZ as required.

The drawing management software is configured so that previous revisions are archived and available for future reference.

### 3.6. Drawing Offices

Drawing numbers for sites within **Northern Powergrid (Yorkshire)** will be issued by the drawing office, (the Northern Powergrid (Yorkshire) drawing office contractors) at the following address:

**Northern Powergrid (Yorkshire) Drawing Office,**  
98 Aketon Road, Castleford, West Yorkshire, WF10 9DS.  
Email: [cadservices@Northernpowergrid.com](mailto:cadservices@Northernpowergrid.com)

Drawing numbers for sites within **Northern Powergrid (Northeast)** will be issued by the Northern Powergrid (Northeast) drawing office at the following address:

**Northern Powergrid (Northeast) Drawing Office,**  
New York Road, Shiremoor, Newcastle Upon Tyne, NE27 0LP.  
Email: [safediggingplans@northernpowergrid.com](mailto:safediggingplans@northernpowergrid.com)

### 3.7. Substation Drawings Required

#### 3.7.1. Substation Layout Drawings

A site plan should be filed in Section 1, Subsection 0. These drawings should normally be at a scale of 1:100 or 1:200 and contain a location plan to a scale of 1:2500 or 1:1250. The drawing should show the overall site layout with dimensions and circuit centre lines.

A substation layout drawings should be filed in Section 1, Subsection 1, 2 or 4. These drawings should show an overview of the equipment layouts in buildings and compounds and would normally be at a scale of 1:100. The drawing will dimension the key items of plant in relation to the layout of the site boundaries. For smaller sites, building, transformer and compound details can be detailed on the substation layout drawing. For more complicated sites, this drawing can be simplified to show more of an overview of the site, and the building, transformer and compound can be shown in more detail on specific drawings.

Building layouts should give the dimensions of the building in more detail. These would show the position of switchgear, relay panels etc. Separate plan views would be used to detail electrical requirements, equipment layouts, and conduit layout. The drawing would normally be to a scale of 1:50. A separate drawing may be required to show elevations.



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Transformer layouts should give the dimensions of the transformer bund and enclosure where appropriate in more detail. Separate plan views would be used to detail electrical requirements, equipment layouts, and conduit layout. The drawing would normally be to a scale of 1:50. A separate drawing may be required to show elevations.

Oil containment calculations for the transformer bunds should be filed in Section 2, Subsection 0.

Compound layouts should show circuit names, centre lines and detailed equipment layouts, including location marks, mech box positions, structure references, and clearances. Dimensions of equipment in the compound should be shown. These drawings would normally be to a scale of 1:100 or 1:50. A separate drawing may be required to show elevations.

On larger sites where the substation layout drawing has become over crowded, separate drawings usually at a scale of 1:100 or 1:50 can also be used to detail proposed conduit layouts, cable routes etc.

Structure drawings should be filed in Section 1, Subsection 5. These drawings should show an outline of the proposed structures for use by the structure designer/fabricator. They are intended to indicate Northern Powergrid requirements for the structure and should show phase centres, structure heights, mech box positions and heights, cross sectional area for wind loading, equipment weights, earthing requirements, structure references etc.

### **3.7.2. Civil Drawings**

Drawings produced by the civil contractor(s) should be filed in Section 1, Subsections 2, 3, 5, or 6 as appropriate. These should detail the civil requirements associated with the site nominally at a scale of 1:50 or 1:100 as appropriate.

### **3.7.3. Transformer Drawings**

General arrangement, diagram plate, rating plate, valve location plate and marshalling kiosk arrangement drawings should be filed in Section 2, Subsection 0.

Circuit and wiring diagrams should be filed in Section 4, Subsections 2, 3, 5 or 6 as appropriate.

Drawings provided by transformer manufacturers should show detailed information relating to the arrangement of the transformer. Key dimensions should be shown such as phase centres, cable termination positions, tank dimensions and mounting footprint, oil capacities and weights.

### **3.7.4. Switchgear Drawings**

General arrangement drawings and switchgear detail drawings should be filed in Section 2, Subsections 1 or 2 as appropriate

Circuit and wiring diagrams should be filed in Section 4, Subsections 2, 3, 5 or 6 as appropriate.

Drawings provided by switchgear manufacturers should show detailed information relating to the arrangement of the switchgear. Key dimensions should be shown such as panel sizes, cable box positions and sizes, transportation and installation requirements etc.

### **3.7.5. Relay Panel Drawings**

General arrangement drawings of relay and control panels should be filed in Section 2, Subsection 3.

Circuit and wiring diagrams should be filed in Section 4, Subsections 2, 3, 5 or 6 as appropriate.

Drawings provided by relay panel manufacturers should show detailed information relating to the arrangement of the panels. Key dimensions should be shown such as panel sizes, heights, transportation and installation requirements etc.

### **3.7.6. Earthing Drawings**

Earthing layout drawings should be filed in Section 2, Subsection 4.

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Separate drawings may be required to show building, compound, site and transformer enclosure earthing designs. The drawings would normally be to the same scale as the equivalent layout drawings. Drawings should detail the earthing design, along with supporting detail such as earth tape size, tape lengths, mech box earthing positions, stance earth positions, structure earth positions, earth rod and fence earth rod positions etc. Any specific earthing requirements such as insulated fence panels will be shown. Dimensions will only be required where specifically required i.e. distance of tape from fence or building. Drawings will cross reference other related drawings and shall show a key to the main requirements of the earthing design.

### **3.7.7. Heating and Lighting and Fire Mitigation Drawings**

Heating, lighting and power point layout drawings and calculations should be filed in Section 2, Subsection 4.

The drawings would normally be to the same scale as the equivalent layout drawings. Drawings should detail the electrical requirements associated with the low voltage heating and lighting circuits and fire mitigation requirements.

They are intended to show a representation of the physical position of the equipment, switch positions, heater positions etc. for the install contractor to use as an indication of our requirements. They are not intended to be used to provide a detailed wiring diagram of the substation installation. Drawings should show a key to the symbols used and a layout of the LVAC board circuitry showing the key equipment fed from each way.

### **3.7.8. Cable Route Drawings**

Proposed cable route drawings should be filed in Section 3, Subsection 1.

The drawings would normally be to the same scale as the substation layout drawing. Drawings should detail the feeder and transformer cable route proposals for planning purposes. These drawings are not intended to replace the statutory mains record drawings which should always be the first choice drawing for cable positions.

### **3.7.9. Multicore Cable Layouts and Schedules**

Multicore cable layout drawings and multicore cable schedules should be filed in Section 3, Subsection 3.

The drawings would normally be to the same scale as the substation layout drawing. Drawings should detail the multicore cable route proposals for planning purposes. These drawings are not intended to replace the statutory mains record drawings which should always be the first choice drawing for cable positions.

### **3.7.10. Single Line Diagrams**

Drawings showing Main Connections & Protection, Logic Diagrams, Phasing Diagrams, Interlocking arrangements should be filed in Section 4, Subsection 0

### **3.7.11. Telecontrol Schedules**

Telecontrol schedules should be filed in Section 4, Subsection 1.

### **3.7.12. Circuit Diagrams and Wiring Diagrams**

Circuit diagrams for equipment from 11kV up to 66kV should be filed in Section 4, Subsection 2.

Wiring diagrams for equipment from 11kV up to 66kV should be filed in Section 4, Subsection 3.

Circuit diagrams for equipment at 132kV should be filed in Section 4, Subsection 6.

Wiring diagrams for equipment at 132kV should be filed in Section 4, Subsection 5.

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**3.7.13. Auxiliary Equipment Drawings**

General arrangement drawings, circuit diagrams and wiring diagrams for batteries, LVAC Boards etc. should be filed in Section 4, Subsection 4.

**3.7.14. Temporary Drawings**

Drawings showing temporary arrangements or proposals should be filed in Section 5.

**3.7.15. Contractors Drawings**

All drawings provided by contractors should be clear and concise, and conform to a similar standard of detail as provided by the Northern Powergrid electrical layout drawings. All drawings should be provided electronically in an industry standard CAD format – AutoCAD (.dwg or .dxf) or microstation (.dgn).

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## 4. References

### 4.1. External Documentation

Reference	Title
n/a	

### 4.2. Internal Documentation

Reference	Title
n/a	

### 4.3. Amendments from Previous Version

Reference	Description
Whole doc review	

## 5. Definitions

Term	Definition
n/a	

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## 6. Authority for Issue

### 6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		<b>Date</b>
Liz Beat	Governance Administrator	05/02/2024

### 6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

**Review Period** - This document should be reviewed within the following time period;

Standard CDS review of 3 years?	Non Standard Review Period & Reason	
Yes	Period:	Reason:
Should this document be displayed on the Northern Powergrid external website?		Yes
		<b>Date</b>
David Johnson	Major Projects Specification & Design Engineer	16/05/2024

### 6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		<b>Date</b>
Mark Thompson	Major Projects Specification & Design Manager	30/05/2024

### 6.4. Authorisation

Authorisation is granted for publication of this document.

		<b>Date</b>
David Sillito	Head of Major Projects	24/05/2024