

# Network Standard

Document No.

**NS290**

Title:

**Selection of Distribution Substations**

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## Revision

No	Date	Description	Technical Approver	Authorised By
0	16/09/2024	Initial – Distribution Substation related content was removed from NS109 and placed in this NS	Matthew Cupples	Murray Chandler
1	14/02/2025	Updates to remove single standard chamber substations restriction on one site.	Matthew Cupples	Jacob Bayley

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**Scope**

This Network Standard sets the requirements for the selection of suitable distribution substations based on development type and rating.

**Reference Documents**

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards.

NS001 Glossary of Terms

NS100 Field Recording of Network Assets

NS113 Site Selection and Construction Design Requirements for Chamber Substations

NS114 Electrical Design and Constructions Standards for Chamber Substations

NS117 Design and Construction Standards for Kiosk Type Substations

NS122 Pole Mounted Substation Site Selection and Construction

**Clause Standard Requirements****1 Distribution Substations**

- 1.1 Distribution substations shall be selected from the options in Table 1.
- 1.2 **Firm and non-firm ratings**
- 1.2.1 The firm rating shall be the maximum load which can normally be carried by a multiple transformer substation and which allows for 1 transformer being out of service under emergency or maintenance conditions.
- 1.2.2 The non-firm rating shall be the maximum load that can normally be carried by a distribution centre.
- 1.3 **Load cycles**
- 1.3.1 The appropriate load cycle for the development shall be used when selecting a substation from Table 1. Where there is no rating, that substation type is not available for that application.
- 1.4 **Supply interruptions**
- 1.4.1 Customer requirements shall dictate the selection of substation options with respect to supply interruptions for routine maintenance<sup>1</sup>.
- 1.4.2 Loads in excess of the firm rating (up to the non-firm rating) can be accommodated by some substation options but will have the following consequences:
- Load shall be restricted to allow periodic maintenance of each transformer.
  - An interruption to supply shall occur in the event of failure of any transformer or associated equipment.

**2 Pole substations**

- 2.1 Pole substations for developments shall only be used in rural overhead high voltage areas.

**3 Kiosk substations**

- 3.1 K-type kiosks shall be restricted to installations for single industrial customers or single commercial customers.
- 3.2 Where multiple kiosks supply a single development a 400A “normally open” interconnector shall be installed between the two LV boards.
- 3.3 A site shall have no more than two kiosk substations installed adjacent to each other.

**4 Chamber Substations**

- 4.1 Single transformer substations controlled by high voltage circuit-breakers shall be restricted to installations for single industrial customers or single commercial customers.
- 4.2 Loads for options 19 and 20 (2 x 750kVA and 2 x 1000kVA chamber substations) shall not exceed the thermal limit current of the high voltage cartridge fuses.
- 4.3 Where a chamber substation supplies the distribution network with no alternative supply available, the firm rating shall be applied.
- 4.4 Options 19 and 20 (2 x 750kVA and 2 x 1000kVA chamber substations) shall have a normally open disconnecter between the two low voltage busbars.

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<sup>1</sup> 1500kVA transformers have periodic maintenance that require outages for non-firm rated substations


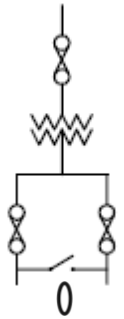
- 4.5 The ratings for dry-type transformers in chamber substations shown in Table 1 are Air Natural (AN) and shall only be used when there is no SCADA monitoring.

## **5 Sydney City CBD Substations**

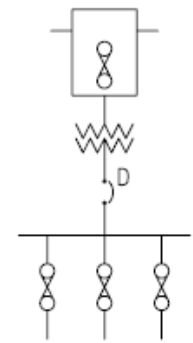
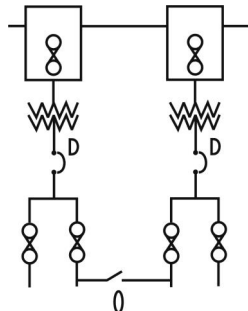
- 5.1 All substations on the Sydney CBD network shall be firm rated.
- 5.2 Sydney CBD substations with dry-type transformers shall be equipped with SCADA monitoring of the transformer fans and the Air Forced (AF) Normal and Emergency rating of the dry-type transformer may be used in determining the rating of the substation.
- 5.3 For substations that are not equipped with SCADA monitoring, the Air Natural (AN) Normal and Emergency ratings of the dry type transformers shall be used to determine the rating of the substation (firm or non-firm).

## 6 Substation options

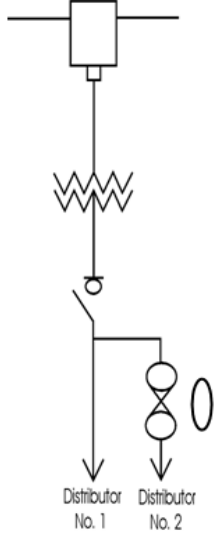
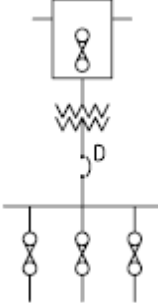
**Table 1 - List of permitted substation options**

Option No.	Substation type	Transformers <sup>1</sup>	Commercial load cycle <sup>5</sup> (Firm)	Commercial load cycle (Non-firm)	Domestic load cycle (Non-firm)	Indicative line diagram
1	Single-phase pole substation	16kVA	-	-	90A	
2	Single-phase pole substation	25kVA	-	-	150A	
3	Single-phase pole substation	63kVA	-	-	370A	
4	3-phase pole substation	25kVA	-	35A	50A	
5	3-phase pole substation	63kVA	-	90A	140A	
6	3-phase pole substation	100kVA	-	152A	200A	
7	3-phase pole substation	200kVA	-	300A	390A	
8	3-phase pole substation	400kVA	-	600A	800A	

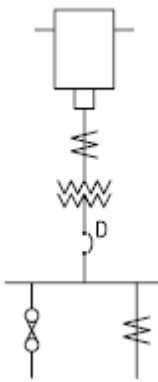
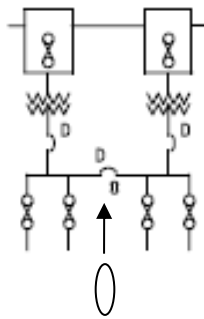
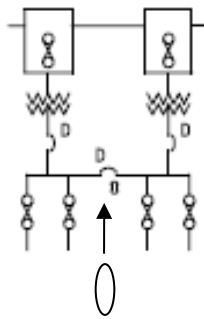
SELECTION OF DISTRIBUTION SUBSTATIONS

Option No.	Substation type	Transformers <sup>1</sup>	Commercial load cycle <sup>5</sup> (Firm)	Commercial load cycle (Non-firm)	Domestic load cycle (Non-firm)	Indicative line diagram
9	"L" Kiosk	1 x 400kVA	-	600A	800A	
10	"L" Kiosk	1 x 600kVA	-	900A	1,140A	
11	"L" Kiosk	1 x 800kVA	-	1,100A	1,470A	
12	"L" Kiosk	1 x 1000kVA	-	1,400A	-	
13	Multiple "L" Kiosks	2 x 800kVA	-	2,200A	2940A	
14	Multiple "L" Kiosks	2 x 1000kVA	-	2,800A	-	

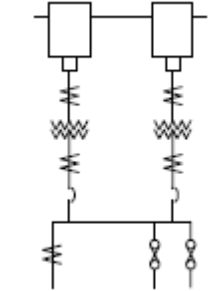
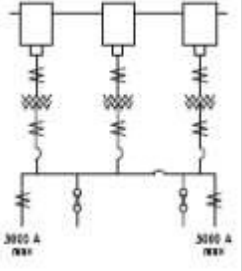
SELECTION OF DISTRIBUTION SUBSTATIONS

Option No.	Substation type	Transformers <sup>1</sup>	Commercial load cycle <sup>5</sup> (Firm)	Commercial load cycle (Non-firm)	Domestic load cycle (Non-firm)	Indicative line diagram
15	"K" Kiosk	1 x 1500kVA	-	2,000A	-	
16	Chamber substation	1 x 750kVA	-	1,100A	-	
17	Chamber substation	1 x 1000kVA	-	1,400A	1700A	

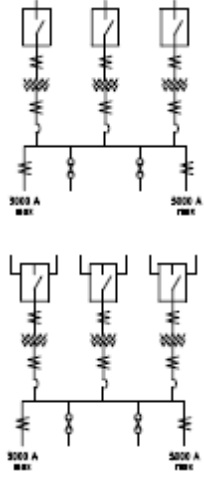
SELECTION OF DISTRIBUTION SUBSTATIONS

Option No.	Substation type	Transformers <sup>1</sup>	Commercial load cycle <sup>5</sup> (Firm)	Commercial load cycle (Non-firm)	Domestic load cycle (Non-firm)	Indicative line diagram
18	Chamber substation	1 x 1500kVA	-	2,000A	-	
19	Chamber substation	2 x 750kVA	1,400A	2,100A	2,550A	
20	Chamber substation	2 x 1000kVA	1,900A	2,800A	3,400A	

SELECTION OF DISTRIBUTION SUBSTATIONS

Option No.	Substation type	Transformers <sup>1</sup>	Commercial load cycle <sup>5</sup> (Firm)	Commercial load cycle (Non-firm)	Domestic load cycle (Non-firm)	Indicative line diagram
21	Chamber substation	2 x 1500kVA	2,900A	4,200A	-	
22	Chamber substation	2 x 1500kVA dry type	-	2,000A summer 2,200A winter	-	
23	Chamber substation	3 x 1500kVA	5,500A	6,000A	-	
24	Chamber substation	3 x 1500kVA dry type	-	4,200A summer 5,500A winter	-	

SELECTION OF DISTRIBUTION SUBSTATIONS

Option No.	Substation type	Transformers <sup>1</sup>	Commercial load cycle <sup>5</sup> (Firm)	Commercial load cycle (Non-firm)	Domestic load cycle (Non-firm)	Indicative line diagram
25	Sydney City CBD substation	3 x 750kVA	2,700A	-	-	
26	Sydney City CBD substation	3 x 1500kVA	5,000A <sup>4</sup>	-	-	
27	Sydney City CBD substation	3 x 1500kVA dry type	5,000A <sup>4</sup>	-	-	

<sup>1</sup> All substation arrangements shown are nominally 11kV/415V.

<sup>2</sup> Ratings are a guide and may be restricted by the combined ratings of the services supplied. Actual ratings will be determined by Ausgrid and are affected by factors including the equipment installed, protection requirements and ventilation limitations.


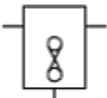
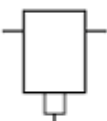







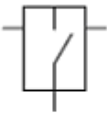

<sup>3</sup> The type of high voltage switchgear installed will depend on the transformer rating, the type of substation and whether the substation is supplied from a closed or radial network system.

<sup>4</sup> 3 x 1500kVA Sydney CBD substation ratings are indicative only and are limited by protection settings.

<sup>5</sup> In the case of multiple transformer substations, the firm ratings given are based on one transformer out of service.

### Annexure A: Distribution Substation Options – Symbols

The following table lists distribution substation options that are currently permitted to be connected to 11kV three-phase systems, subject to application limitations indicated in the table, the notes following the table, and application limitations contained in other Network Standards.

Symbols	
	Fuse: 11kV or LV
	11kV ring main fuse switch unit
	11kV ring main circuit breaker unit
	Transformer 11kV/ 415V nominal
	Low voltage link
	Low voltage air circuit breaker
	Low voltage disconnect
	Interpact switch disconnect (K kiosk only)
	Current transformer
	Isolating and earthing switch (City System only)
	3-way isolating and earthing switch (City System only)
	Circuit-breaker