Northpower Electricity Network Standard

Voltage Drop Determination

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Document Purpose

This standard details Northpower's requirements for Voltage Drop Determination

1. Introduction

This standard details Northpowers requirements for Voltage Drop Determination. This document contains instructions relating to Design parameters, regarding allowances for positive and negative voltage variation above 6%. Additionally contains information on methods and methodology for calculating voltage drop, and interpretation of regulation.

2. References

Reference	Details
ENS 03.01.095	Overhead and Underground Distribution - Conductor and Cable
ENS 03.04.025	Transformer Selection
AS/NZS 3000 Electrical Installations (Wiring Rules)	Section 3.6 Voltage Drop
NZ Electrical Code of Practice 28	Selection and Installation of Cables
Electricity (Safety) Regulations 2010	Section 28 Voltage supply to installations
Electricity Act 1992	Part 1 Sect 2 Interpretation
2Y118s1	Voltage Drop Limit

3. Methodology

Based on the expected load, the proposed design must meet or better voltage drop specified. Voltage drop must meet the customer's and regulatory requirements. The design includes:

(a) Line/cable route
(b) Conductor type and size
(c) Number of phases
(d) Transformer location and size

The expected load characteristics may include the following:

(a) Diversity
(b) Distribution
(c) Planned or stage development
(d) Demand side management
(e) Time of use tariffs
(f) Load balancing across phases

4. Interpretation of Regulations and Standards

Electrical (Safety) Regulations Section 28 voltage supply to installations

- Installations operating between 200 volts AC and 250 volts AC must be a standard low voltage 230 volts AC and except for momentary fluctuation must be kept within 6% (measured at the point of supply)
- Installation operating at other than standard low voltage, the voltage must be agreed between the customer and the retailer or unless otherwise has maintained except for momentary fluctuation within 6% of the agreed supply voltage.

AS/NZS 3000 Electrical Installations Section 3.6 Voltage Drop

- The voltage drop between the point of supply and any point in the installation shall not exceed 5% unless the installation is specifically designed to operate at reduced voltage.

The point of supply is the point on the boundary where the exclusive (low voltage) fittings enter the property. Refer to the Electricity act 1992 Part 1 Section 2 Subsection 3.

5. Northpower Design Parameters

5.1. High Voltage Network

Northpower's LV voltage variation is based on a maximum voltage drop in the HV distribution network of 6%.

Distribution transformer no load voltage will be tapped nearest to 240 volts. 11 kV lines and the transformer will account for voltage variance between 230 volts and maximum voltage of 243.8 Volts.

5.2. Low voltage Network from the Transformer to the Point of Supply

Design shall allow for the positive and negative 6% voltage variation between 243.8 Volts (maximum) and 216.2 Volts (minimum).

Subdivision reticulation design should allow no more than 6% volt drop between the transformer terminals and each installation's point of supply. Refer to drawing 2Y118s1 Voltage Drop Limit. Rural lifestyle subdivision design should account for a domestic supply on all likely building sites utilising conductor no larger than 95mm^2 Aluminium cable. Similarly, urban subdivisions should assume a service cable of 16mm^2 copper.

5.3. Service Cable beyond the Point of Supply

Design should allow for a 5% volt drop, generally Northpower designs for 3% in the service main and 2% within the installation. Refer to drawing 2Y118s1 Voltage Drop Limit.

In cases where 230 volt (1, 2 or 3 phase) service mains are supplied directly from a transformer the design may allow for a maximum of 7% volt drop (5% in service main and 2% within installation). Efforts should be taken to check that the transformer position is unlikely to alter in this case.

The "Maximum Volt Drop for Service Main Cables" chart attached (Appendix A Maximum Volt Drop for Service Cables) may be used for determining the above.

When electric motors are installed also refer to Appendix B Service Lines Serving Motive Power on its Own.

Further consideration should be given to reducing the allowable service main volt drop where the installation's mains are in excess of 10 metres.

6. Standard Domestic Loading

Refer to ENS 03.04.025 Transformer Selection Appendix A Transformer Size selection.

7. Balancing

3 phase, 400v systems, with more than 3 dwellings connected to a common neutral may be assumed as a balanced load in the common portion of line for the purpose of voltage drop calculation. All other domestic situations should assume an unbalanced load evenly distributed over the phases available.

8. Methods

Methods of calculating voltage drop can be either:-

(a) Mathematical calculation (line computer modelling).
(b) Charts and data (see Appendix A Maximum Volt Drop for Service Cables).

9. Documentation

Where an electrical installation is being designed to exceed 6% voltage drop between the supply transformer and the meter station, the calculated voltage, expected maximum load, point of measuring and details of limitations on voltage sensitive equipment shall be recorded on (or attached to) the installation's Certificate of Compliance. The owner of the installation shall be consulted and advised of the limitations. This should also be documented.

Appendix A: Maximum Volt Drop for Service Main Cables

3 Phase House - Based on 21A/ph Unbalanced

	3% Volt Drop	6% Volt Drop
10mm² N/sc	Max. 77m	155m
16mm² N/sc	122m	244m
25mm² N/sc	187m	373m
50mm² A1 Kutu u/g	198m	397m
70mm² A1Rango u/g	265m	529m
100mm² A1 Beetle u/g	349m	698m

2 Phase House - Based on 32A/ph Unbalanced

	3% Volt Drop	6% Volt Drop
10mm² N/sc	Max. 52m	103m
16mm² N/sc	81m	163m
25mm² N/sc	124m	249m
50mm² A1 Kutu u/g	132m	265m
70mm² A1Rango u/g	176m	353m
100mm² A1 Beetle u/g	233m	465m

1 Phase House - Based on 65 A

	3% Volt Drop	6% Volt Drop
10mm² N/sc	Max. 26m	52m
16mm² N/sc	41m	81m
25mm² N/sc	62m	124m
50mm² A1 Kutu u/g	66m	132m
70mm² A1Rango u/g	88m	176m
100mm² A1 Beetle u/g	116m	233m

Appendix B: Service Lines Serving Motive Power on its Own

Note: Check that transformer fuses are not blown at starting in case of larger motors.

Max. Distances in Metres for Conductors

H.P.	Type	Amps	(16mm²) 7,064	Gopher ACSR	Ferret ACSR	Kutu A.A.
½	1ø 2W	3.5	342	342	503	624
	1ø 3W	2.0	113	113	-	-
	3ø 4W	1.2	1,810	1,810	-	-
¾	1ø 2W	4.8	241	241	362	443
	1ø 3W	3.0	-	764	-	-
	3ø 4W	1.7	1,408	1,408	-	-
1	1ø 2W	6.2	181	181	282	362
	1ø 3W	4.0	624	583	885	1,106
	3ø 4W	2.0	1,207	1,207	-	-
1½	2ø 3W	5.7	422	402	624	785
	3ø 4W	2.8	865	865	-	-
2	2ø 3W	7.0	342	342	503	624
	3ø 4W	3.5	704	704	1,046	1,308
2½	2ø 3W	8.2	282	262	402	503
	3ø 4W	4.3	563	563	845	905
3	3ø 4W	5.0	483	483	724	785
5	3ø 4W	8.0	302	302	462	503
7.5	3ø 4W	12	201	201	302	322
10	3ø 4W	15	161	161	241	262