

Electricity Policy Document 281

Issue 5 November 2022

Distribution System Design – 33kV Network



Amendment Summary

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1 Introduction

The general principles contained within this Electricity Policy Document (EPD) shall be applied to all new work on the 33kV network (Network) owned and operated by Electricity North West Limited (Electricity North West). The decision as to whether existing systems shall be brought into line with this EPD when reinforcements or material alterations are carried out (including asset replacement work and new connections) will depend on individual circumstances and each case shall be actively considered.

This document is one of the following suite of documents relating to Network Design.

EPD279	-	Distribution System Design – General Requirements
EPD280	-	Distribution System Design – 132kV Network
EPD281	-	Distribution System Design – 33kV Network
EPD282	-	Distribution System Design – 11/6.6kV Network
EPD283	-	Distribution System Design – Low Voltage Network

This document shall be read in conjunction with EPD279.

2 Scope

This document describes the general distribution network design principles, at 33kV, that shall be used by the service provider Electricity North West Limited (Electricity North West) staff and any third-party connector. It will assist network designers in discharging their responsibilities for compliance with The Electricity Safety, Quality and Continuity Regulations 2002, Electricity Distribution Licence – Condition 5, The Distribution Code and appropriate safety legislation. Additional information and guidance are available, in Code of Practice 281, to staff and contractors employed by Electricity North West Limited.

3 Definitions

CP	Code of Practice
EPD	Electricity Policy Document
ES	Engineering Specification
PES	Public Electricity Supplier
Primary Substation	33/11kV or 33/6.6kV Substation

4 33kV System and Primary Substations

4.1 General

Full use shall be made of supervisory switching to restore supplies under fault outage conditions.

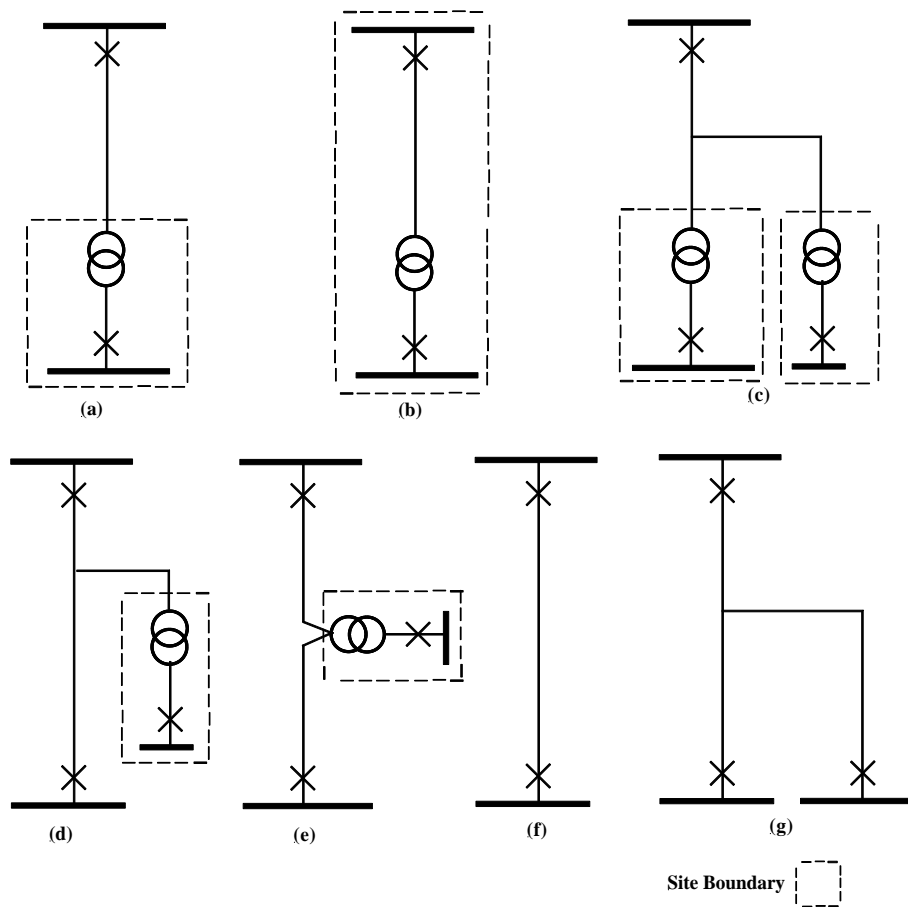
Circuit & transformer loading shall be obtained from the Feeder Load Analysis system.

4.2 Network Development

The approved Network configurations shall be as shown in Figure 1 with primary substations designed on the feeder transformer principle. No other arrangement shall be installed without the agreement, in writing, of the Network Planning Policy Manager, Electricity North West Limited.

The protection arrangements for the network configurations shown in [Figure 1](#) are provided in ES312 - 36kV Single Busbar Indoor Switchgear (Cable Connected).

Figure 1



A sample network, utilising all the above arrangements is shown in [Figure A - Appendix A](#) and [Figure B - Appendix B](#).

4.3 Voltage Step Change and Voltage Collapse

The Network shall be designed to limit voltage step changes and to avoid voltage collapse. Reference shall be made to EPD279, subsection 4.6.7.

4.4 Network Extensions and Alterations

Extensions to the Network shall be designed on the feeder transformer principle. Closed ring or mesh arrangements, which enable load transfers between supply points to increase firm capacity and increase plant utilisation, shall be considered only if they can be supported by an acceptable cost benefit analysis.

Extensions and alterations to the Network shall take account of the existing protection arrangements and shall not degrade system performance.

The following restrictions shall be applied to Network extensions and alterations`:

- (a) No item of equipment shall have isolating facilities at more than four different sites.
- (b) Under normal running arrangements the normal operating procedure for making dead any 33kV circuit shall not require the opening of more than seven circuit breakers.

4.5 Substations and Security of Demand

- 4.5.1 Primary substations shall be designed in accordance with current Electricity North West Limited practice.
- 4.5.2 33kV switchgear shall generally be suitable for indoor installation.
- 4.5.3 Normally each primary substation shall be designed to accommodate up to two transformers of 23MVA peak capacity, or, where justified, 32MVA or 38MVA peak capacity. A single transformer installation may be appropriate initially, preferably operating in parallel with an adjacent primary substation over the 11/6.6kV network.
- 4.5.4 Only in exceptional circumstances, e.g. high-density load or for customers with large loads, shall new primary substations be designed for more than 2 transformers.
- 4.5.5 Where more than two transformers are to be operated normally in parallel with each other, consideration shall be given to the capability of the stranded copper earth screens of cables to carry the possible earth-fault currents.
- 4.5.6 Single transformer sites shall be installed only if requirements for capacity after a first circuit outage can be met. Consideration shall also be given to maintenance requirements.
- 4.5.7 The approved transformer arrangements are as shown in [Figure C1](#) and [Figure C2 - Appendix C](#).
- 4.5.8 For teed arrangements supplying sites with two (or three) transformers Substation Types C and F shall be the preferred options.
- 4.5.9 For teed arrangements supplying sites with a single transformer (as described in subsection 4.5.3) Substation Types B and E shall be the preferred options.
- 4.5.10 Only combinations of the arrangements shown in [Appendix C](#) shall be used to construct two and three transformer sites.

4.6 Cables & Lines

New 33kV underground or overhead feeder circuits shall be designed to one of the following standards unless special circumstances apply e.g. a high load factor: -

- (a) Where there is no expected increase in capacity, feeder transformer circuit ratings shall match the required transformer emergency rating.
- (b) Feeders that may be used for interconnection, mesh circuits or for a possible increase in transformer capacity shall be rated at 38 MVA (or nearest equivalent) regardless of the method of installation or the proximity to other circuits and services.
- (c) For special circumstances guidance shall be sought from the Network Planning Policy Manager.

Where two underground circuits are to be laid to one substation along a common route then they may be laid in the same trench. If a third circuit is required to a substation or a mutually dependent group, then it shall be laid on an independent route if economically practical. Where cables are particularly exposed to common mode failure, e.g. on cable bridges, to which the public has access, a risk assessment shall consider the need for independent routes or additional mechanical protection.

Consideration shall be given to circuit de-rating when two high load factor circuits run together.

4.7 Protection

Protection of the 33kV system shall be in accordance with EPD350 – Protection for 132kV, 33kV and 11kV Systems.

Standard diagrams in use by Electricity North West Limited are included in ES312 – 36kV Single Busbar Indoor Switchgear (Cable Connected).

The protection to be applied to automatic reclosing circuit breakers controlling overhead lines shall be as described in EPD321 - Automatic Reclosing of Overhead Lines.

New 33kV underground cables shall have pilot circuits laid with them or provision (e.g., ducts and pits) made for the future installation of pilot cables. The design of such duct and pit installation shall take account of any need of telecommunication cables, either operational or non-operational, on the same route. The pilot cable shall be installed at the time of the work, only if it can be utilised within the pilot system within 12 months of the proposed commissioning date of the cable. New and refurbished 33kV overhead lines may require pilot circuits to be installed with them. The specifications for such pilot circuits shall be agreed, for each individual cable or overhead line, with the Protection Policy Manager.

5 Documents Referenced

DOCUMENTS REFERENCED	
Non-Electricity North West Documents	
The following documents, legislation, national standards and ENA publications, cannot be supplied by Electricity North West Limited to persons outside those companies:	
Electricity Safety, Quality and Continuity Regulations 2002	
Grid Code	
The NGET Connection and Use of System Code	
ENA ER P1/3	275/33kV, 132/33kV and 132/11kV Supply Point Transformers
ENA ER P2/7	Security of Supply
ENA ER P18	Complexity of 132kV Circuits
Electricity North West Limited Published Documents	
The following documents are available from Electricity North West Limited:	
The Distribution Code	
Electricity Distribution Licence	
EPD279	Distribution System Design – General Requirements
EPD280	Distribution System Design – 132kV Network
EPD282	Distribution System Design – 11/6.6kV Network
EPD283	Distribution System Design – Low Voltage Network
EPD321	Automatic Reclosing of Overhead Lines
EPD350	Protection for 132kV, 33kV and 11kV Systems
ES312	36kV Single Busbar Indoor Switchgear (Cable Connected)
The following document is available to Electricity North West Limited staff:	
CP281	Distribution System Design - 33kV Networks

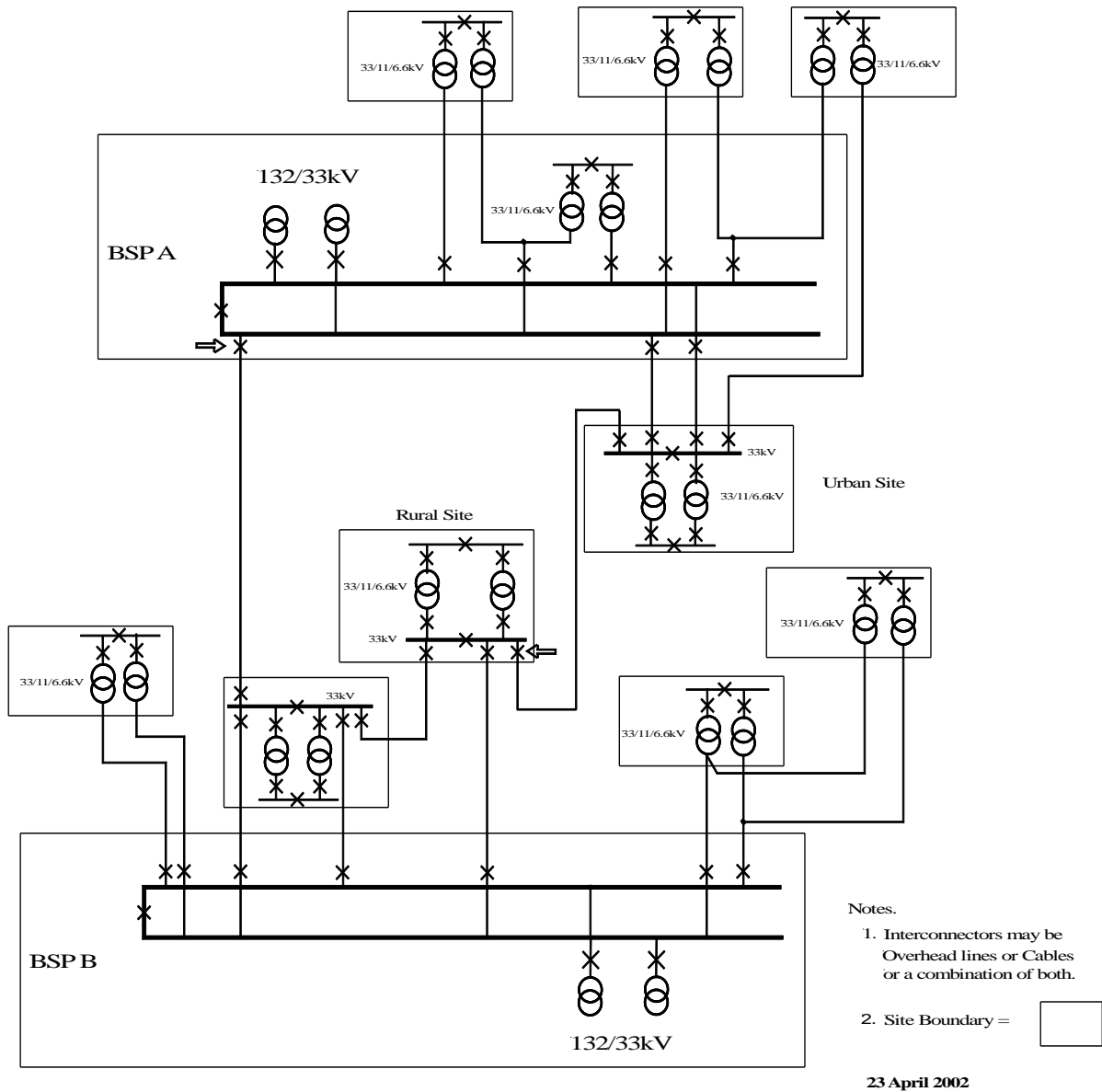
6 Keywords

Design; Network; Planning; Policy; System; 33kV

Appendix A

Figure A – Typical 33kV Network Configuration

Typical 33kV Network Configuration

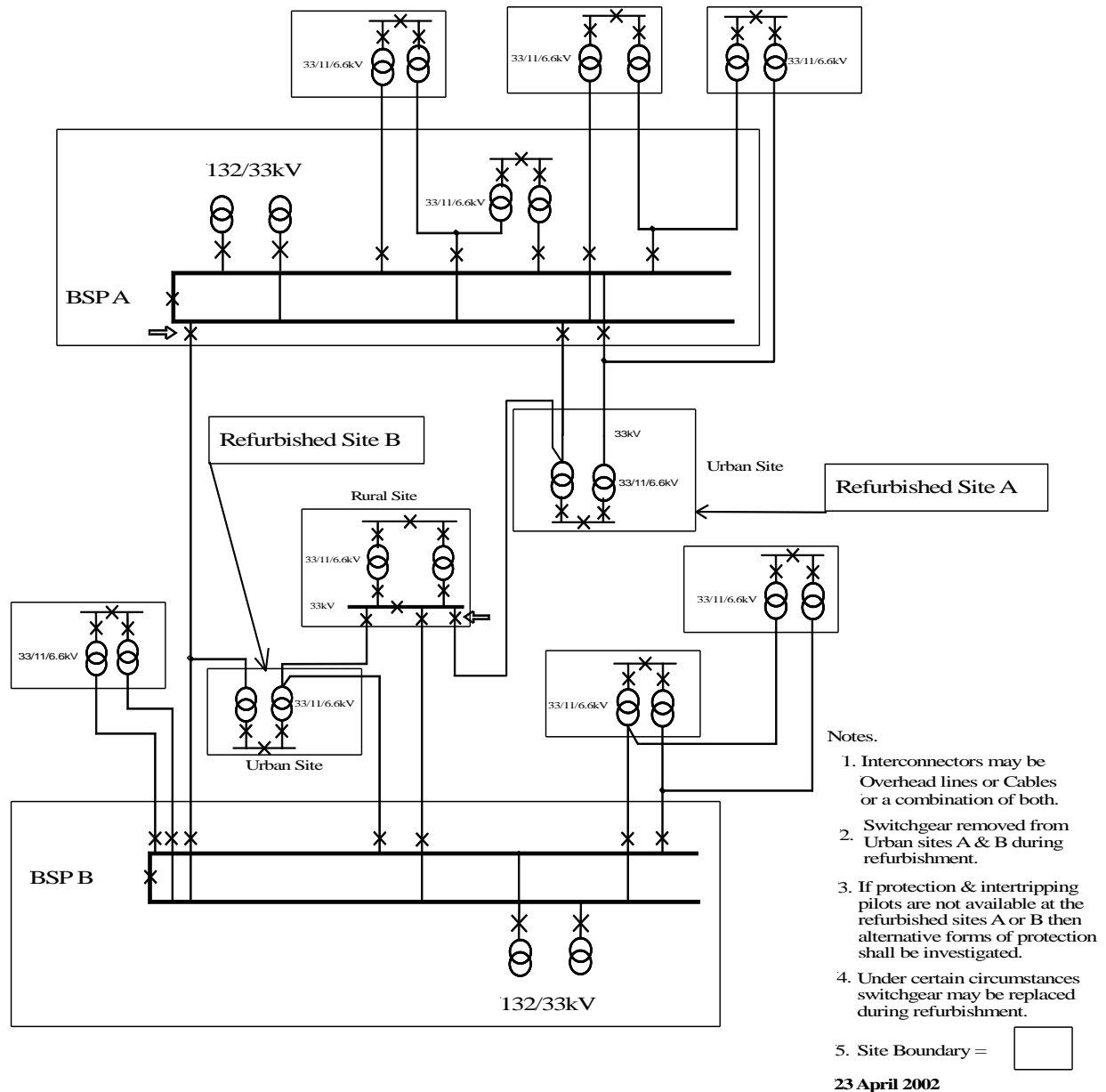


(Compare with [Figure B](#) – Appendix B for the network configuration after refurbishment)

Appendix B

Figure B – Typical 33kV Network Configuration

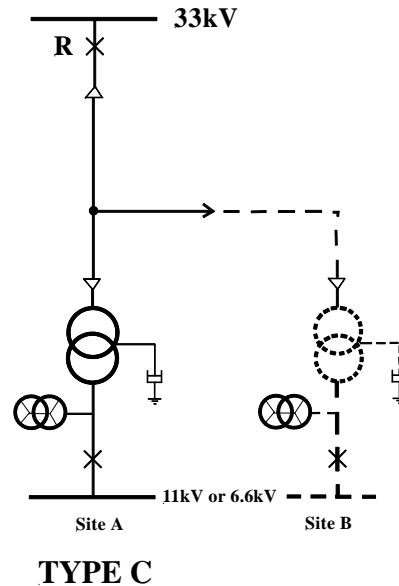
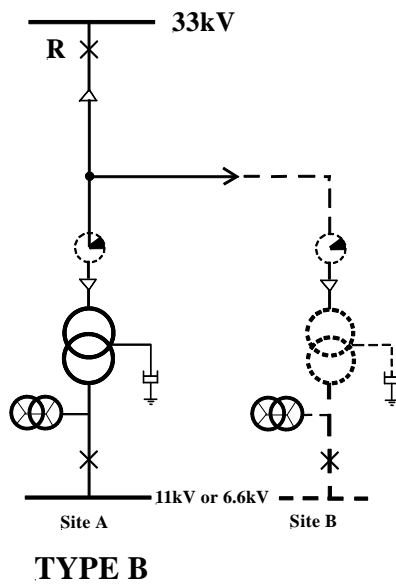
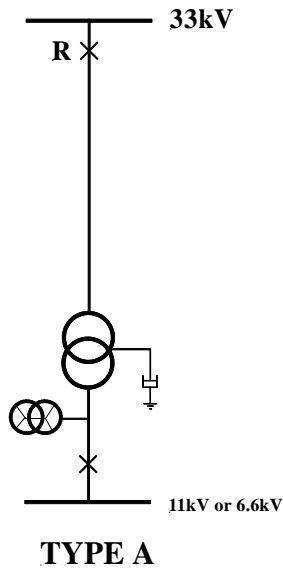
Typical 33kV Network Configuration Showing switchgear reduction at refurbished sites



Appendix C

Figure C1 – 33kV Circuit with Intertripping

APPROVED 33/11/6.6kV TRANSFORMER ARRANGEMENTS

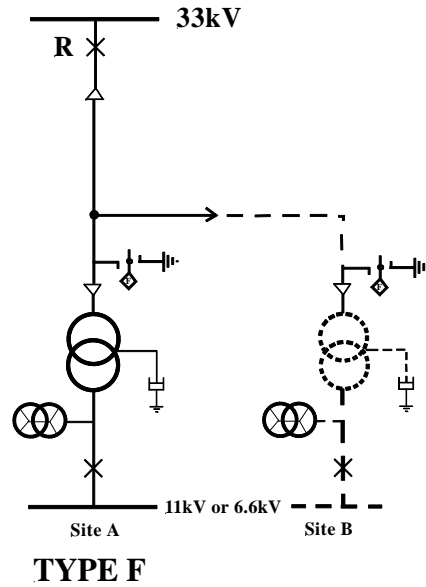
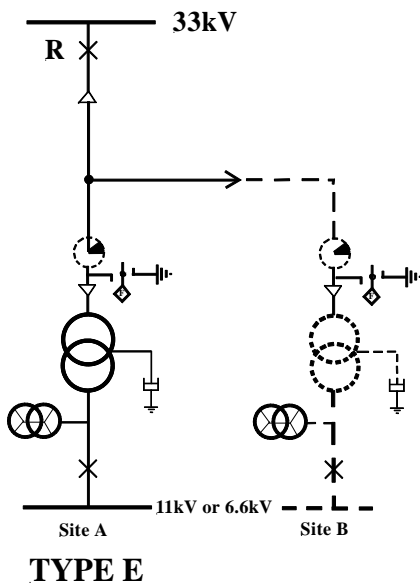
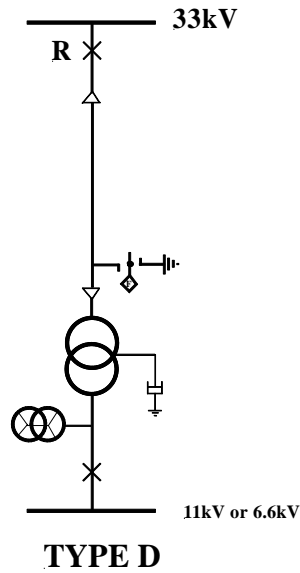


33kV Circuit With Intertripping

(overhead circuits fitted with autoreclose
at 33kV end blocked by I/T Receive)

Figure C2 – 33kV Circuit Without Intertripping

APPROVED 33/11/6.6kV TRANSFORMER ARRANGEMENTS



33kV Circuit Without Intertripping

(autoreclose fitted at 33kV end)

