



## **Electricity Specification 217**

**Issue 3**

**May 2020**

## **33kV Connection up to 90MVA**

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### **Approved for issue by the Policy Approval Panel**

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### Issue and Amendment Summary

Amendment No. Date	Brief Description and Amending Action
0  31/03/03	<p>Issue 1</p> <p>First Issue.</p> <p>Prepared by: P. Leather. <span style="float: right;">Authorised by: Paul Whittaker Policy &amp; Standards Manager:</span></p>
1  27/07/07	<p>Issue 1</p> <p>Reference to ES366 and the requirement for customer to provide substation LV supply added.</p> <p>Prepared by: Peter Leather</p> <p>Approved by the Technical Policy Panel and signed on its behalf by Simon Rushton:</p>
0  19/12/07	<p>Issue 2</p> <p>Company name changed to “Electricity North West Limited”. Requirements for the provision of pilot circuits modified.</p> <p>Prepared by: Peter Leather</p> <p>Approved by the Technical Policy Panel and signed on its behalf by Simon Rushton:</p>
1  13/01/10	<p>Issue 2</p> <p>Addition of connection arrangement: single circuit via a composite switchboard. Other minor clarifications. Appendix A diagrams redrawn.</p> <p>Prepared by: Peter Leather</p> <p>Approved by the Technical Policy Panel and signed on its behalf by Simon Rushton:</p>
2  04/08/11	<p>Issue 2</p> <p>New subsection 3.8 inserted; emergency tripping. Also provision of DC supplies expanded - now subsection 3.9.</p> <p>Prepared by: Peter Leather</p> <p>Approved by the Technical Policy Panel and signed on its behalf by Paul Whittaker:</p>

<p>0</p> <p>29/05/20</p>	<p>Issue 3</p> <p>General update including company name changes and latest template.</p> <p>Requirement to segregate ENWL switchgear for composite switchboards added in sections 3.1.3.4 and 3.13.8.</p> <p>Prepared by: Peter Twomey</p> <p>Approved by the Policy Approval Panel and signed on its behalf by Paul Turner.</p>
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## 33kV CONNECTION UP TO 90MVA

### 1. SCOPE

This Specification details the requirements of a connection of industrial and large commercial Users with a maximum supply capacity of 90MVA directly connected to the 33kV electricity distribution network (Network) owned and operated by Electricity North West Limited (Electricity North West), that connection being intended to be adopted by Electricity North West. It may be appropriate to provide connections of up to 15MVA capacity in accordance with Electricity Specification (ES)216.

This document shall be read in conjunction with ES210.

### 2. GENERAL

Any variation to this specification shall be agreed, in writing, with the Design and Construction Manager, Electricity Connections, Electricity North West prior to any design being accepted.

The Owner's Works shall comply with the requirements of ES210.

It is a requirement that all work shall be carried out strictly in accordance with the provisions of all relevant legislation and industry best practice.

The Owner's Works shall comply in all respects with the provisions of Regulations 3 (1), 6, 7, 8 (1), 8 (3), 9, 10, 12 to 14 and 17 to 22 of the Electricity Safety, Quality and Continuity Regulations 2002 and with the Electricity at Work Regulations 1989.

Users shall be supplied and metered at a nominal 33kV, 11kV or 6.6kV.

With any single circuit arrangement, the agreed supply capacity shall not be considered to be firm; interruptions caused by faults may not be restorable until repairs have been completed. Users shall be made aware of this.

New 33kV underground cables shall have pilot circuits laid with them or provision (eg, ducts and pits) made for the future installation of pilot cables. New and refurbished 33kV overhead lines may require pilot circuits to be installed with them. The specifications for such pilot circuits, which may be required for protection, monitoring, control or other communications, shall be agreed, for each individual cable or overhead line, with Primary Project Management, Electricity Connections, Electricity North West (PPM).

The design of the connection shall meet the following system requirements:

Maximum Fault Levels on the Network are:

33kV = 1000MVA

11kV and 6.6kV = 250MVA

The minimum short circuit ratings shall be:

33kV = 17.5kA for 3 second

11kV = 13.1kA for 3 seconds

6.6kV = 21.9kA for 3 seconds

The maximum earth fault current is as follows:

33kV = 3500 Amps.

The maximum earth fault current for both the 11kV and 6.6kV electricity distribution network is 3300A, based on connection to a primary substation, with three transformers operating in parallel.

The minimum impulse withstand levels for new equipment connected to the 33kV Network is 170kV and for the 11kV and 6.6kV Networks 75kV.

In particular, the rating of any switchgear and fusegear, forming part of any new connection, must be fully compatible with all the system parameters, as set out in this clause.

### 3. CONNECTION ARRANGEMENTS

3.1 The connection provided from an Electricity North West Primary 33kV substation may be either direct at 33kV or via a 33/11kV or 33/6.6kV transformer and be one of the following arrangements:

3.1.1. Dedicated User connection at 33kV from a BSP or Primary substation – an example of this arrangement is shown in Figure A1 in Appendix A.

3.1.1.1 The maximum load, which is subject to the existing loading on the Network, supplied from a single 33kV feeder shall not exceed 45 MVA. If the Network permits a second 33kV feeder, the capacity may be increased to 90MVA.

3.1.1.2 The exit point shall be the outgoing terminals of the Electricity North West circuit breaker.

3.1.1.3 A User's emergency trip facility shall be provided with this type of connection. The trip facility shall operate the Electricity North West circuit breaker(s).

3.1.2 Dedicated User Tee connection from the 33kV network – an example of this arrangement is shown in Figure A2 in Appendix A.

3.1.2.1 The maximum load, which is subject to the existing loading on the Network, supplied from a single 33kV tee arrangement shall not exceed 36 MVA.

3.1.2.2 The exit point shall be the outgoing terminals of the Electricity North West circuit breaker or isolator arrangement.

3.1.2.3 A User's emergency trip facility shall be provided with this type of connection. The trip facility shall operate the Electricity North West owned circuit breaker.

3.1.3 Dedicated User Tee connection from the 33kV Network with User's circuit breaker as part of a composite switchboard – an example of this arrangement is shown in Figure A3 in Appendix A.

3.1.3.1 The maximum load, which is subject to the existing loading on the Network, supplied from a single 33kV tee arrangement shall not exceed 36 MVA.

3.1.3.2 The exit point shall be the busbar bolted connections between Electricity North West's circuit breaker(s) and the User's circuit breaker(s).

3.1.3.3 A User's emergency trip facility shall be provided with this type of connection. The trip facility shall operate the Electricity North West circuit breaker.

- 3.1.3.4 Switchgear owned by Electricity North West shall be physically segregated from the User's switchgear as described in subsection 3.13.8 of this document.
- 3.1.4 Dedicated User connection at 11kV via a transformer connected to an Electricity North West 33kV primary substation - an example of this arrangement is shown in Figure A4 in Appendix A.
- 3.1.4.1 The maximum load, which is subject to the existing loading on the Network, supplied from a single 33/11kV transformer shall not exceed 29 MVA. If the Network permits a second 33/11kV transformer then the capacity may be increased to 58MVA.
- 3.1.4.2 The exit point shall be the outgoing terminals of the final Electricity North West 11kV circuit breaker.
- 3.1.4.3 A User's emergency trip facility shall be provided with this type of connection. The trip facility shall operate the final Electricity North West circuit breaker(s).
- 3.1.5 Shared User connection at 11kV or 6.6kV via a transformer connected to an Electricity North West primary substation - an example of this arrangement is shown in Figure A5 in Appendix A.
- 3.1.5.1 The maximum load, which is subject to the existing loading on the Network, supplied from a single 33/11kV or 6.6kV transformer shall not exceed 20MVA.
- 3.1.5.2 The exit point shall be the outgoing terminals of the final Electricity North West owned circuit breaker.
- 3.1.5.3 The substation shall be designed to accommodate a second transformer.
- 3.1.5.4 Electricity North West may make a financial contribution to this type of connection arrangement.

### 3.2 Environmental Conditions

- 3.2.1 The equipment shall be designed and constructed to allow operation in environments defined in Clause 6 of BS EN 60947-1 as follows:
- 3.2.1.1 Equipment that is housed in a controlled environment shall be suitable for operation in Pollution Degree 2.
- 3.2.1.2 Equipment that is not housed in a controlled environment shall be suitable for operation in Pollution Degree 3.
- 3.2.2 All equipment shall be protected from the deposit of excessive levels of dust and from the influx of water or other substances liable to have a harmful effect.

### 3.3 Demarcation of Responsibilities

- 3.3.1 Every connection agreement shall include a Site Responsibility Schedule.
- 3.3.2 In completing and agreeing a Site Responsibility Schedule, particular attention shall be given to auxiliary facilities, including LV supplies, and batteries and battery chargers.

### 3.4 Overhead Lines

Overhead lines shall be designed and constructed in accordance with ES400O3 or ES400O2. The conductor cross section selected for any particular installation shall be compatible with the load to be supplied and the system short circuit level.



### 3.5 Cables

3.5.1 33kV cable to be used shall be in accordance with ES400C10.

No other type or cross-section of cable is permitted.

3.5.2 11/6.6 kV cable to be used shall be 95 or 300 mm<sup>2</sup> Triplex formation single core 'quasi – dry design' polymeric insulated with solid aluminium conductors in accordance with ES400C9.

No other types or cross section of cable is permitted.

3.5.3 The conductor cross section selected for any particular installation shall be compatible with the load to be supplied and the system short circuit level. Where the 11/6.6kV point of connection is to a single transformer or two transformer groups, the single core cable earth screen shall, as a minimum, carry the fault current detailed in BS 7870, Section 4.10 without sustaining damage.

### 3.6 Earthing conditions

All installations are to comply with Electricity Policy Document (EPD)333 and shall be discussed and agreed with PPM prior to the formal submission of an 'Outline Plan of Works' as described in ES210.

### 3.7 Cable installation and jointing

3.7.1 The installation and jointing of underground cables shall comply with the relevant parts of ES400E4 and ES400E5. Jointing systems employed shall be compatible with the cable used and type test evidence shall be available to demonstrate that the performance of the complete system of cable and joints is appropriate for the service duty for which the system is installed.

3.7.2 Core crosses or rolls required for circuit phasing purposes in 3 core cables shall be accommodated within underground cable joints, not in cable boxes.

3.7.3 Small wiring shall be ferruled in accordance with ENA TS 50-19.

### 3.8 Emergency Tripping

3.8.1 Where it is necessary to open an Electricity North West circuit breaker, in order to make the User's equipment dead (or in such other cases as it may be required by the Health and Safety Executive), a suitably protected device to afford the customer with an emergency trip push-button shall be provided and maintained by Electricity North West. This device shall be located on the customer's premises in an accessible position as close as possible to the supply terminals. The device shall be clearly labelled "FOR EMERGENCY USE ONLY".

3.8.2 The customer's emergency trip push button shall be of key reset type, with red button and with full guard against inadvertent operation.

3.8.3 Where the customer's emergency trip push-button is to provide DC tripping of more than one circuit breaker, the push-button shall be equipped with an independent pair of normally open contacts for each circuit breaker to be operated.

### 3.9 Protection & Substation Control

3.9.1 The type of protection and control systems to be applied shall be discussed and agreed with PPM prior to the formal submission of an 'Outline Plan of Works' as described in ES210.

3.9.2 All protection systems shall comply with EPD350 and ES396.

- 3.9.3 Protection settings and automation and control timings shall be agreed with Electricity North West prior to final commissioning.
- 3.9.4 Control and relay panels shall comply with ES337.
- 3.9.5 Protection and control wiring, including the wiring for the emergency trip facility, shall not be run in the same trunking or conduits as **User's** wiring.
- 3.9.6 Where both Electricity North West and the customer require a DC supply for protection or control purposes, the parties may agree that only one battery is necessary, for the purposes of both. In that case, Electricity North West will provide the necessary battery and charger and be responsible for their monitoring and maintenance. The low voltage (240V) supply to the charger will be derived from the permanent wiring installation within the substation. It is normally expected that this supply will be provided from the customer's electrical installation. In any particular case, all these responsibilities shall be set out in the Site Responsibility Schedule.

Note: Electricity North West may provide a fused supply from the battery at the request of the customer, provided that DC circuits are not extended outside the site boundary, that the drain imposed on the battery by customer's equipment is fixed and specifically agreed, and that the battery charger is fitted with an alarm connected to the Electricity North West's telecontrol system (where connected). However, Electricity North West will recover any costs associated with a failure of the battery charger as a result of any failure on the customer's system.

### 3.10 Cable Entry to Substations

Cable entry to substations shall comply with the following criteria:

- 3.10.1 33/11/6.6kV cable entries to substations shall be made at the laying depth of the cable, using red plastic duct of at least 150 mm diameter complying with ES400D4. Cable joints are not permitted in entry ducts.
- 3.10.2 Bends in cable ducts shall be of no smaller radius than that permitted for the cable.
- 3.10.3 All entry ducts including any ducts for earth conductors shall be sealed against the ingress of gas after installation of the cable. Sealing shall be achieved in accordance with Module 38 of CP411 Part 2 - HV Jointing.

### 3.11 Routeing of cables in buildings

The following provisions apply where substations are sited within larger buildings and 33/11/6.6 kV cables, for adoption by Electricity North West, must be routed through those buildings:

- 3.11.1 Ducts for 33/11/6.6kV cables within buildings shall be at least 150mm in diameter. Where ducted cable routes change direction in buildings, draw pits at least 1.5m square shall be provided, allowing for future repair or replacement of cables. No single run of duct within a building shall exceed 25m between draw pits.
- 3.11.2 Alternatively, covered trenches may be used to route cables. On completion of cable work, cable trenches shall be filled with sand and covered with a 100mm thick screed.
- 3.11.3 Where 33/11/6.6 kV cables are fixed to racks or cleated to walls, adequate mechanical protection shall be provided.
- 3.11.4 All cables shall be securely supported. Particular consideration shall be given to the secure support of cables in vertical runs.

### 3.12 33/11/6.6 kV Switchgear for adoption by Electricity North West

- 3.12.1 33kV Switchgear shall comply with ES312.
- 3.12.2 11/6.6kV switchgear shall comply with ES313.
- 3.12.3 Approval for the use of specific types of switchgear shall be obtained, in writing, from the Plant Policy Manager, Policy and Implementation, Electricity North West.
- 3.12.4 Substation, circuit and plant identification shall be as directed by PPM, prior to the commissioning of the equipment.

### 3.13 Substation Construction

- 3.13.1 All substation arrangements shall be discussed and agreed with PPM prior to the formal submission of an 'Outline Plan of Works' as described in ES210.
- 3.13.2 The design of all substations to be adopted shall comply with the requirements of Code of Practice (CP)351.
- 3.13.3 Substation designs shall ensure compliance with all relevant statutory regulations.
- 3.13.4 Buildings shall be of sufficient dimensions that the switchgear is capable of safe operation, inspection and maintenance. Substation doors and any access doors or gates shall always open outwards and access to substations (including if appropriate access within buildings) shall be such that rapid egress of personnel is facilitated. Locking arrangements shall comply with Electricity North West requirements, to be agreed with PPM.
- 3.13.5 Substations shall be accessible by personnel authorised by Electricity North West at all times, including out of hours, and during weekends and public holidays.
- 3.13.6 Notices and nameplates shall comply with ES356.
- 3.13.7 The substation shall be fitted with a low voltage electrical installation generally conforming with ES366, supply being provided, where necessary, by the User. The actual requirements for those parts of the substation to be occupied by Electricity North West shall be agreed, in any particular case, between the designer of the substation and Electricity North West.
- 3.13.8 Substations housing composite switchboard arrangements shall be designed and constructed such that the switchgear adopted by Electricity North West shall be physically segregated from the User's switchgear to prevent uncontrolled access to Electricity North West's switchgear. Doors providing access to the Electricity North West switchgear shall be in accordance with ES326 Substation Security Doors. Emergency egress arrangements shall be compliant with CP351 Civil Design Aspects of Primary Substations.

29/05/20

### 3.14 Metering

- 3.14.1 Metering for 33kV connection, as shown in Figure.A 1, Appendix A, shall be before the User's point of connection with the metering ct's contained within the Electricity North West 33kV circuit breaker housing. The metering vt shall have a 110V secondary winding.
- 3.14.2 Metering for 11kV or 6.6kV connection, as shown in Figs. A2 and A3, Appendix A, shall be before the User's point of connection with the metering ct's contained within the Electricity North West 11kV or 6.6kV circuit breaker housing. The metering vt shall have a 110V secondary winding.
- 3.14.3 Metering cts and vts shall comply with ES501.

3.14.4 In order to ensure the accuracy of metering, the burden of cts shall be restricted by limiting the length of multicore cables connecting the cts to the meter. The maximum permissible length of 2.5 mm<sup>2</sup> multicore cable, measured from the flange mounted cabinet multicore cable gland to the meter panel cable gland, shall not exceed 40m for 1 A and 5 A rated cts.

### **3.15 Transformers & Ancillary Equipment for adoption by Electricity North West**

3.15.1 Transformers shall be in accordance with ES323.

3.15.2 Transformer neutral earthing resistors shall comply with ES350.

3.15.3 The initial utilisation factors shall not be less than 0.6.

### **3.16 Supplier**

The Installer shall be responsible for ensuring that a Supplier is appointed on behalf on the User.

## **4. EQUIPMENT RECORDS**

The Installer shall provide records of all equipment installed, using Form C of ES210 and marked upon the latest available edition of the Ordnance Survey map for the area, at 1/500 scale with any relevant detail shown on 1/250 enlargements. Guidance on the provision of records of underground equipment may be found in ES281 - Part 6.

## **5. DOCUMENTATION**

Documentation shall be as described in ES210.

## **6. DOCUMENTS REFERENCED**

### **6.1 Regulations (Statutory Instruments)**

Electricity Safety, Quality and Continuity Regulations 2002

Electricity at Work Regulations 1989

### **6.2 Standards (British Standards and Energy Networks Association)**

BS 7870 - LV and MV Polymeric Insulated Cables for use by Distribution and Generation Utilities

BS EN 60947-1 - Specification for Low Voltage Switchgear and Control Gear

ENA TS 50-19 - Standard Numbering for Small Wiring

Note: The above standards may be obtained from the British Standards Institute or the Energy Networks Association as appropriate. They cannot be supplied by Electricity North West.

### **6.3 Electricity North West Documents**

EPD333 - Supply System Earthing

EPD350 - Protection Policy for 132kV, 33kV and 11/6.6kV Systems

CP351 - Civil Design Aspects of Primary Substations

CP411 Part 2 - HV Jointing

ES210 - General Specification for Third Party Constructed New Connections, Extensions and Alterations

ES216 - 11/6.6kV Connections of up to 9MVA (6.6kV) or 15MVA (11kV) Capacity

ES312 - 36kV Single Busbar Indoor Switchgear

ES313 - 6.6kV and 11kV Single Busbar Indoor Switchgear (Cable Connected)

ES323 - 33/11 or 6.6kV System Transformer Technical Clauses & Schedules

ES326 – Substation Security Doors

ES337 - 19” Rack Control & Relay Panels for use in BSP & Primary Substations

ES350 - Neutral Earthing Resistors at BSP & Primary Substations

ES356 - Notices & Nameplates

ES366 - Heating and Lighting Installations in Primary Substations

ES396 - Protection in Primary Substations

ES400D4 - Plastic Ducts, Conduit & Accessories

ES400C9 - 11kV Distribution Cables

ES400C10 - 33kV Distribution Cables

ES400C14 – 132kV Cables with Extruded XLPE Insulation

ES400E4 - Installation, Commissioning and Repair of Solid Type Underground Cables Operating on the LV and 6.6/11kV Systems, and the Restoration of Excavated Areas

ES400E5 - Installation, Commissioning and Repair of Underground Cables Operating at 33kV and 132kV, and the Restoration of Excavated Areas

ES400O2 - Overhead Lines of Compact Covered Construction for 6.6, 11 and 33kV

ES400O3 - Bare-wire Overhead Lines on Wood Poles

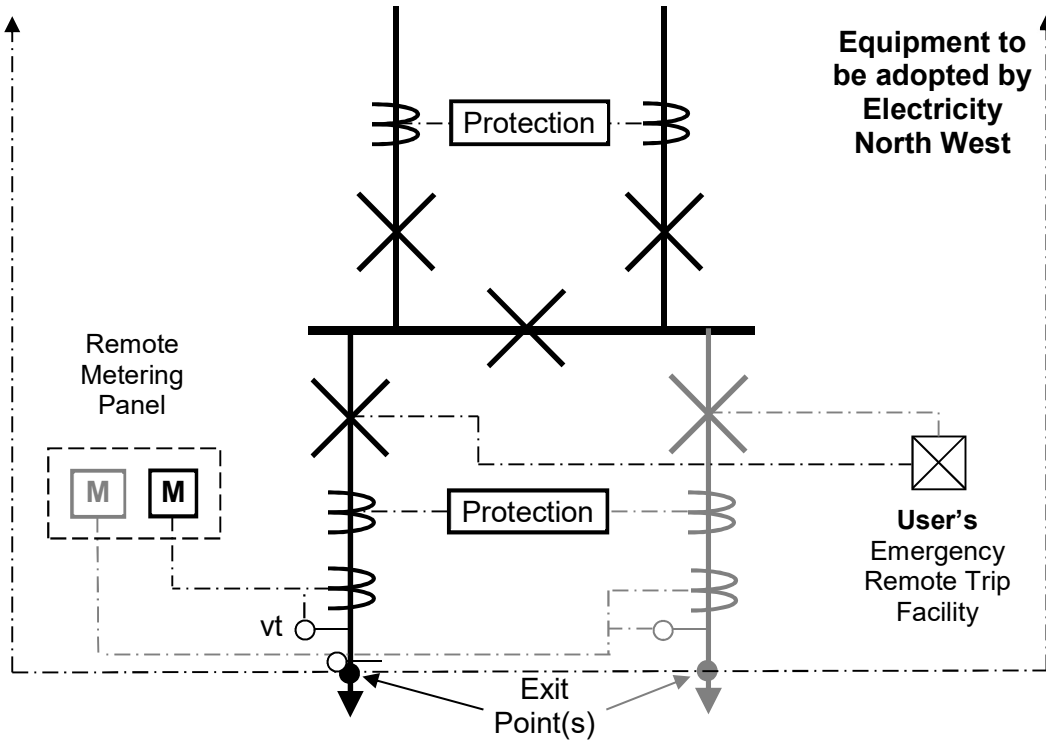
ES501 - Metering Current & Voltage Transformers

“Guide for Recording Underground Assets - Electricity”

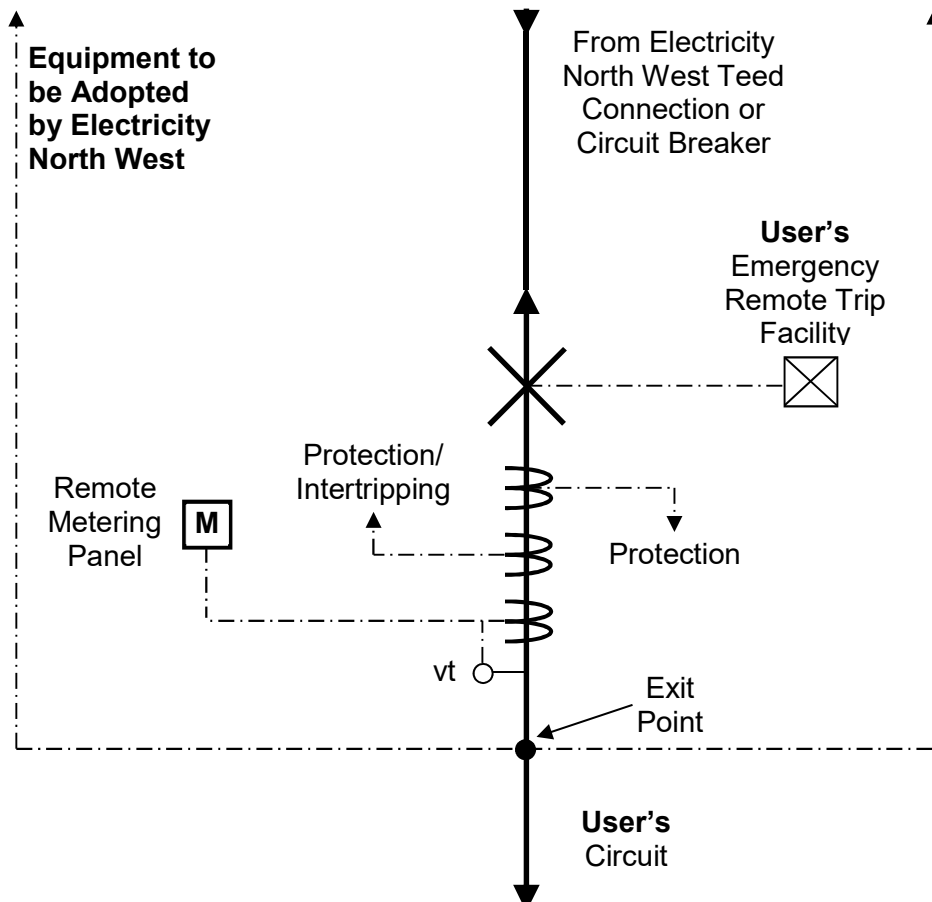
## 7. KEYWORDS

Substation; third party; connection;

**APPENDIX A**

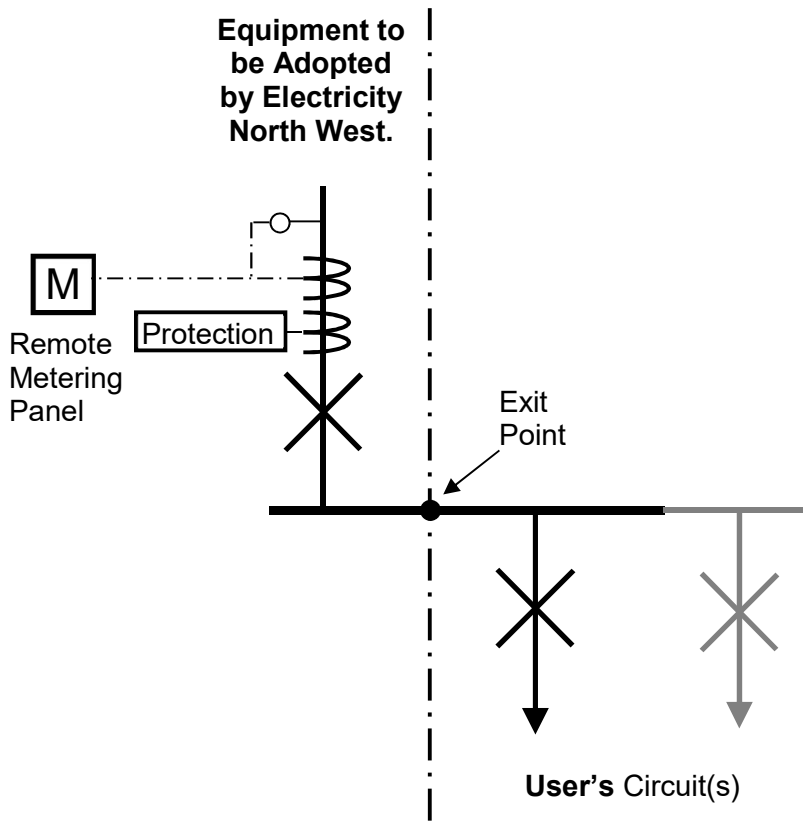


**Figure A1 - Example of Connection at 33kV at a Primary Substation**



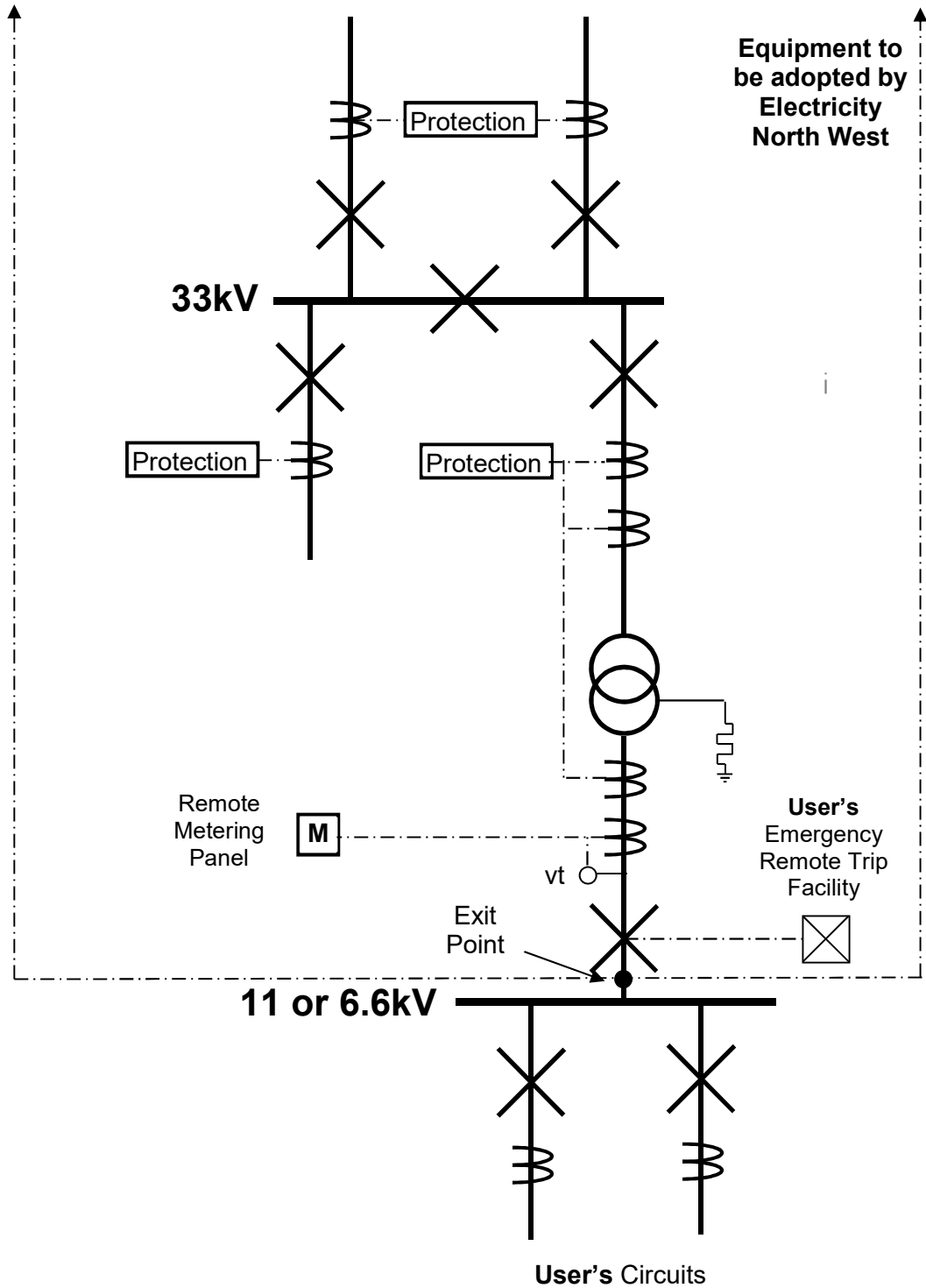
**Figure A2 - Example of Connection at 33kV from Electricity North West Circuit Breaker or Tee**

APPENDIX A (CONTINUED)



**Figure A3 - Example of Connection via a Composite Switchboard**

APPENDIX A (CONTINUED)



**Figure A4 - Example of Connection at 11kV via a 33/11kV Transformer (User only Connection at 11kV)**



APPENDIX A (CONTINUED)

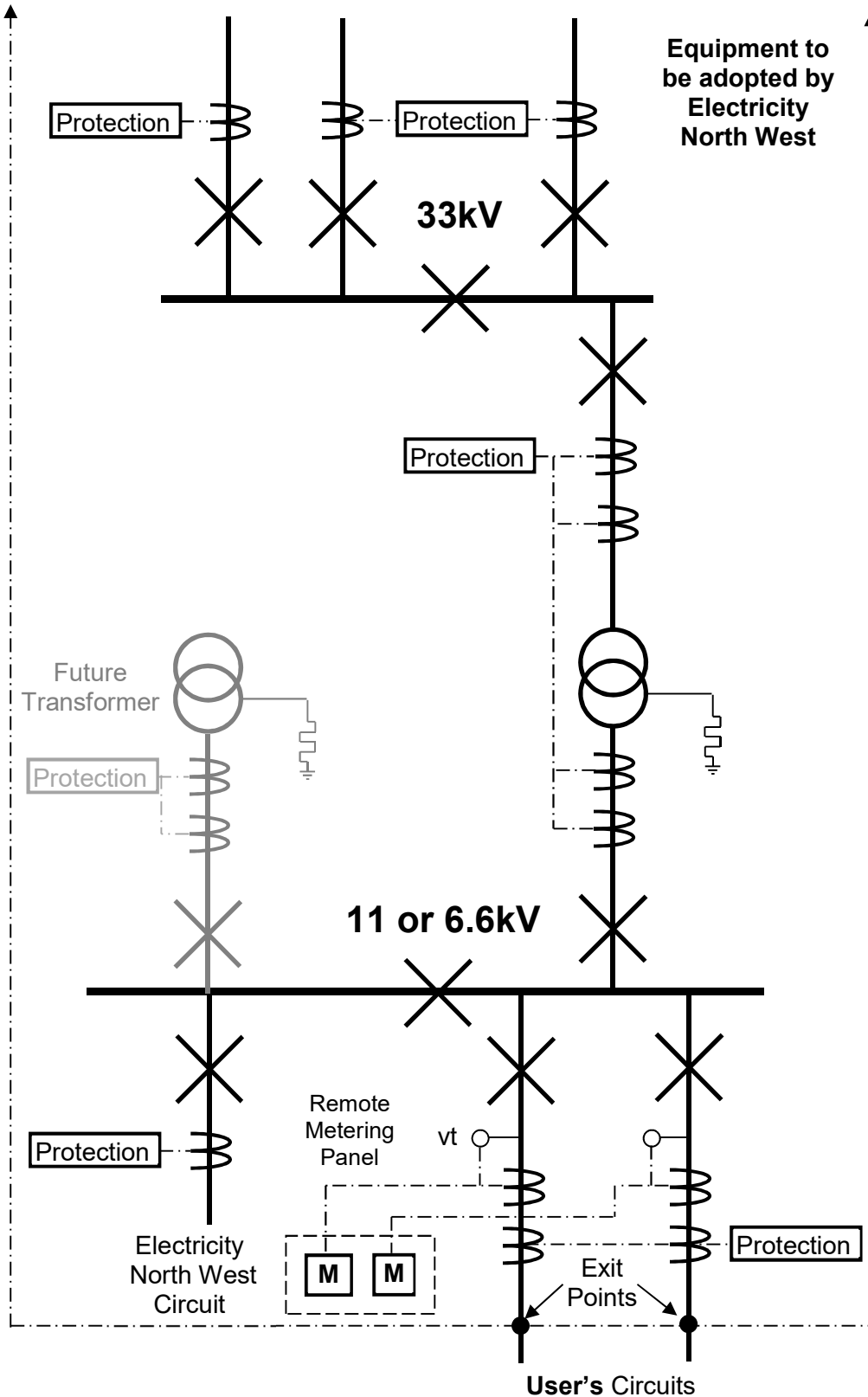


Figure A5 - Example of Connection at 11kV via a 33/11kV Transformer  
(User and Electricity North West Shared Facilities at 11kV)