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Electricity Specification 216

Issue 4 July 2024

6.6kV to 132kV Connection Requirements for Capacity Loads of 9MVA to 240MVA

Amendment Summary

ISSUE NO. DATE	DESCRIPTION
Issue 4 **July 2024**	ES216, ES217 and ES218 combined into one specification. Document now consists of 4 Modules: A 'Common' requirements module and 3 modules each containing the content from the previous separate documents. No technical changes have been made during the combining process, only minor editorial and formatting improvements. Prepared by: Peter Twomey Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chair.

Contents

1 Introduction

This Electricity Specification (ES) details the requirements for new connections of Users with maximum supply capacities between 240MVA and 9MVA, and directly connected to the HV 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.

The design principles for such connections can be found in CP279 Distribution System Design General Requirements.

2 Scope

This ES covers the following connections and capacities directly connected to the Electricity North West Limited (Electricity North West) electricity distribution network (Network), that connection being intended to be adopted by Electricity North West:

VOLTAGE CONNECTION	CAPACITY
132kV	**240MVA**
33kV at Bulk Supply Points (BSP)	**120MVA**
33kV at Primary Substations	**90MVA**
11kV	**15MVA**
6.6kV	**9MVA**

This ES applies to new connections, whether installed by Electricity North West, or by Independent Connection Providers (ICP).

3 Definitions

ABBREVIATION OR TERM	TERM DETAIL
ARLS	Automatic Load Reduction Scheme
BS	British Standard
CP	Code of Practice
CT	Current Transformer
DC	Direct Current
ENA	Energy Networks Association
EN	Euro Norm (European Standard)
Electricity North West	Electricity North West Limited
EPD	Electricity Policy Document
EREC	Engineering Recommendation NOTE: The legacy acronym for Engineering Recommendation is 'ER'.
ES	Electricity Specification
GIS	Gas Insulated Switchgear
HV	High Voltage -above 1kV and up to 132kV
ICP	Independent Connection Providers
IET	Institution of Engineering Technology
kV	Kilo Volt
LS0H	Low Smoke Zero Halogen

LV	**Low Voltage – a voltage less than 1000V**
PPM	**Primary Project Management**
RMU	**Ring Main Unit**
TS	**Technical Specification**
VT	**Voltage Transformer**

4 MODULE 1 – General Common Connection Arrangements

4.1 Contents

This module contains the generic technical requirements for connections in the following categories:

- 6.6kV connections up to 9MVA
- 11kV connections up to 15MVA
- 33kV connections up to 90MVA
- 132kV connections up to 240MVA

4.2 General

Any variation to this specification shall be agreed, in writing, with the Network Planning Policy Manager, Engineering and Technical, 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 design shall ensure that Electricity North West can comply with all relevant ENA Engineering Technical Specifications & Engineering Recommendations.

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 will be supplied and metered at one of the following nominal system voltages:

- 132kV
- 33kV
- 11kV
- 6.6kV.

Connections at 25kV and 132/11kV will be the subject of joint discussions.

With any single circuit arrangement, the agreed supply capacity shall not be considered to be secure against any Network outage.

For new 132kV and 33kV connections, underground cables shall have pilot circuits laid with them or provision (e.g., ducts and pits) made for the future installation of pilot cables. New and refurbished 132kV overhead lines shall have pilot circuits to be installed with them. 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 the Head of Customer Quotations, Electricity Connections, Electricity North West.

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

SYSTEM VOLTAGE CONNECTION	MAXIMUM FAULT LEVEL RATING	MINIMUM SHORT CIRCUIT RATING	MAXIMUM EARTH FAULT CURRENT	MINIMUM IMPULSE LEVEL	SYSTEM EARTHING
132kV	**3500MVA**	**21.9kA for 3s**	**See Note[a]**	**650kV**	**Solid**
33kV	**1000MVA**	**17.5kA for 3s**	**3500A**	**170kV**	**Resistance**
11kV	**250MVA**	**13.1kA for 3s**	**2200A[b]**	**75kV**	**Resistance**
6.6kV	**250MVA**	**21.9kA for 3s**	**2200A[b]**	**75kV**	**Resistance**

NOTE:

(a) Maximum earth fault for 132kV shall be determined by Electricity North West.

(b) The maximum earth fault current for both the 11kV and 6.6kV electricity distribution network is 2200A, based on connection to a primary substation, with three transformers operating in parallel.

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

The exit point shall be the outgoing terminals of the Electricity North West circuit breaker or metering unit where applicable.

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.

4.3 Environmental Conditions

The equipment shall be designed and constructed to allow operation in environments defined in Clause 6 of British Standard (BS) EN 60947-1 as follows:

Equipment that is housed in a controlled environment shall be suitable for operation in Pollution Degree 2.

Equipment that is not housed in a controlled environment shall be suitable for operation in Pollution Degree 3.

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.

For 11/6.6kV connections where, in order to provide the necessary functionality of switchgear or protection, it is necessary to use switchgear generally complying with ES313 - 6.6kV and 11kV Single Busbar Indoor Switchgear (Cable Connected), the standard of accommodation for the switchgear shall comply with the appropriate sections of Electricity North West Code of Practice (CP) 351 - Civil Design aspects of Primary Substations and ES366 - Heating and Lighting Installations in Primary Substations. For further details, see Electricity North West Electricity Policy Document (EPD) 282 - Distribution System Design - 11/6.6kV Network, CP351 and ES366.

4.4 Earthing Conditions

All installations are to comply with Electricity North West 's EPD 333 and shall be discussed and agreed with the Engineer prior to the formal submission of an 'Outline Plan of Works' as described in ES210.

In additions, all 11/6,6kV connections shall comply with EPD332 and CP333.

4.5 Cable Requirements

4.5.1 Cable Installation and Jointing

The installation and jointing of underground cables shall comply with the relevant parts of ES400E4 and ES400E5. In addition, for 11/6.6kV, all jointing shall be undertaken in accordance with CP411 - Cable Jointing.

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.

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

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

4.5.2 Cable Entry to Substations

Cable entry to substations shall comply with the following criteria:

Cable entries to substations shall be made at the laying depth of the cable, using red plastic duct of at least 150mm diameter complying with ES400D4. Cable joints within entry ducts are not permitted.

Bends in cable ducts shall be of no smaller radius than that permitted for the cable.

All entry ducts including any spare ducts and any ducts for earth conductors shall be sealed against the ingress of gas and water after installation of the cable. Sealing shall be achieved in the approved manner in accordance with Module 38 of CP411 Part 2 - HV Jointing.

4.5.3 Routeing of Cables in Buildings

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

Ducts for HV cables within buildings shall be at least 150mm in diameter complying Electricity North West's specification ES400D4. 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.

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.

Where HV cables are fixed to racks or cleated to walls, adequate mechanical protection shall be provided.

All cables shall be securely supported. Particular consideration shall be given to the secure support of cables in vertical runs.

Exposed runs of cables within buildings shall use Low Smoke Zero Halogen (LS0H) type cable.

4.6 HV Switchgear

132kV switchgear shall be of non-oil design.

132kV Gas Insulated Switchgear (GIS) shall comply with Electricity North West's ES310.

33kV Switchgear shall comply with ES312.

11/6.6kV switchgear shall comply with ES313.

Approval for the use of specific types of switchgear shall be obtained, in writing, from the Plant Policy Manager, Engineering and Technical, Electricity North West.

Substation, circuit and plant identification shall be as directed in accordance with CP615 Substation, Circuit and Plant Identification, prior to the commissioning of the equipment.

4.7 Substation Construction for 132kV and 33kV Systems

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.

The design of all substations to be adopted shall comply with the requirements of Code of Practice (CP)351.

Substation designs shall ensure compliance with all relevant statutory regulations.

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.

Substations shall be accessible by personnel authorised by Electricity North West at all times, including out of hours, and during weekends and public holidays.

Notices and nameplates shall comply with ES356.

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.

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.

4.8 Protection and Control

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.

All protection systems shall comply with EPD350 and ES396.

Protection settings and automation and control timings shall be agreed with Electricity North West prior to final commissioning.

Control and relay panels shall comply with ES337.

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.

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.

4.9 Metering

Metering for 132/33kV transformer connection, as shown in Figure C1 in Appendix C, shall be before the customer Exit Point with the metering ct's contained within the Electricity North West 33kV circuit breaker housing. The metering vt shall have a 110V secondary winding.

Metering for 132kV single and dual connection arrangements, as shown in Figure C2 in Appendix C and Figure C3 in Appendix C, shall be before the customer Exit Point with the metering ct's contained within the Electricity

North West 132kV circuit breaker. The metering vt shall be of the capacitor type with a 110V secondary winding.

Metering for 33kV connection, as shown in Figure B1 in Appendix B, 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.

Metering for 11kV or 6.6kV connection, as shown in Figure B2 in Appendix B and Figure B3 in Appendix B , 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.

All HV metering cts and vts shall comply with ES501.

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. For 132kV and 33kV connections, the maximum permissible length of 2.5 mm^2 multicore cable, measured from the flange mounted cabinet multicore cable gland to the meter panel cable gland, shall not exceed 40m for 1A and 5A rated cts. 11kV and 6.6kV connections shall be limited to 25m for cts rated at 15VA.

4.10 Substation LV Supply

The substation shall be fitted with a low voltage electrical installation conforming with ES397, supply being provided, where necessary, by the User.

4.11 Emergency Tripping and DC Supplies

Where a HV connection is provided and it is necessary to open an Electricity North West circuit breaker or switch-fuse, 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 User with an emergency trip push-button shall be provided and maintained by Electricity North West. This device shall be located on the User's premises in an accessible position as close as possible to the supply terminals. The device shall be clearly labelled "FOR EMERGENCY USE ONLY".

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

Where the connection is given from a HV metered switch-fuse, the distance from the switch-fuse to the User's emergency trip push button shall be limited to 10 metres, if it is intended to provide emergency remote tripping via a Bowden cable. If this distance is exceeded, then DC tripping will normally be required but may, on technical and economic grounds, be the preferable means of tripping even at less than 10 metres. Switch-fuses are not rated to break fault current (except by means of the fuses) and, therefore, no automatic trip facility, which might operate a switch-fuse to clear a fault, is acceptable.

Where the User's equipment is more than 10m from Electricity North West's equipment, the use of a capacitor-trip unit may be considered.

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

Where both Electricity North West and the User 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 User'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 User, provided that DC circuits are not extended outside the site boundary, that the drain imposed on the battery by User'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 User's system.

4.12 Supplier

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

4.13 Second Connection for Emergency Purposes

The request for a second connection for emergency firefighting lifts and equipment and pressurised escape routes shall be refused even if the Installer claims to satisfy the requirements of BS 7671 "Requirements for Electrical Installations" also known as the "IET Wiring Regulations".

The preferred option is for the Installer to install automatically started generation (in accordance with BS 9999) for the following reasons:

There are adverse safety implications (inadvertent re-energisation, stray earth and return currents etc) from having two connections. It is not prudent to introduce a safety risk in order to mitigate another.

It cannot be assumed that the second connection will always be available during 11/6.6kV (or higher voltage) faults. Even if a second connection were to be derived from a separate source, Electricity North West could not guarantee that this separation would be maintained.

It may be necessary to de-energise substations or feeders for fault location or maintenance work. It follows that Electricity North West cannot guarantee 100% availability of the second connection.

To be of practical use, the integrity of the second connection would need to be continuously monitored. Electricity North West cannot undertake this responsibility.

The Installer shall be made aware that, although a second connection might appear to be the cheapest option, it would not produce the desired level of safety and might engender an unwarranted sense of security.

Distributors are absolved from the obligation to provide a quotation on demand for a connection where it would not be reasonable in all the circumstances (s17(1)(c) of the Electricity Act 1989 (as amended)). The issues listed above mean that it is not reasonable to provide a second connection, where a safer and more reliable option is for the Installer to install on-site generation.

4.14 Transformers & Ancillary Equipment for Adoption by Electricity North West

132kV transformers shall be in accordance with ES324.

33kV transformers shall be in accordance with ES323.

132kV and 33kV transformer neutral earthing resistors shall comply with ES350.

132kV and 33kV initial utilisation factors shall not be less than 0.6.

5 MODULE 2 - 132kV Connection Arrangements

5.1 132kV Contents

5.2 132kV General Connection Arrangements

The connection shall be provided from an Electricity North West BSP or direct from the 132kV electricity distribution system and be one of the following arrangements:

132/33kV Transformer connection – see example in Figure A1 of Appendix A.

The maximum load, which is subject to the existing loading on the Electricity North West electricity distribution network, supplied from a single 132/33kV transformer shall not exceed 60 MVA. If Electricity North West distribution network permits a second 132/33kV transformer then the capacity may be increased to 120MVA. An Automatic Load Reduction Scheme (ARLS) shall be installed with a second transformer.

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

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

Single feeder 132kV circuit connection – see example in Figure A2 of Appendix A.

The maximum load, which is subject to the existing loading on the Electricity North West distribution network, supplied from a single 132kV feeder shall not exceed 120 MVA.

The exit point shall be the outgoing terminals of the final Electricity North West owned 132kV isolator.

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

Dual feeder 132kV circuit connection - see example in Figure A3 of Appendix A.

The maximum load, which is subject to the existing loading on the Electricity North West distribution network, supplied from a dual connection arrangement shall not exceed 240MVA.

The exit points shall be the outgoing terminals of the final Electricity North West owned 132kV isolators.

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

5.2.1 132kV Cable Requirements for 132kV Systems

The size and type of 132kV cables or overhead lines shall be approved by the Engineer. Cables shall comply with the requirements of ES400 C14.

33kV cables shall be in accordance with Electricity North West's specification ES400C10.

No other type or cross section of cable is permitted.

The conductor cross section selected for any particular installation shall be compatible with the load to be supplied and the system short circuit level.

6 MODULE 3 - 33kV Connection Arrangements

6.1 33kV Contents

6.2 33kV General Connection Arrangements

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:

Dedicated User connection at 33kV from a BSP or Primary substation – an example of this arrangement is shown in Figure B1 in Appendix B.

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.

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

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).

Dedicated User Tee connection from the 33kV network – an example of this arrangement is shown in Figure B2 in Appendix B.

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.

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

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.

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 B3 in Appendix B.

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.

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

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.

Switchgear owned by Electricity North West shall be physically segregated from the User's switchgear.

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 B4 in Appendix B.

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.

The exit point shall be the outgoing terminals of the final Electricity North West 11kV circuit breaker.

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).

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 B5 in Appendix B.

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.

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

The substation shall be designed to accommodate a second transformer.

Electricity North West may make a financial contribution to this type of connection arrangement.

The substation shall be fitted with a low voltage electrical installation conforming with ES397, supply being provided, where necessary, by the User.

6.2.1 33kV Cable Requirements for 33kV Systems

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

No other type of cable is permitted.

11/6.6 kV cable to be used shall be 95 or 300 mm² 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.

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.

6.2.2 33kV Demarcation of Responsibilities for 33kV Systems

Every connection agreement shall include a Site Responsibility Schedule.

In completing and agreeing a Site Responsibility Schedule, particular attention shall be given to auxiliary facilities, including LV supplies, and batteries and battery chargers.

6.2.3 33kV Overhead Lines for 33kV Systems

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.

7 MODULE 4 - 11kV/6.6kV Connection Arrangements

7.1 11kV/6.6kV Contents Page

7.2 11kV/6.6kV General Connection Arrangements

The connection provided from the Network may be one of the following arrangements:

11/6.6kV Ring Main Unit (RMU) or equivalent 3-panel switchboard connection – see Figure C1: RMU or 3-panel Switchboard.

This arrangement is available only where the substation is to be looped into the Network.

The maximum connected load, which is subject to the existing loading on the Network, shall not exceed 7.5MVA at 11kV or 4.5MVA at 6.6kV.

11/6.6kV Circuit Breaker and Switch connection – see Figure C2 in Appendix C

This arrangement is available where the substation is not to be looped into the Network.

The maximum connected load, which is subject to the existing loading on the Network, shall not usually exceed 7.5MVA at 11kV or 4.5MVA at 6.6kV, but may be extended to 15MVA at 11kV or 9MVA at 6.6kV, if a pair of double-banked incoming cables can be used.

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.

The Exit Point to the User shall be at the outgoing terminals of the circuit breaker/metering unit.

11/6.6kV Connection via Two RMUs with Switch-fuses and Dual Transformers – see Figure C3 in Appendix C

This arrangement may continue in use where the substation has previously been looped into the Network.

The maximum connected load, which is subject to the existing loading on the Network, shall not exceed 3MVA at 11kV or 2MVA at 6.6kV.

The load shall be connected via two transformers each with a maximum rating of 1.5MVA at 11kV or 1MVA at 6.6kV.

Paralleling of the transformers via the User's circuits shall be prevented.

The maximum length of each 11/6.6kV transformer cable connection between a switch fuse and transformer shall be 15m.

A User's emergency trip facility shall be provided with this type of connection. The trip facility shall operate the Electricity North West owned switch-fuses, either separately or together, as appropriate.

Metering current transformers (ct) and voltage transformers (vt) shall be accommodated within separate HV metering units.

The Exit Points to the User shall be at the outgoing terminals of the metering units.

11/6.6kV Dual Switch Fuse and single Switch connection with dual transformers – see Figure C4 in Appendix C.

This arrangement may continue in use, where the substation has previously been tee-connected to the Network.

The maximum connected load, which is subject to the existing loading on the Network, shall not exceed 3MVA at 11kV or 2MVA at 6.6kV.

The load shall be connected via two transformers each with a maximum rating of 1.5MVA at 11kV or 1MVA at 6.6kV.

Paralleling of the transformers via the User's circuits shall be prevented.

The maximum length of each 11/6.6kV transformer cable connection between a switch fuse and transformer shall be 15m.

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

Metering cts and vts shall be accommodated within separate HV metering units.

The Exit Points to the User shall be at the outgoing terminals of the metering units.

11/6.6kV Connection via Multiple Circuits, not Operated in Parallel - see Appendix C in Figure 5.

This arrangement is suitable, where the customer's demand cannot be met by a single circuit and where the customer can accept limited security of connection.

The maximum connected load, which is subject to the existing loading and spare capacity on the Network, shall not normally exceed 15MVA at 11kV or 9MVA at 6.6kV.

Metering cts shall be accommodated in each of the circuit breakers controlling the Exit Points to the User and be positioned as shown in Figure C5 in Appendix C.

A metering vt shall be provided on each metered feeder and be positioned as shown in Figure C5 in Appendix C.

The Electricity North West feeders shall be provided with cts and protection as specified by its Protection Policy Manager, Engineering and Technical. The cts used for the protection shall be positioned as shown in Figure C5 in Appendix C.

A User's emergency trip facility shall be provided with this type of connection. The trip facility shall operate all the Electricity North West owned circuit breakers, via independent pairs of normally open contacts.

The Exit Points to the User shall be at the outgoing terminals of the circuit breaker(s) controlling the User's incoming circuit(s) and shall be after the metering cts.

Where the customer's HV switchgear and circuits are arranged to permit the transfer of the customers demand between the Electricity North West circuits, a mechanical interlocking scheme (e.g. by means of transferable keys) shall be installed, in order to prevent any parallel connection being made between the Electricity North West circuits.

The customer shall accept that, in the event of a fault, part of the demand is at risk of disconnection, for a period of time ranging from switching time to repair time.

11/6.6kV Connection via Multiple Circuits Operated in Parallel– see Figure C6 in Appendix C.

This arrangement is suitable, where the customer requires additional security of connection.

The maximum connected load, which is subject to the existing loading and spare capacity on the Network, shall not normally exceed 15MVA at 11kV or 9MVA at 6.6kV.

Metering cts shall be accommodated in each of the Electricity North West circuit breakers controlling the incoming circuits and be positioned as shown in Figure C6 in Appendix C.

A metering vt shall be provided on each incoming circuit and be positioned as shown in Figure C6 in Appendix C.

The User's feeders shall have as a minimum, overcurrent and earth fault protection. The protection settings and operating regime shall provide adequate discrimination with the Electricity North West feeder protection. In order to achieve this, it might be necessary to apply certain restrictions:

(a) where the substation is to be looped into a high voltage ring or interconnector, with other customers connected to it, depending on the User's demand, it might be necessary to arrange that the Exit Points to the User shall not be operated in parallel (This could be assured by the installation of suitable interlocks on the User's switchgear.);

(b) where the Electricity North West circuits are connected directly to a primary substation and have no other customers connected, no such restriction would normally be necessary.

Protection settings shall be approved by the appropriate Electricity North West Design Manager.

The cts for the User's feeder protection shall be positioned as shown in Figure C5 in Appendix C . The final arrangement shall be subject to agreement with the Network Planning Policy Manager, Engineering and Technical, Electricity North West.

The Electricity North West feeders shall be provided with cts and protection as specified by its Protection Policy Manager, Engineering and Technical. The cts used for the protection shall be positioned as shown in Figure C5 in Appendix C. In order to provide 'no-break' security of connection, Electricity North West's circuits will require suitable protection, e.g. directional overcurrent or a unit protection scheme.

The Exit Points to the User shall be at the busbar connections of the circuit breaker(s) controlling the Electricity North West incoming circuit(s).

Particular care is required when designing the layout of these substations. Electricity North West requires continuous, unfettered access to its switchgear, cables and any ancillary plant. The front and rear of switchgear shall be accessible. Switchgear shall be housed in buildings meeting the requirements of CP351 Civil Design of Primary substations, particularly with regard to environmental and security conditions. Electricity North West equipment must only be accessible to operatives holding the relevant Electricity North West authorisation.

7.2.1 11kV/6.6kV Cable Requirements for 11kV and 6.6kV Systems

The 11/6.6kV cable to be used shall be 95mm^2 or 300mm^2 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.

Where the point of connection is to a single transformer or two transformer group, the single core cable earth screen shall, as a minimum, carry the fault current detailed in BS 7870, Section 4.10 without sustaining damage.

Cable of 95mm^2 cross-section may be used for the local connection between switchgear and transformer and for connections to or from overhead lines of equal or less current rating. In all other situations, 300mm^2 cable shall be used.

All multicore and multipair cables shall comply with ES400C13.

7.2.2 11kV/6.6kV Substation Housings and Enclosures for 6.6kV & 11kV Systems

Substation housings and enclosures shall comply with ES352.

8 Equipment Records

The installer shall provide records of all equipment installed, in accordance with CP606 G18 and marked upon the latest version of the Ordnance Survey MasterMap Topographic map for the area, at 1:500 scale with any complex details shown on 1:250 enlargements. Guidance on the provision of records of underground equipment may be found in ES281 - Part 6.

The colour codes and symbols to be used for marking shall comply with Electricity North West's' CP012.

9 Documents Referenced

Non-Electricity North West documents e.g. ENA TS, British Standards etc may be purchased by the Installer or Owner. They will not, under any circumstances, be provided by Electricity North West.

DOCUMENTS REFERENCED	
Regulations (Statutory Instruments)	
Electricity Act 1989	
Electricity Safety, Quality and Continuity Regulations 2002	
Electricity at Work Regulations 1989	
Standards (National, European or International)	
BS 7671	**Requirements for Electrical Installations**
BS 7870	**LV and MV Polymeric Insulated Cables for use by Distribution and Generation Utilities**
BS 9999	**Code of Practice for Fire Safety in the Design, Management and Use of Buildings**
BS EN 60947-1	**Specification for Low Voltage Switchgear and Control Gear**
Energy Networks Association Technical Specifications and Engineering Recommendations	
ENA ER G81	**Framework for Design and Planning, Materials Specification, Installation and Records**
ENA TS 50-19	**Standard Numbering for Small Wiring (for Switchgear and Transformers together with their Associated Relay and Control Panels)**
Electricity North West Documents	
EPD282	**Distribution System Design - 11/6.6kV Network**
EPD332	**Customer Installation Earthing**

EPD333	**Supply System Earthing**
EPD350	**Protection Policy for 132kV, 33kV and 11/6.6kV Systems**
CP012	**Electricity Geographical Information System (GIS)**
CP351	**Civil Design aspects of Primary Substations**
CP606	**Procedure S16 - Substation & Switchgear Locks**
CP411 Part 2	**Cable Jointing**
ES210	**General Specification for Third Party Constructed New Connections, Extensions and Alterations**
ES215	**Connections of up to 1500kVA Capacity**
ES281	**Company-specific Appendices to ENA ER G81**
ES310	**Gas Insulated Switchgear**
ES312	**36kV Single Busbar Indoor Switchgear**
ES313	**6.6kV and 11kV Single Busbar Indoor Switchgear**
ES314	**12kV & 7.2kV 21.9kA Switchgear**
ES323	**33/11 or 6.6kV System Transformer Technical Clauses & Schedules**
ES324	**132kV/Lower Voltage Transformers, Earthing / Auxiliary Transformers**
ES326	**Substation Security Doors**
ES337	**19" Rack Control & Relay Panels for use in BSP & Primary Substations**
ES350	**Neutral Earthing Resistors at BSP & Primary Substations**
ES352	**Design of Distribution Substations and Transforming Points**

ES356	**Notices & Nameplates**
ES366	**Heating and Lighting Installations in Primary Substations**
ES396	**Protection in Primary Substations**
ES397	**Electrical Installations within Distribution Substations**
ES400C9	**11kV Distribution Cables**
ES400C10	**33kV Distribution Cables**
ES400C13	**Multipair and Multicore Auxiliary Cables**
ES400C14	**132kV Cables with Extruded XLPE Insulation**
ES400D4	**Plastic Ducts, Conduit & Accessories**
ES400E4	**Installation, Commissioning and Repair of Solid Type Underground Cables Operating on the Electricity North West Low and Medium Voltage 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**
ES501	**Metering Current & Voltage Transformers**

10 Keywords

Substation; third party; connection

Appendix A – 132kV Connections

Figure A1: Example of a 132/33kV Transformer Connection Arrangement

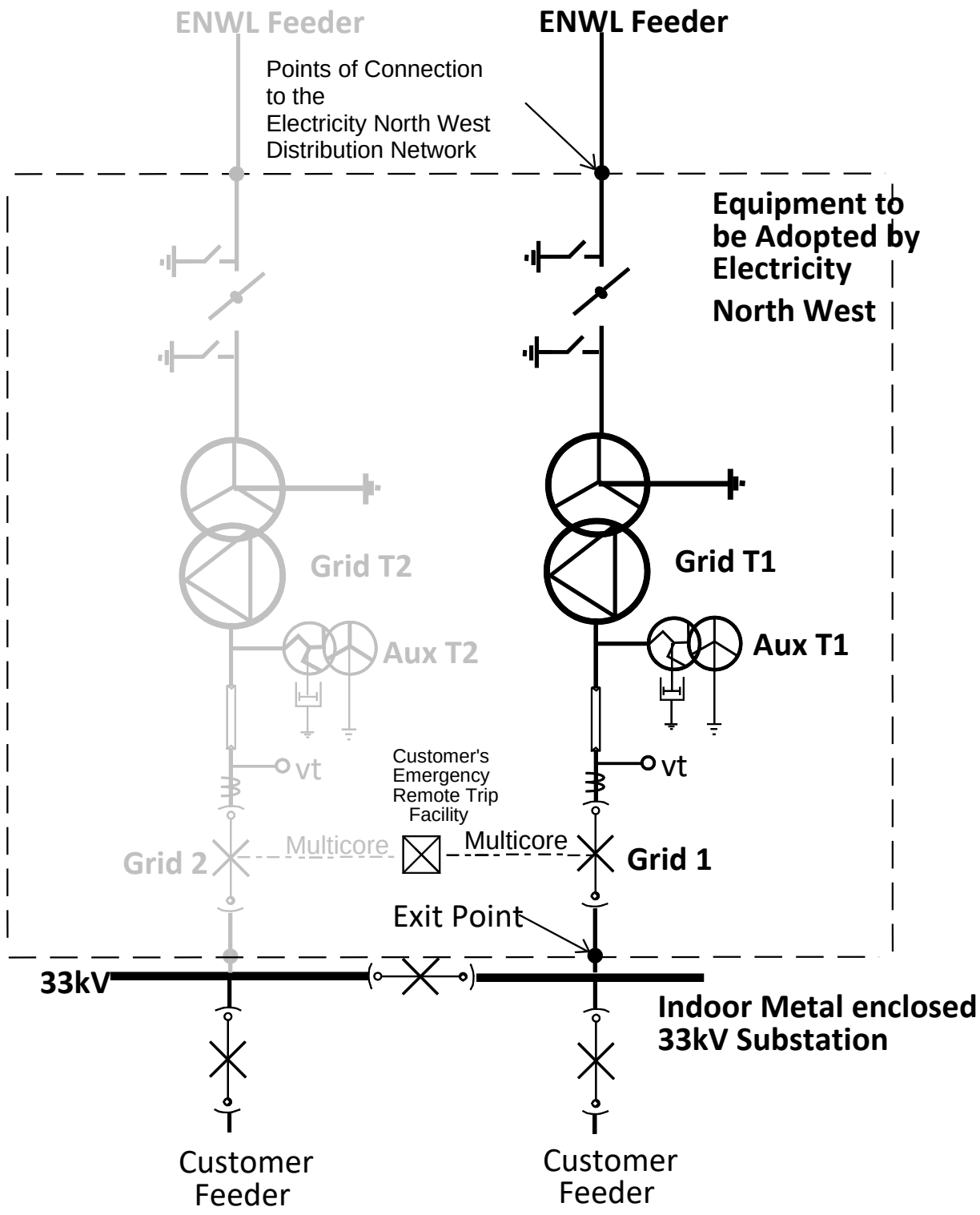


Figure A2: Example of a Single 132kV Connection Arrangement

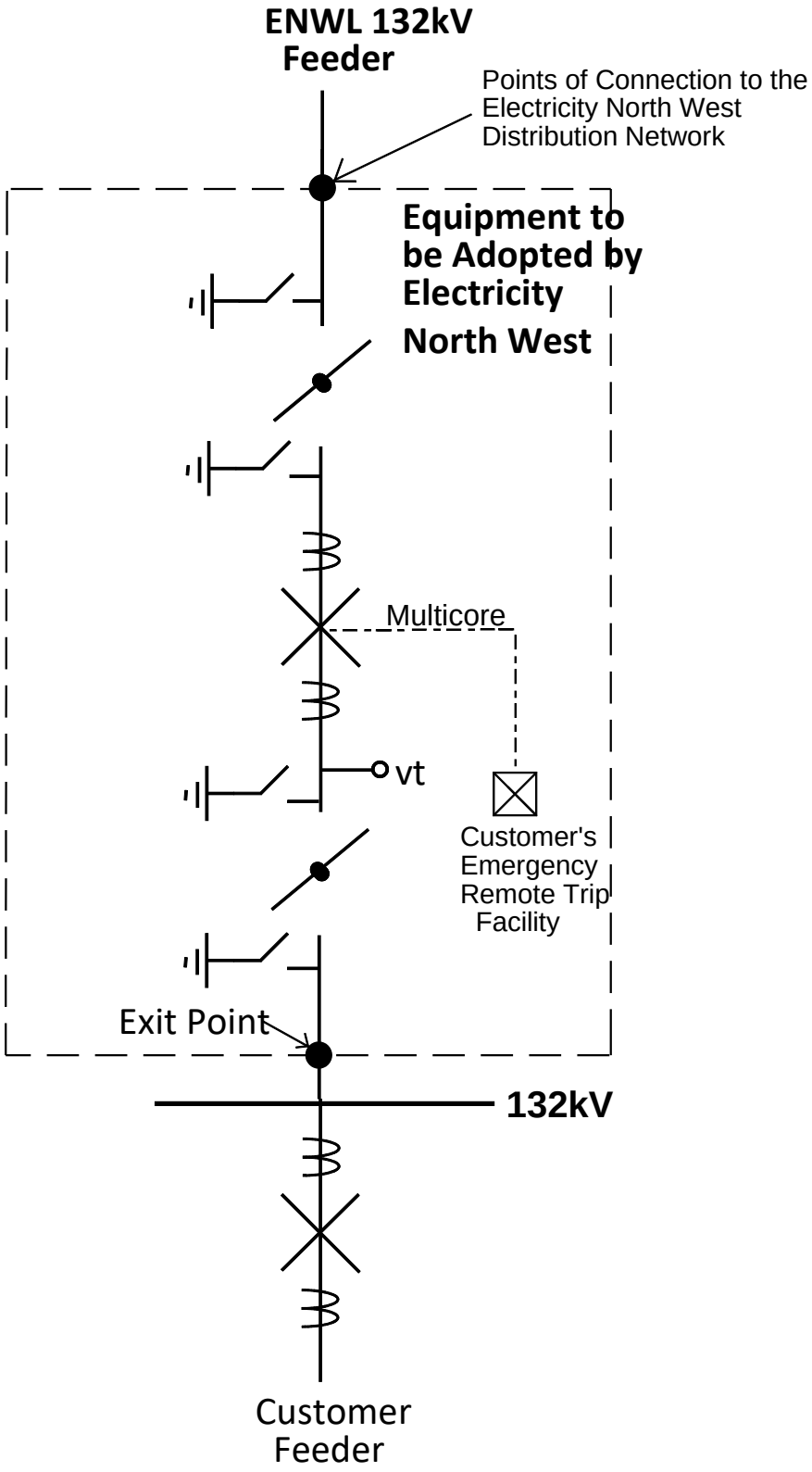
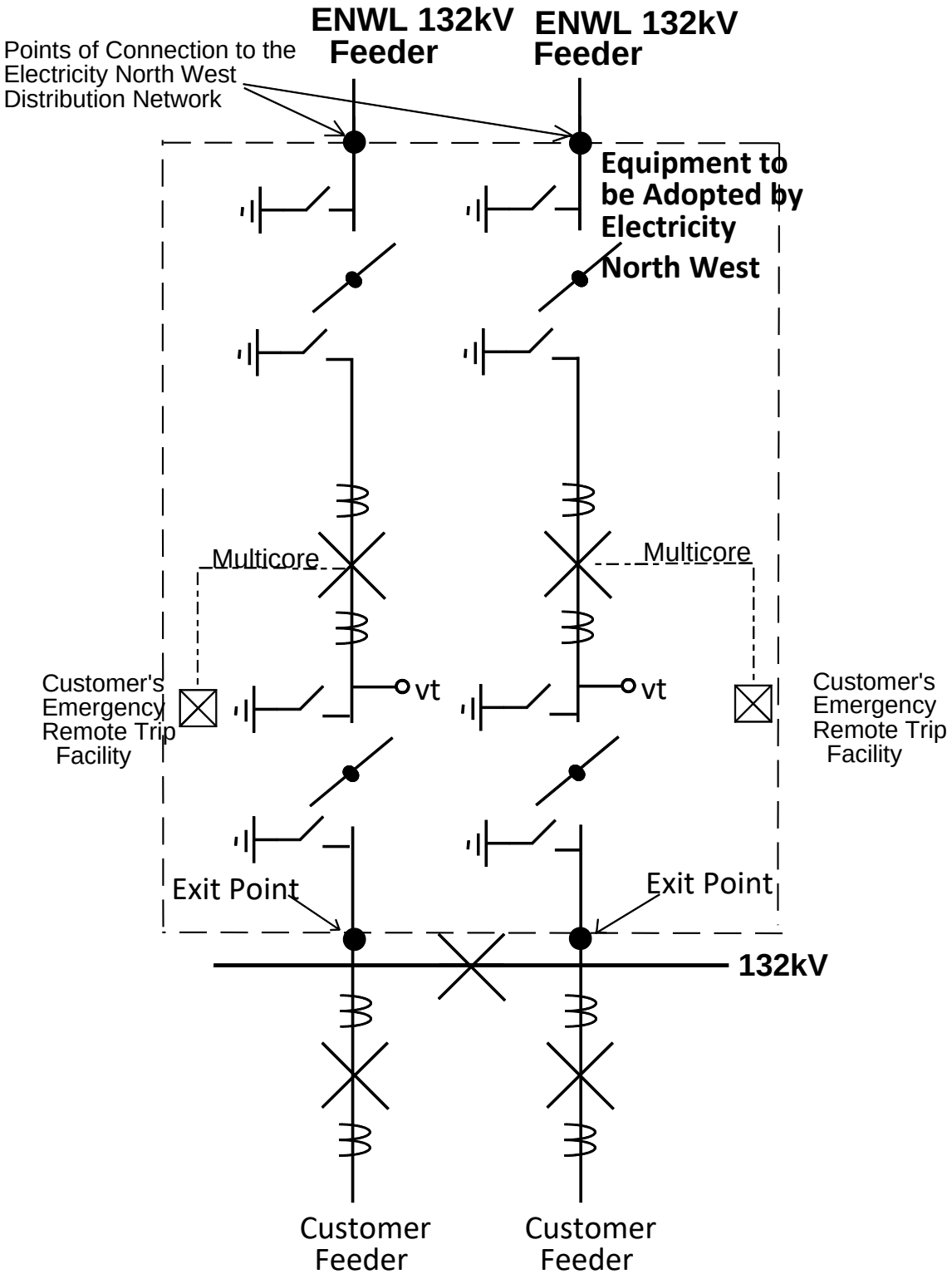


Figure A3: Example of a Dual 132kV Connection Arrangement



Appendix B – 33kV Connections

Figure B1: Example of Connection at 33kV at a Primary Substation

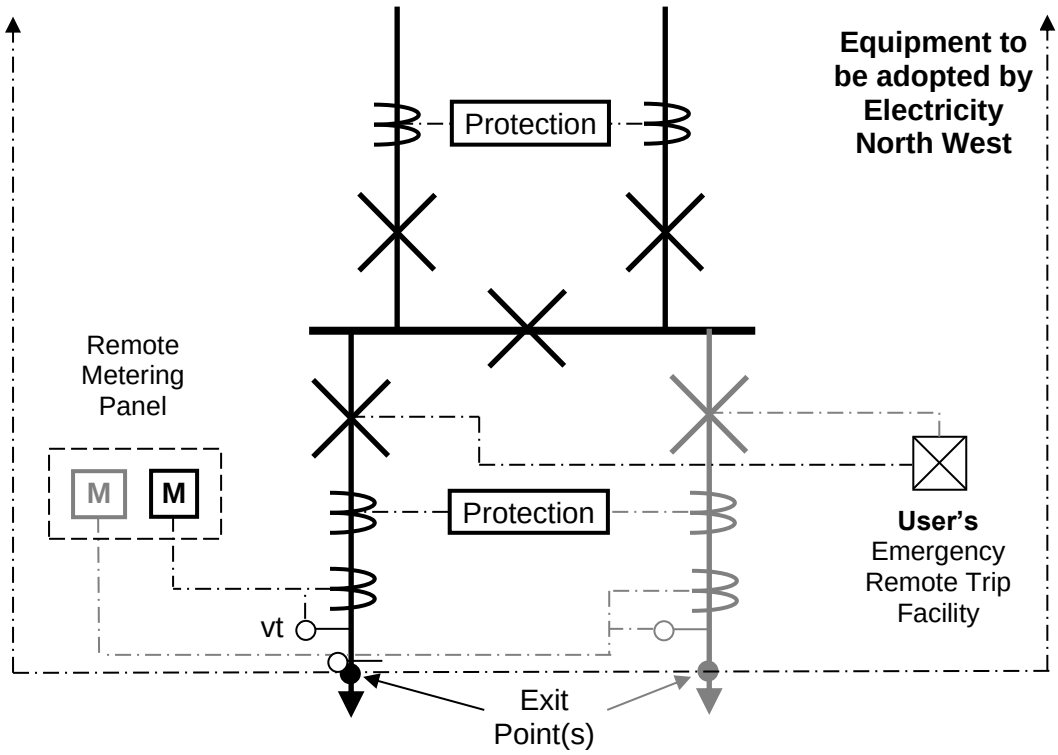


Figure B2: Example of Connection 33kV from Electricity North West Circuit Breaker or Tee

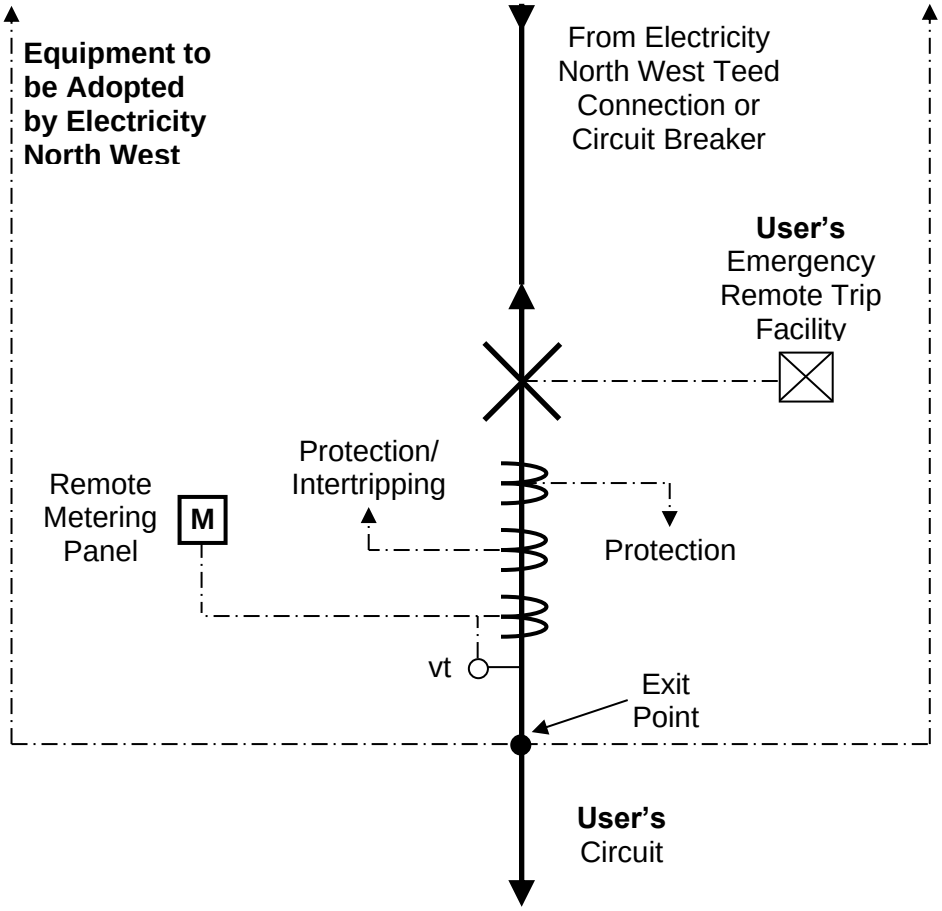


Figure B3: Example of Connection via a Composite Switchboard

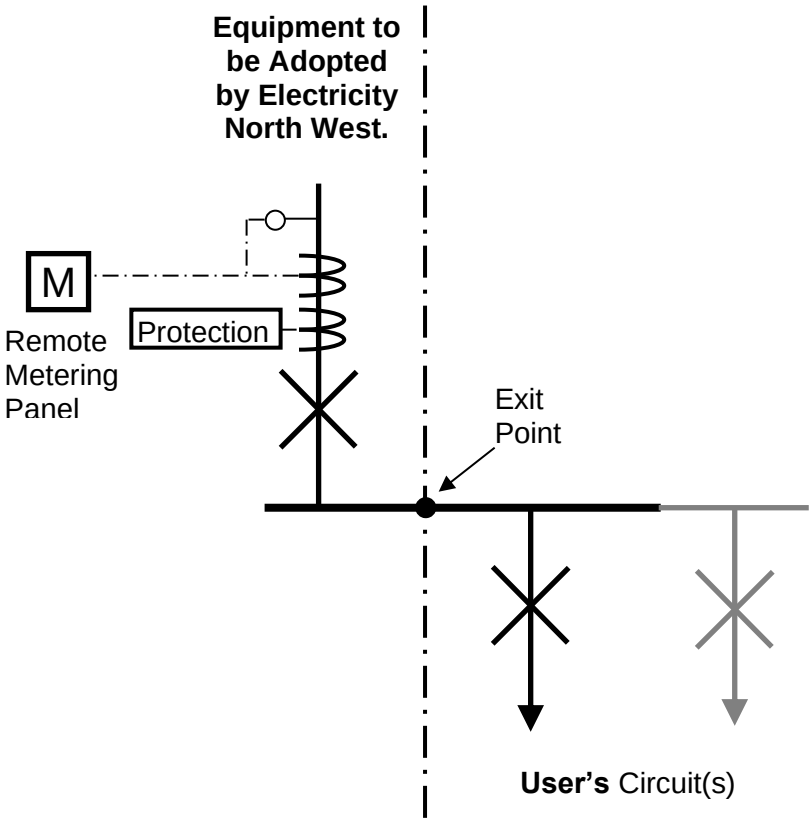


Figure B4: Example of Connection at 11kV via a 33/11kV Transformer (User Only Connection at 11kV)

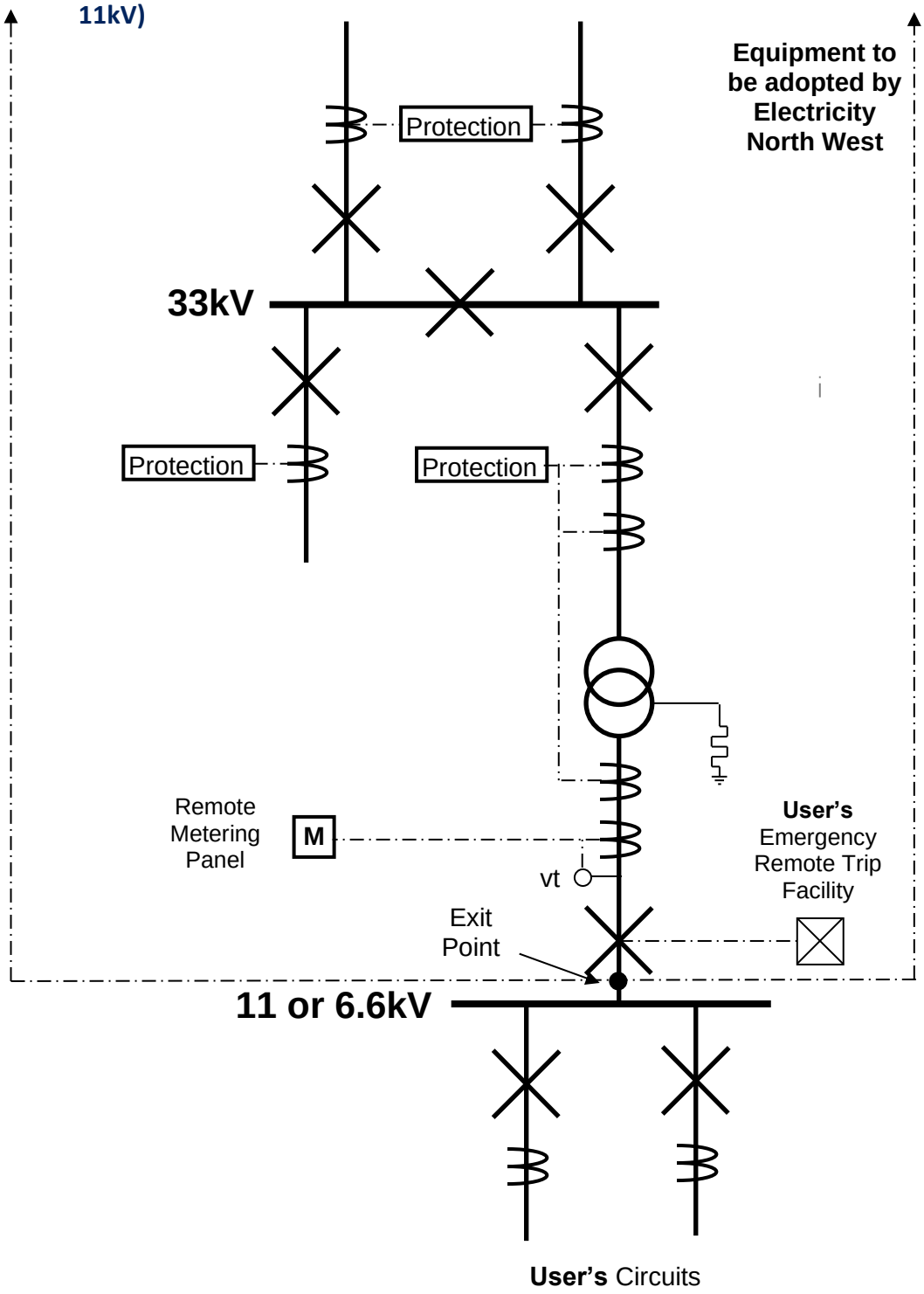
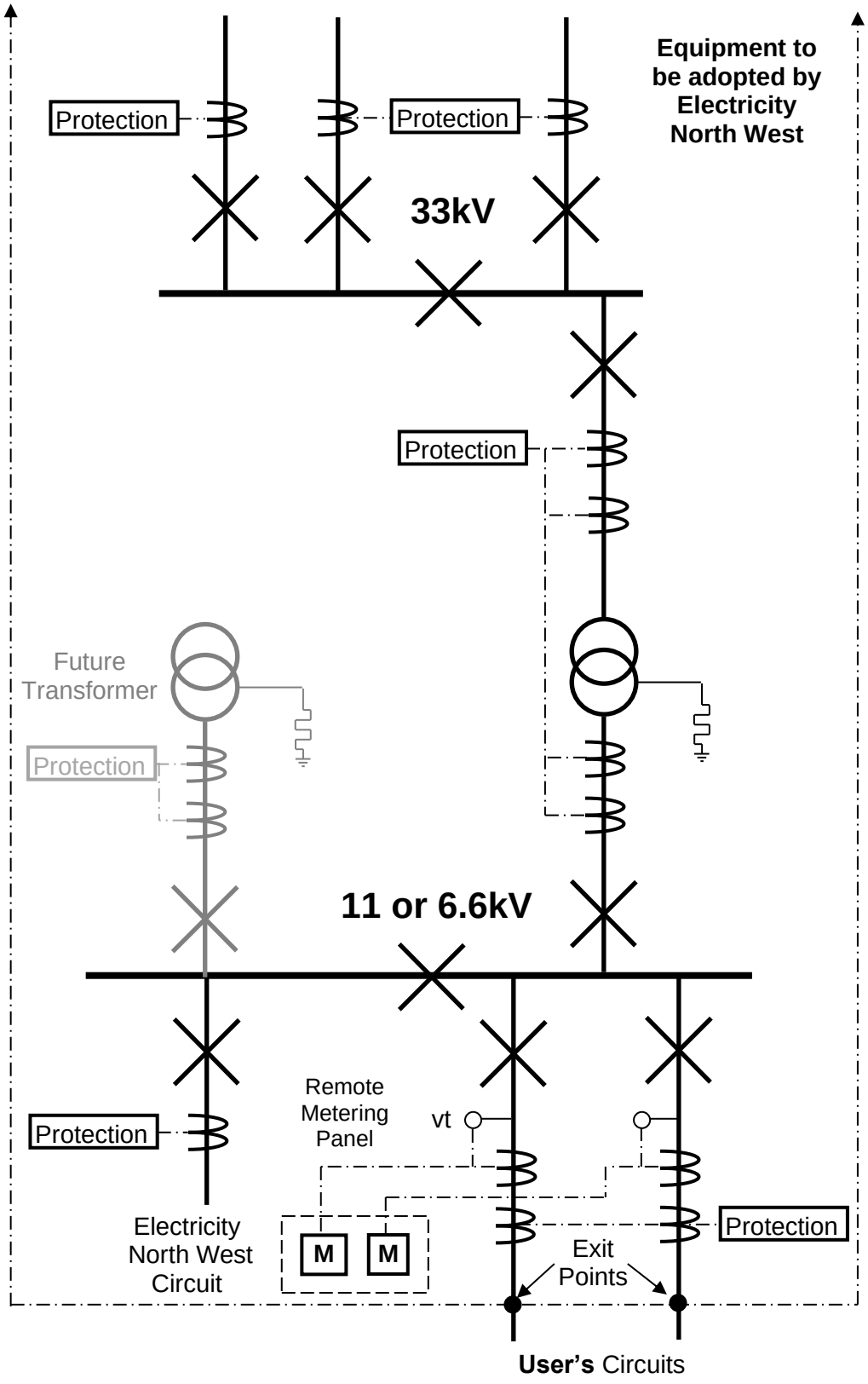


Figure B5: Example of Connection at 11kV via a 33/11kV Transformer (User and Electricity North West Shared Facilities at 11kV)



Appendix C – 11kV & 6.6kV Connections

Figure C1: RMU or 3-panel Switchboard

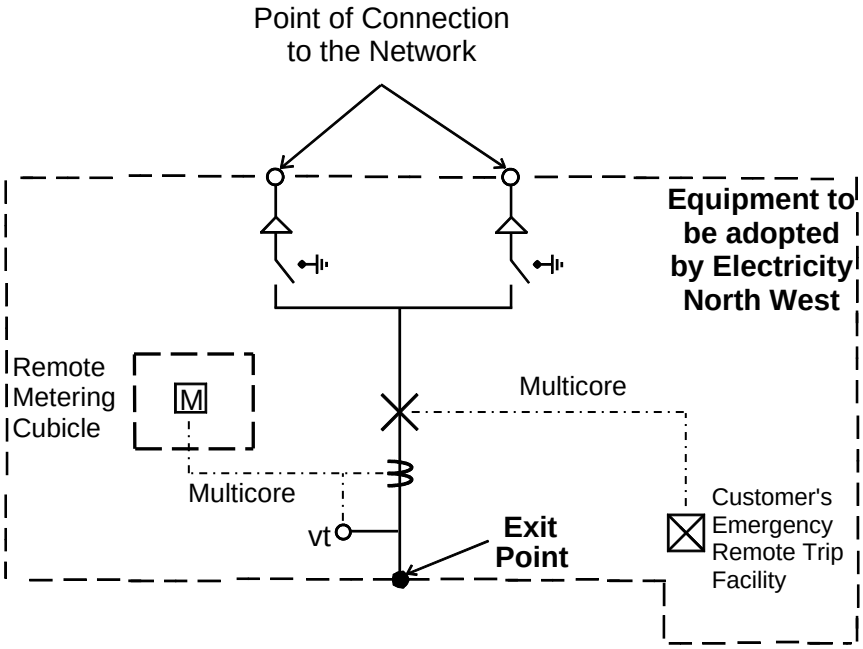


Figure C2: Circuit Breaker & Isolator Connection

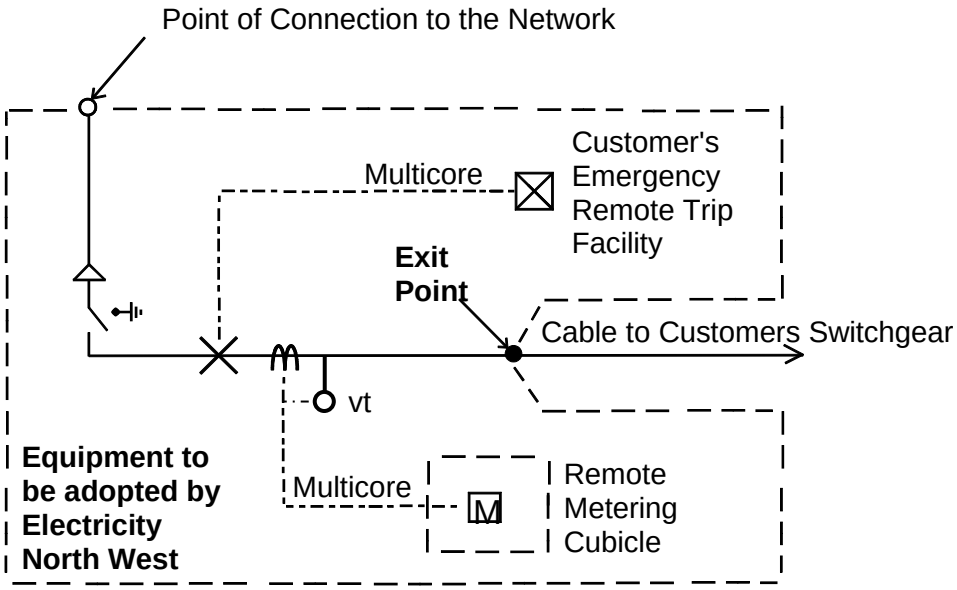


Figure C3: Connection via Two RMUs with Switch-fuses and Dual Transformers

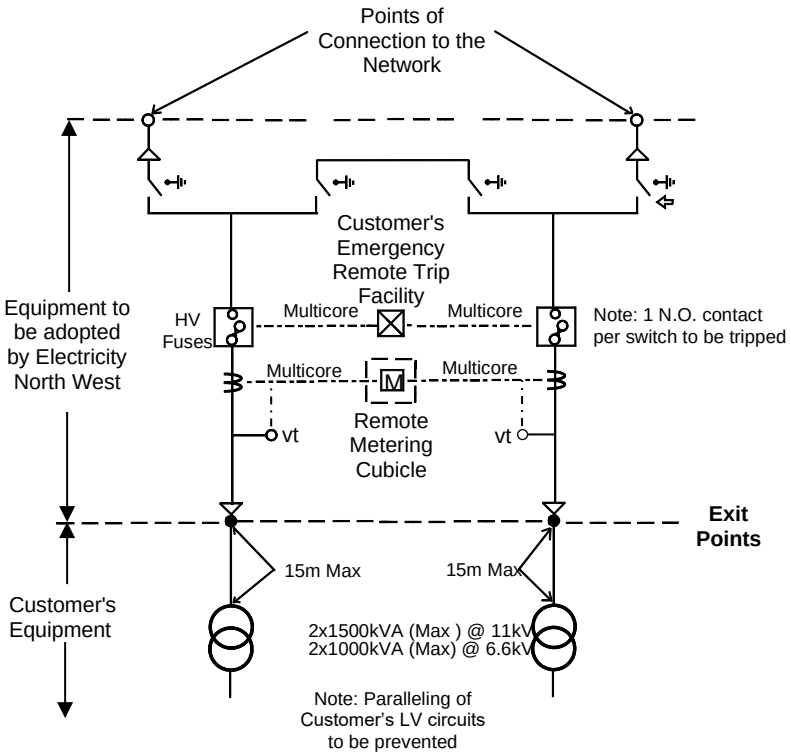


Figure C4: Dual Switch-fuse and Single Isolator Connection with Dual Transformers

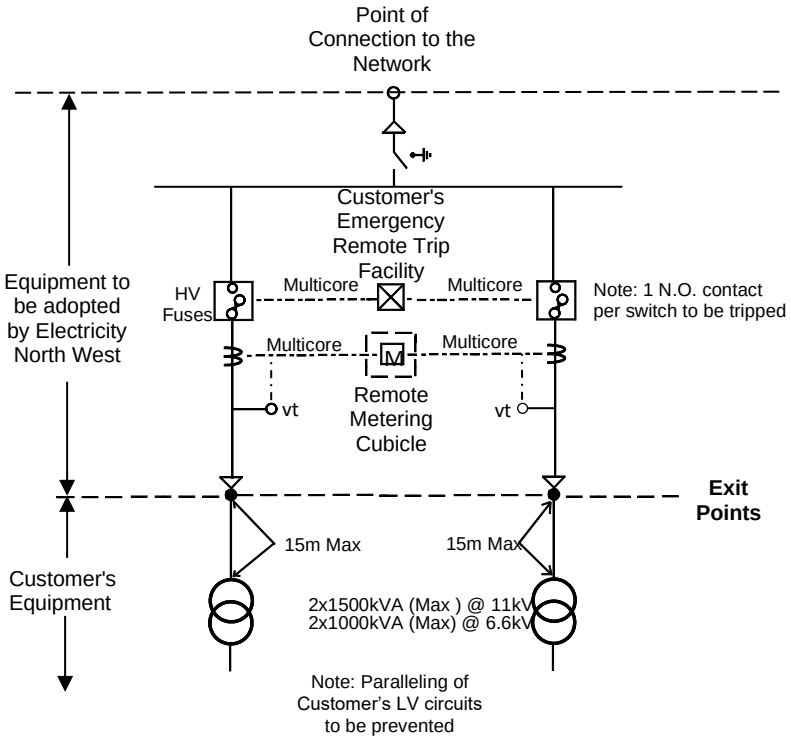


Figure C5: 11/6.6kV Connection – Multiple Circuits, Not Operated in Parallel

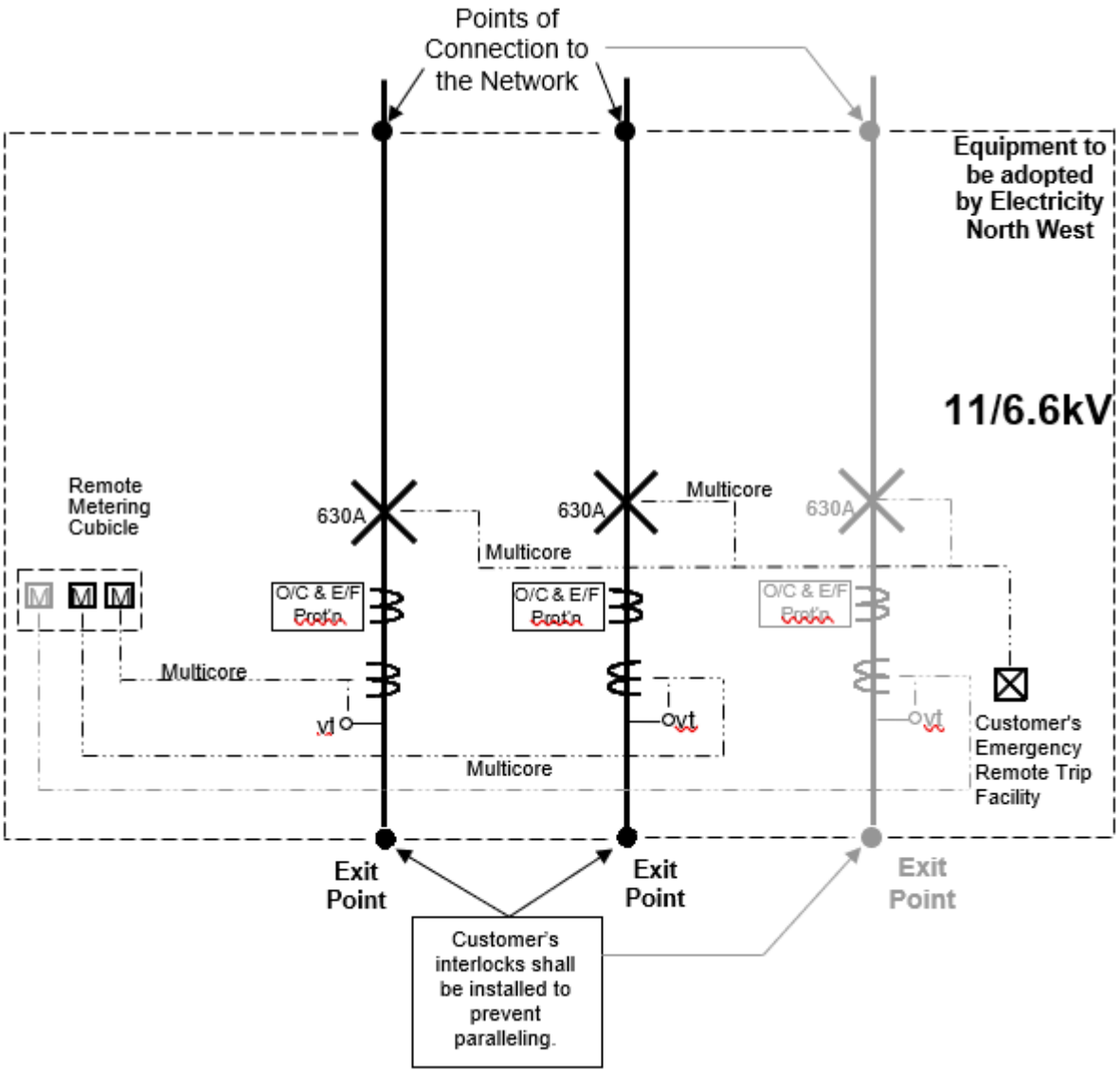


Figure C6: 11/6.6kV Connection – Multiple Circuits, Operated in Parallel