



## **Electricity Specification 216**

**Issue 3**

**February 2021**

### **11/6.6kV Connections of up to 9MVA (6.6kV) or 15MVA (11kV) Capacity**

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

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Amendment No. Date	Brief Description and Amending Action
<p>4</p> <p>04/08/11</p>	<p>Issue 2</p> <p>New subsection 3.14 inserted; emergency tripping and DC supplies.</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>02/02/21</p>	<p>Issue 3</p> <p>Requirement to use LS0H cable added in section</p> <p>Requirement that 'composite' boards are designed to restrict access to Electricity North West assets to operatives with the relevant Electricity North West Isolation. This access needs to be continuous and unfettered.</p> <p>New template applied, other minor updates and revisions made.</p> <p>Prepared by: Peter Twomey</p> <p>Approved by the Policy Approval Panel and signed on its behalf by Paul Turner</p>

## 11/6.6kV CONNECTIONS OF UP TO 9MVA (6.6kV) OR 15MVA (11kV) CAPACITY

### 1. SCOPE

This Electricity Specification (ES) details the requirements for 11/6.6kV connections with metering with capacities up to 9MVA (6.6kV) or 15MVA (11kV) 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. This ES applies to new connections, whether installed by Electricity North West, or by Independent Connection Providers (ICP). It is usually appropriate to provide connections of up to 1000kVA capacity in accordance with ES215.

This document shall be read in conjunction with ES210.

### 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 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 a nominal 11kV or 6.6kV.

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

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

Maximum Fault Levels on the Network for both 11kV and 6.6kV is 250MVA

The minimum short circuit ratings shall be:

- 11kV = 13.1kA for 3s
- 6.6kV = 21.9kA for 3s

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 level for new equipment connected to the 11kV and 6.6kV Network is 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 sub-section 2.8.

### **3. CONNECTION ARRANGEMENTS**

- 3.1 The connection provided from the Network may be one of the following arrangements:
- 3.1.1 11/6.6kV Ring Main Unit (RMU) or equivalent 3-panel switchboard connection – see Figure 1 in Appendix A
- 3.1.1.1 This arrangement is available only where the substation is to be looped into the Network.
- 3.1.1.2 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.
- 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 owned circuit breaker.
- 3.1.1.4 The Exit Point to the User shall be at the outgoing terminals of the circuit breaker/metering unit.
- 3.1.2 11/6.6kV Circuit Breaker and Switch connection – see Figure 2 in Appendix A
- 3.1.2.1 This arrangement is available where the substation is not to be looped into the Network.
- 3.1.2.2 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.
- 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.
- 3.1.2.4 The Exit Point to the User shall be at the outgoing terminals of the circuit breaker/metering unit.
- 3.1.3 11/6.6kV Connection via Two RMUs with Switch-fuses and Dual Transformers – see Figure 3 in Appendix A
- 3.1.3.1 This arrangement may continue in use where the substation has previously been looped into the Network.
- 3.1.3.2 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.
- 3.1.3.3 The load shall be connected via two transformers each with a maximum rating of 1.5MVA at 11kV or 1MVA at 6.6kV.
- 3.1.3.4 Paralleling of the transformers via the User's circuits shall be prevented.
- 3.1.3.5 The maximum length of each 11/6.6kV transformer cable connection between a switch fuse and transformer shall be 15m.
- 3.1.3.6 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.

- 3.1.3.7 Metering current transformers (ct) and voltage transformers (vt) shall be accommodated within separate HV metering units.
- 3.1.3.8 The Exit Points to the User shall be at the outgoing terminals of the metering units.
- 3.1.4 11/6.6kV Dual Switch Fuse and single Switch connection with dual transformers – see Figure 4 in Appendix A
  - 3.1.4.1 This arrangement may continue in use, where the substation has previously been tee-connected to the Network.
  - 3.1.4.2 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.
  - 3.1.4.3 The load shall be connected via two transformers each with a maximum rating of 1.5MVA at 11kV or 1MVA at 6.6kV.
  - 3.1.4.4 Paralleling of the transformers via the User's circuits shall be prevented.
  - 3.1.4.5 The maximum length of each 11/6.6kV transformer cable connection between a switch fuse and transformer shall be 15m.
  - 3.1.4.6 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.
  - 3.1.4.7 Metering cts and vts shall be accommodated within separate HV metering units.
  - 3.1.4.8 The Exit Points to the User shall be at the outgoing terminals of the metering units.
- 3.1.5 11/6.6kV Connection via Multiple Circuits, not Operated in Parallel - see Appendix A, Figure 5
  - 3.1.5.1 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.
  - 3.1.5.2 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.
  - 3.1.5.3 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 5 in Appendix A.
  - 3.1.5.4 A metering vt shall be provided on each metered feeder and be positioned as shown in Figure 5 in Appendix A.
  - 3.1.5.5 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 5 in Appendix A.
  - 3.1.5.6 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.
  - 3.1.5.7 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.
  - 3.1.5.8 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 (eg by means of transferable keys) shall be installed, in order to prevent any parallel connection being made between the Electricity North West circuits.

3.1.5.9 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.

**3.1.6 11/6.6kV Connection via Multiple Circuits Operated in Parallel– see Appendix A, Figure 6.**

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

3.1.6.2 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.

3.1.6.3 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 6 in Appendix A.

3.1.6.4 A metering vt shall be provided on each incoming circuit and be positioned as shown in Figure 6 in Appendix A.

3.1.6.5 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.

3.1.6.6 The cts for the User's feeder protection shall be positioned as shown in Figure 5 in Appendix A. The final arrangement shall be subject to agreement with the Network Planning Policy Manager, Engineering and Technical, Electricity North West.

3.1.6.7 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 5 in Appendix A. In order to provide 'no-break' security of connection, Electricity North West's circuits will require suitable protection, eg directional overcurrent or a unit protection scheme.

3.1.6.8 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).

3.1.6.9 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.

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## **3.2 Environmental Conditions**

- 3.2.1 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:
- 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.
- 3.2.3 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.

## **3.3 Cables**

- 3.3.1 The 11/6.6kV cable to be used shall be 95mm<sup>2</sup> or 300mm<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.

- 3.3.2 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.
- 3.3.3 Cable of 95mm<sup>2</sup> 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<sup>2</sup> cable shall be used.
- 3.3.4 All multicore and multipair cables shall comply with ES400C13.

## **3.4 Earthing Conditions**

All installations are to comply with EPD332, EPD333 and CP333.

## **3.5 Cable Installation and Jointing**

- 3.5.1 The installation and jointing of underground cables shall comply with the relevant parts of ES400E4. All jointing shall be undertaken in accordance with CP411 - Cable Jointing.
- 3.5.2 Small wiring shall be ferruled in accordance with ENA TS 50-19.

## **3.6 Substation Housings and Enclosures**

Substation housings and enclosures shall comply with ES352.

### 3.7 Cable Entry to Substations

- 3.7.1 11/6.6kV 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.
- 3.7.2 Bends in cable ducts shall be of no smaller radius than that permitted for the cable.
- 3.7.3 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 an approved manner.

### 3.8 Routeing of Cables in Buildings

The following provisions apply where substations are sited within larger buildings and 11/6.6kV cables must be routed through those buildings:

- 3.8.1 Ducts for 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.
- 3.8.2 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.
- 3.8.3 Where 11/6.6kV cables are fixed to racks or cleated to walls, adequate mechanical protection shall be provided.
- 3.8.4 All cables shall be securely supported. Particular consideration shall be given to the secure support of cables in vertical runs.
- 3.8.5 Exposed runs of cables within buildings shall use Low Smoke Zero Halogen (LS0H) type cable.

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### 3.9 11/6.6 kV Switchgear

- 3.9.1 Switchgear shall comply with ES314, or ES313 (See 3.2.3.).
- 3.9.2 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.
- 3.9.3 Substation, circuit and plant identification shall be as directed in accordance with CP615 Substation, Circuit and Plant Identification.

### 3.10 Protection

- 3.10.1 Relays and protection systems shall comply with EPD350.
- 3.10.2 Approval for the use of specific types of relays shall be obtained, in writing, from the Protection Policy Manager, Engineering and Technical, Electricity North West.

### 3.11 Metering Current Transformers

- 3.11.1 11/6.6kV metering units shall comply with ES314.
- 3.11.2 All HV metering cts and vts shall be in accordance with ES501.

### 3.12 Metering Current Transformer Burdens

In order to ensure the accuracy of metering, the burden of the cts shall be restricted by using multicore cable of at least 2.5mm<sup>2</sup> copper cross-section and by limiting the length of the cable connecting the cts to the meter. The designer shall ensure that the burden connected to the cts is not excessive. As guide, the length of the cable should not exceed 25m for cts rated at 15VA.

### 3.13 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.

### 3.14 Emergency Tripping and DC Supplies

3.14.1 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".

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

3.14.3 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.

3.14.4 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.

3.14.5 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.

3.14.6 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.

### **3.15 Supplier**

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

### **3.16 Second Connection for Emergency Purposes**

3.16.1 The request for a second connection for emergency fire fighting 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 “IEE Wiring Regulations”.

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

3.16.2.1 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.

3.16.2.2 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.

3.16.2.3 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.

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

3.16.3 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.

3.16.4 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. EQUIPMENT RECORDS**

The installer shall provide records of all equipment installed, using form C of ES210 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.

## **5. DOCUMENTATION**

Documentation shall be as described in ES210.

## 6. DOCUMENTS REFERENCED

Non-Electricity North West documents eg 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.

### Non- Electricity North West Documents

Electricity Act 1989

Electricity Safety, Quality and Continuity Regulations 2002

Electricity at Work Regulations 1989

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

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

CP351 - Civil Design aspects of Primary Substations

CP411 - 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

ES313 - 6.6kV and 11kV Single Busbar Indoor Switchgear

ES314 - 12kV & 7.2kV 21.9kA Switchgear

ES352 - Design of Distribution Substations and Transforming Points

ES366 - Heating and Lighting Installations in Primary Substations

ES397 - Electrical Installations within Distribution Substations

ES400C9 - 11kV Distribution Cables

ES400C13 - Multipair and Multicore Auxiliary Cables

ES400D4 - Plastic Ducts, Conduit & Accessories

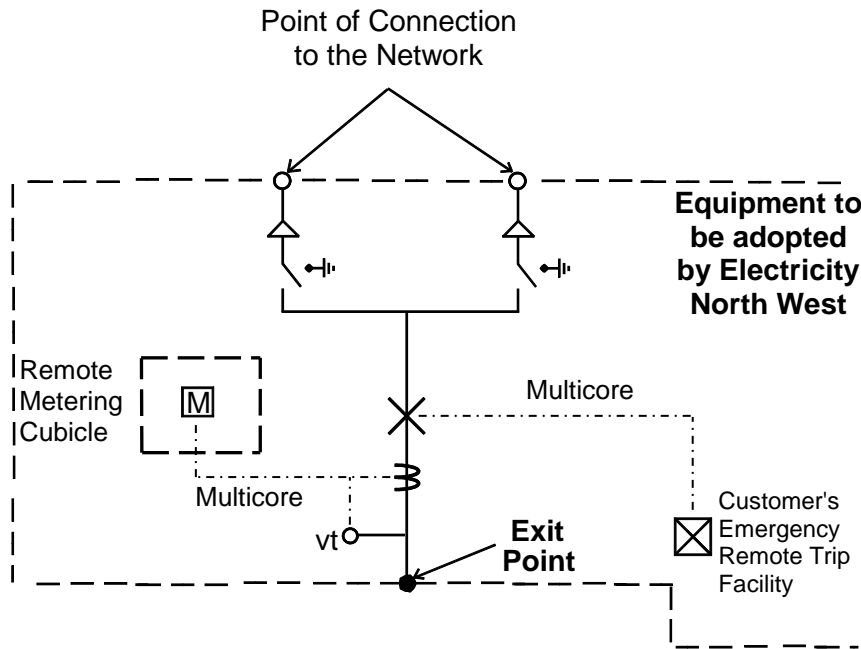
ES400E4 - Installation, Commissioning and Repair of Solid Type Underground Cables Operating on the Electricity North West Low and Medium Voltage Systems and the Restoration of Excavated Areas

ES501 - Metering Current & Voltage Transformers

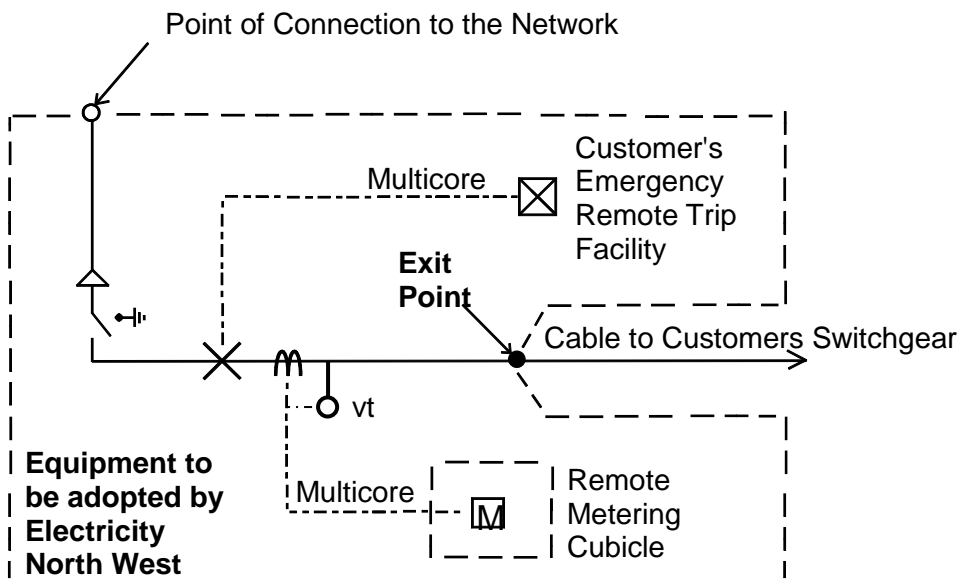
## **7. KEYWORDS**

Connection.

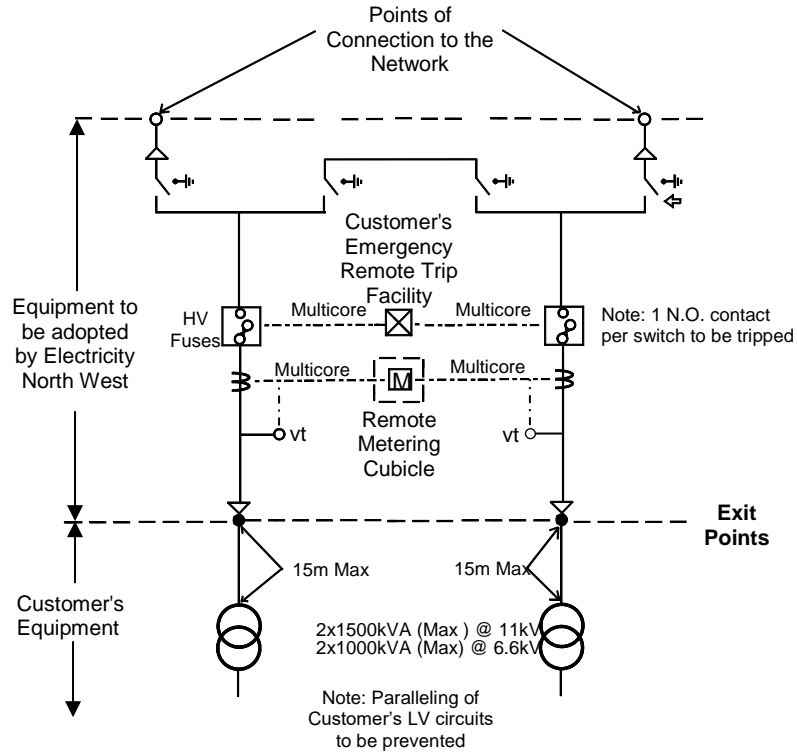
APPENDIX A



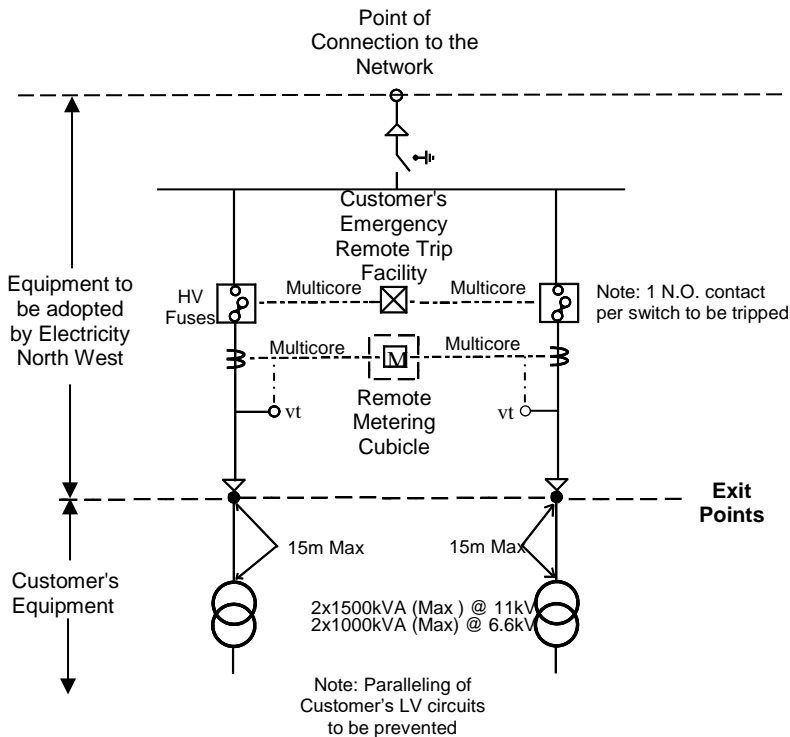
**Fig. A1 RMU or 3-panel Switchboard**



**Fig. A2 Circuit Breaker & Isolator Connection**

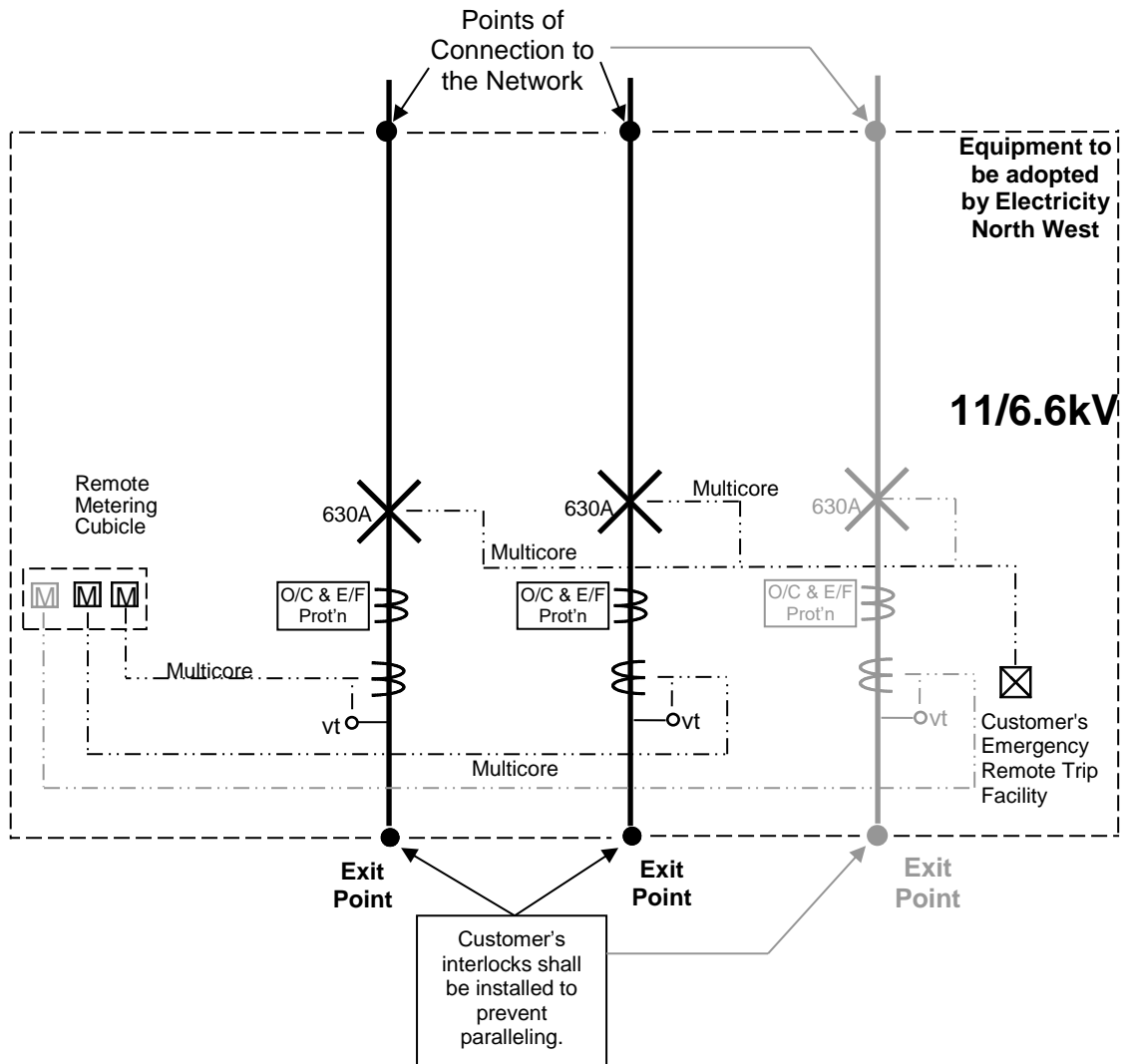


**Fig. A3 Connection via Two RMUs with Switch-fuses and Dual Transformers**

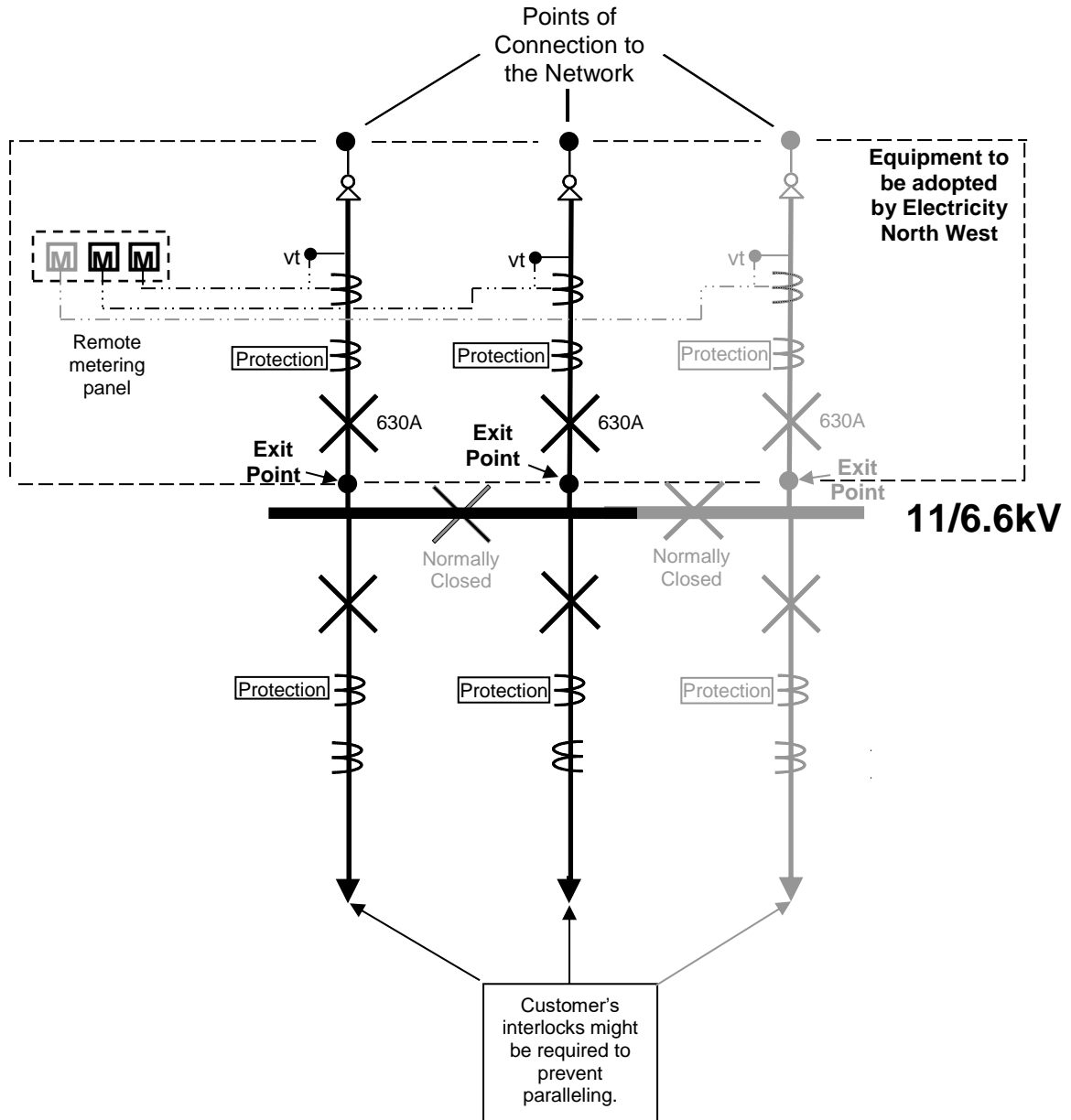


**Fig. A4 Dual Switch-fuse and Single Isolator Connection with Dual Transformers**





**Fig. A5 11/6.6kV Connection - multiple circuits, not operated in parallel**



**Fig. A6 11/6.6kV Connection - multiple circuits operated in parallel**