IMP/001/010 – Code of Practice for Standard Arrangements for Customer Connections

1. Purpose

The purpose of this document is to state Northern Powergrid's policy for the standard arrangements for the provision of connections for supplies of electricity to Customers.

This Code of Practice also helps to ensure Northern Powergrid achieves its requirements with respect to the Electricity Safety, Quality, and Continuity (ESQC) Regulations 2002 (including amendments);[1] The Electricity Act 1989 (as amended); The Electricity at Work Regulations 1989, and its Distribution Licences.

This document supersedes the following documents, all copies of which should be withdrawn from circulation.

Document Reference	Document Title	Version	Published Date
IMP/001/010	Code of Practice for Standard Arrangements for Customer Connections	9.0	July 2021

2. Scope

The scope of the document includes connections to individual premises and to distribution systems of other authorised distributors i.e. Independent Distribution Network Operators (IDNOs) and Building Network Operators (BNOs). This document specifies the connection voltage (Low Voltage (LV) and High Voltage (HV)) and standard connection arrangements that are applicable to different size loads. Extra High Voltage (EHV) and 132kV arrangements are outside the scope of this document and shall be considered on an individual basis in accordance with the principles laid down this document and in the appropriate design policy.[2]

The standard connection configurations described in this document relate to load connections.

When designing a customer connection that supplies load only then this document applies along with one of the following Codes of Practice:

- IMP/001/911 – Code of Practice for the Economic Development of the LV System;
- IMP/001/912 – Code of Practice for the Economic Development of the HV System;
- IMP/001/913 – Code of Practice for the Economic Development of the EHV System; or
- IMP/001/914 – Code of Practice for the Economic Development of the 132kV System;

Where the customer has generation plant installed IMP/001/007 – Code of Practice for the Economic Development of Distribution Systems with Distributed Generation also applies.

This document describes the generic principles and connection configurations that should be applied when designing a new connection and when modifying an existing connection. Each connection shall be individually designed based on the principles contained in this document and take into account the capability of the existing network and the Customers' requirements. The Distribution Code and the Engineering Recommendations G98 and G99 are associated with the connection of generation plant.

[1] Guidance on the application to EHV and 132kV connections is provided in Annex 6

[2] This includes The ESQC (Amendment) Regulations 2006 (no 1521, 1st October 2006) and The ESQC (Amendment) Regulations 2009 (No 639, 6th April 2009).

2.1. Table of Contents

3. Code of Practice

3.1. Assessment of Relevant Drivers

The key internal business priorities relating to the standard arrangements for Customer connections are:

- Employee Commitment;
- Financial Strength;
- Customer Service;
- Regulatory Integrity; and
- Operational excellence.

The external business drivers relating to standard arrangements for Customer connections are detailed in the following sections.

3.2. Requirements of the Electricity Act 1989

The Electricity Act 1989 (as amended) lays down the core legislative framework for Northern Powergrid's operations as an authorised distributor. Specifically, it gives force to the ESQC Regulations 2002, and in section 9 identifies the general duties of the licence holder, as shown below.

9 General duties of licence holders.

1) It shall be the duty of an electricity distributor—

   a) To develop and maintain an efficient, co-ordinated and economical system of electricity distribution;

   b) To facilitate competition in the supply and generation of electricity.

2) It shall be the duty of the holder of a licence authorising him to transmit electricity—

   a) To develop and maintain an efficient, co-ordinated and economical system of electricity transmission; and

   b) To facilitate competition in the supply and generation of electricity.

Discharge of this obligation shall be supported in this document by describing policy for the efficient connection of Customers to the wider network.

Section 16 obligates Northern Powergrid to offer, maintain and provide a connection with the exceptions stated in section 17, below:

17 Exceptions from duty to connect.

3) Nothing in section 16(1) requires an electricity distributor to make a connection if and to the extent that -

   a) He is prevented from doing so by circumstances not within his control;

   b) Circumstances exist by reason of which his doing so would or might involve his being in breach of regulations under section 29, and he has taken all such steps as it was reasonable to take both to prevent the circumstances from occurring and to prevent them from having that effect; or

   c) It is not reasonable in all the circumstances for him to be required to do so.

This means that connection offers need not exactly reflect Customers' stated preference, particularly if it would be less safe than these standard arrangements.

3.3. Requirements of the Electricity Safety, Quality and Continuity Regulations

The following Regulations are in force:

- Electricity Safety, Quality and Continuity (ESQC) Regulations 2002 (Statutory Instrument 2002 No. 2665, January 31st 2003;
- Electricity Safety, Quality and Continuity (Amendment) Regulations 2006 (Statutory Instrument 2006 No. 1521, October 1st 2006); and
- Electricity Safety, Quality and Continuity (Amendment) Regulations 2009 (Statutory Instrument 2009 No. 639, 6th April 2009).

All these Regulations impose a number of obligations on the business, mainly relating to quality of supply and safety.

All the requirements of the ESQC Regulations that are applicable to the provision of connections to Customers shall be complied with and Northern Powergrid's distribution networks shall be designed to comply with these requirements.

Regulation	Reg. No	Text	Application to this policy
ESQCR 2002 Part I Introductory 3. General adequacy of electrical equipment	3(1)(a)	…distributors…shall ensure that their equipment is sufficient for the purposes for and the circumstances in which it is used; and …	This will be achieved by defining policy for the efficient connection of Customers to the wider network, specifically by laying down functional requirements for connection assets.
ESQCR 2002 Part II Protection and earthing 6. Electrical protection	6	A…distributor shall be responsible for the application of such protective devices to his network as will, so far as is reasonably practicable, prevent any current, including any leakage to earth, from flowing in any part of his network for such a period that that part of his network can no longer carry that current without danger.	This will be achieved by defining requirements for interface protection.
ESQCR 2002 Part VII Supplies to installations and to other networks 23. Precautions against supply failure	23(1)	A network shall be: (a) so arranged; and (b) so provided, where necessary, with fuses or automatic switching devices, appropriately located and set; as to restrict, so far as is reasonably practicable, the number of consumers affected by any fault in his network.	
ESQCR 2002 Part VII Supplies to installations and to other networks 24. Equipment on consumer's premises	24(4)	Unless he can reasonably conclude that it is inappropriate for reasons of safety, a distributor shall, when providing a new connection at low voltage, make available his supply neutral conductor or, if appropriate, the protective conductor of his network for connection to the protective conductor of the consumer's installation.	This will be achieved by defining appropriate earthing terminals to be made available.
ESQCR 2002 Part 7 Supplies to installations and to other networks 25. Connections to installations and other networks	25(2)	A distributor shall not give his consent to the making or altering of the connection referred to in paragraph (1), where he has reasonable grounds for believing that - (a) the consumer's installation, street electrical fixture or other distributor's network fails to comply with British Standard Requirements or these Regulations; or (b) the connection itself will not be so constructed, installed, protected and used or arranged for use, so as to prevent as far as is reasonably practicable, danger or interruption of supply.	This will be achieved by defining requirements for the interface between our public network and other networks or Customers' installations.

3.4. The Building Regulations 2010

Two parts of the Building Regulations[3] (Part P and Part B) need to be considered:

- Buildings Regulations 2010 (Electrical Safety – Dwellings) Part P; P1 Design and Installation of Electrical Installations; and
- Buildings Regulations 2010 (Fire Safety) Part B; Volume 1 Dwellings and houses.

Part P, P1 Design and Installation of Electrical Installations applies only to a building beyond the Point of Supply in Customer's premises.

The Building Regulations identify the boundary between the Customer's installation and the distribution system as the Source of Electricity Supply. In this Code of Practice, this boundary is defined as the Point of Supply. Any work Northern Powergrid carries as part of its licensed distribution business will be on the distribution system side of the Point of Supply boundary and is therefore not covered by the Building Regulations.

For clarity, Northern Powergrid, as part of its licensed distribution business is not expected to carry out any work on the Customer's side of the Point of Supply, however if we do alter any part of the electrical installation on the Customer's side of the Point of, then the Building Regulations apply.

Part B of the Building Regulations (Fire Safety) 2010; whilst this is generally addressed by adopting the standard arrangements in this Code of Practice, when designing a connection due regard should be given to the Customer's obligations under the Building Regulations.[4]

3.5. Requirements of the Electricity at Work Regulations 1989

The Electricity at Work Regulations 1989[5] place obligations on the business relating to the safety of plant and equipment used on the distribution system. It requires that plant and equipment is designed, constructed and operated within the limits of its capability.

3.6. Requirements of Distribution Licences

The Northern Powergrid Distribution Licences (i.e. relating to Northern Powergrid Northeast and Northern Powergrid Yorkshire) contain a number of conditions to be complied with which are relevant to system design.

Standard Licence Condition 20.2 requires the licensee to at all times have in force and to implement and comply with the Distribution Code.

Standard Licence Condition 24.1 requires the distribution system to be developed to a standard not less than that set out in Engineering Recommendation P2/7, Security of Supply, or any subsequent approved version of Engineering Recommendation P2. Engineering Recommendation P2/7 does not apply to the supply connection to single Customer premises, and these supply connections shall be considered on their own merits by discussion with the Customer.

Standard Licence Condition 49 (Electricity Distribution Losses Management Obligation and Distribution Losses Strategy) requires the licensee to ensure that distribution losses from its distribution system are as low as reasonably practicable, and to maintain and act in accordance with its Distribution Losses Strategy[6]. In particular:

[3] The Buildings Regulations 2010

[4] E.g. where a connection requires the construction of a Northern Powergrid switch room or control room as an integral part of a Customers building

[5] SI 1989/ 635 Electricity at Work regulations 1989, memorandum updated 2007.

[6] Strategy for Losses, February 2018. https://www.northernpowergrid.com/losses and as revised in controlled updates

- Standard Licence Condition 49.2 requires the licensee to design, build, and operate its distribution system in a manner that can reasonably be expected to ensure that distribution losses are as low as reasonably practicable; and
- Standard Licence Condition 49.3 requires that in designing, building and operating its distribution system the licensee must act in accordance with its Distribution Losses Strategy, having regard to the following:
    a) the distribution losses characteristics of new assets to be introduced to its distribution system;
    b) whether and when assets that form part of its distribution system should be replaced or repaired;
    c) the way that its distribution system is operated under normal operating conditions; and
    d) Any relevant legislation that may impact on its investment decisions.

3.7. Requirements of the Distribution Code

The Distribution Code covers all material technical aspects relating to connections to and the operation and use of the Distribution Systems of Distribution Network Operators, including Independent Distribution Network Operators. The Code is governed by The Distribution Code Review Panel and is specifically designed to:

- Permit the development, maintenance and operation of an efficient co-ordinated and economic system for the distribution of electricity;
- Facilitate competition in the generation and supply of electricity; and
- Efficiently discharge the obligations imposed upon DNOs by the Distribution Licence and comply with the Regulation (where Regulation has the meaning defined in the Distribution Licence) and any relevant legally binding decision of the European Commission and/or Agency for the Co-operation of Energy Regulators.

The Distribution Planning and Connection Code, a section of the Distribution Code, specifies the technical and design criteria and the procedures which shall be complied with in the planning and development of distribution systems. It also applies to Users of distribution systems in the planning and development of their own systems in so far as they affect the Northern Powergrid systems. Annex 1 of The Distribution Code lists the key engineering documents that should be consulted, as appropriate, when designing a Customer connection. These are:

- Engineering Recommendation G5 – Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom.
- Engineering Recommendation G12 – Requirements for the application of protective multiple earthing to low voltage networks.
- Engineering Recommendation G98 - Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public low-voltage distribution networks on or after 27 April 2019.
- Engineering Recommendation G99 - Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019.
- Engineering Recommendation P2/7 – Security of supply.
- Engineering Recommendation P14 – Preferred switchgear ratings.
- Engineering Recommendation P24 – AC traction supplies to British Rail.

- Engineering Recommendation P25 – The short-circuit characteristics of single-phase and three-phase low voltage distribution networks.
- Engineering Recommendation P28 – Voltage fluctuations and the connection of disturbing equipment to transmission systems and distribution networks in the United Kingdom.
- Engineering Recommendation P29 – Planning limits for voltage unbalance for voltage unbalance in the United Kingdom.
- Engineering Recommendation S34 – A guide for assessing the rise of earth potential at substation sites.
- Technical Specifications 41-24 – Guidelines for the design, installation, testing and maintenance of main earthing systems in substations.

The Distribution Code also sets out principles relating to the design of equipment and its operating regime. Equipment on Northern Powergrid's systems and on User's systems connected to the distribution systems shall comply with relevant statutory obligations, international and national specifications and Energy Networks Association technical specifications and standards.

3.8. Requirements of Engineering Recommendation G88

Engineering Recommendation G88 'Principles for the planning, connection and operation of electricity distribution networks at the interface between Distribution Network Operators (DNOs) and Independent Distribution Network Operators (IDNOs)' sets out the high-level principles for the DNO/IDNO interface and complements the statutory, regulatory and contractual requirements which take precedence. This Code of Practice incorporates the principles of Engineering Recommendation G88 however the Engineering Recommendation provides additional guidance on the issues to be considered when designing the connection to an Embedded Network.

3.9. Metering Requirements

All connections to Customers premises directly connected to Northern Powergrid's distribution system require energy to be accounted for in accordance with the Balancing and Settlement Code Baseline version 115, effective date 27 June 2013 (BSC). This shall generally be through the provision of an appropriate Settlements Metering system in accordance with BSC sections K, and section L by the registered Supplier.

With the exception of connections to public unmetered electric vehicles charging points[7], unmetered connections may only be provided in line with the guidance contained within the Electricity (Unmetered Supply) Regulations 2001[8] and the guidance contained within the latest version of Balancing and Settlement Code Procedure on Unmetered Supplies in Elexon's Balancing and Settlement Code (BSC) Procedure 520. Section 3.13.4 provides further detail on unmetered supplies. In addition, the principles for the connection of unmetered supplies contained in the Northern Powergrid Unmetered Supplies (UMS) Connection Policy, CUS/008 shall be followed.

Following a review of Ofgem's decision[9] on the need for and financing arrangements for metering at the boundary with Embedded Networks, Northern Powergrid does not require Boundary Metering. The intention is that the enduring portfolio billing solution will provide sufficient data required to enable Northern Powergrid to ensure that it can meet its statutory requirements and plan an efficient, co-ordinated and economical network. If there is thought to be a specific requirement for Boundary Metering, or a request for metering

[7] Although they are referred to as unmetered connections, public unmetered electric vehicle charging points utilise portable meters as opposed to a fixed meter that forms part of the charging facility. Elexon publishes a list of approved Central Management Systems (CMS) on their website, including portable meters to be used for unmetered connections referred to as metered Central Management Systems (mCMS).

[8] Statutory Instrument 2001, No 3263, Electricity (Unmetered Supply) Regulations 2001, Effective 01 October 2001.

[9] Ofgem decision on boundary metering Ref 29/10 March 2010

from an IDNO, associated with a particular Embedded Network boundary, guidance on the funding, registration and other settlement matters should be sought from System Planning and Network Trading.[10]

Where an Embedded Network Operator has a HV Point of Supply associated with a directly coupled HV/LV transformer, an electronic metering device shall be provided by the Embedded Network Operator and the readings made available to Northern Powergrid as contained in NPS/003/005 – Technical specification for LV PENDA ASSEMBLIES and TFX ASSEMBLIES.

3.10. Key Code of Practice Requirements

The objectives of this Code of Practice are:

- To ensure that all new Customer connections are made in such a way as to prevent danger to the public and our staff;
- To minimise as far as reasonably practicable the impact on quality of supply to our Customers due to faults and planned outages on our networks;
- To provide robust network connections and extensions that will be sufficiently future proof to meet the realistic requirements/expectations of the Customer; and
- To minimise as far as reasonably practicable any adverse impact of the power quality experienced by other connected Customers.

3.11. General Requirements Applicable to Both HV and LV Connections

3.11.1. System Development

Northern Powergrid's distribution systems are developed primarily through new connections. The general objective is to obtain a simple, robust, economical and efficient network, taking into account the initial capital investment, system losses, maintenance costs and operation costs over the life of the asset. In general, development of the LV and HV systems shall seek to improve the quality and reliability of supply provided to Customers and to reduce potential Customer Minutes Lost (CML) and Customer Interruptions (CI). The connection arrangement and nature of a Customer's new or additional load shall not disadvantage, or put at material greater risk, supplies to other Customers connected to that part of the distribution system.

3.11.2. Standard Arrangements

The standard connection arrangements described in Section 3.12.9 and 3.13.6 and shown in Appendix 2 and 3 should meet the requirements of the majority of the connections to individual Customer's premises and to Embedded Networks. The approximate size of load that is commonly connected to these standard arrangements is listed in Appendix 2 and 3. Most of the requirements are common to the connections to Customer's premises and Embedded Networks; however, where there are differences, they are identified in this Code of Practice.

Northern Powergrid shall provide a design for a connection request that meets the Customer's proposed capacity and include any likely future load and security requirements of the Customer based on the development, maintenance and operation of an efficient co-ordinated and economic system for the distribution of electricity.

3.11.3. Variations from the Standard Arrangements

The policy requirements outlined in this document shall apply to the majority of situations where the HV/LV system is developed, including new demand and generation connections, system reinforcement, application of flexibility services and asset replacement and recovery. There may be a small number of

[10] It is envisaged that Boundary Metering would only be required in special situations as agreed with the Embedded Network Operator. Whilst EHV connections are outside the scope of this policy, it is likely that Boundary Metering will be required at such interfaces.

cases where special arrangements, which are not strictly in accordance with the documented policy, may be more appropriate and can be considered where there are benefits to both Northern Powergrid and its Customers. Any such deviations relating to tactical implementation at an individual site shall be agreed with the relevant Design Manager[11] at an early stage of the design process. Any such deviations relating to strategic network development shall be agreed with the relevant Planning Manager[12] at an early stage of the design process.

The appropriate connection arrangement will depend on the Customer's existing, proposed, and likely future load and security requirements, and on the spare capacity available in the existing Northern Powergrid system. The Customer shall be made aware of, and agree to, any additional risks or conditions affecting the quality and security of their supply as a result of accepting a connection arrangement which is not one of the standard arrangements. All such agreements shall be documented in the Connection Agreement.

3.11.4. Co-ordination with Customer's System

Northern Powergrid has a duty to develop and maintain an efficient, secure and co-ordinated system that is both economical and safe. The Distribution Code places an obligation on both Northern Powergrid and the Users to comply with the Planning Criteria.[13] Customer connections shall, where practicable and economically viable, be designed such that both Northern Powergrid's and the Customers' systems form part of an economic, co-ordinated, and efficient system with flexibility to facilitate any future load increase that can be reasonably anticipated. This is achieved by applying consistent design approaches and the use of standard connection arrangements, switchgear and buildings.

3.11.5. Power Quality

Where a Customer's installation either directly connected to a Northern Powergrid distribution system or connected via an Embedded Network is likely to comprise equipment that produces voltage distortion, unbalance or harmonics, the connection design should take into consideration the requirements of Engineering Recommendations P28, P29 and G5 as appropriate.

Any costs incurred by Northern Powergrid as a result of providing a connection suitable for such 'abnormal' loads shall be borne by the Customer following the principles in the appropriate Standard Licence Condition 14[14] Statement.

3.11.6. Ownership of Equipment

Northern Powergrid shall retain ownership of the connection and protection equipment which is essential for the continuity and efficiency of its distribution systems and to meet Distribution Licence obligations, based on the principles set out in this section.

Northern Powergrid's equipment and the position of the Point of Supply are indicated on the drawings in Appendices 2 and 3 for HV and LV connections, respectively. The Point of Supply on the Customer's premises shall normally be at the outgoing terminals of Northern Powergrid's equipment, unless otherwise agreed in the Connection Agreement.

All the standard arrangements for connections to individual Customers' premises minimise Northern Powergrid's ownership of equipment on their premises. This reduces as far as possible, problems of access, third party damage, operation and maintenance, whilst allowing the Customer to install and own equipment to their own specifications (which may not necessarily match Northern Powergrid specifications).

[11] The Design Manager is a defined term - see section 5.

[12] The Planning Manager is a defined term - see section 5.

[13] Distribution Code DPC4.1.1.

[14] Electricity Act 1989, Standard conditions of the electricity distribution licence – 14 July 2013, Standard Licence Condition 14, Charges for Use of System.

Responsibility for construction, commissioning, operation, maintenance, repair and eventual replacement of equipment shall normally follow ownership. In appropriate cases however, the Customer may be authorised to open and close Northern Powergrid's switchgear under instruction from the appropriate Northern Powergrid Control Centre in order to restore their supply.

3.11.6.1. Northern Powergrid Switchgear and Protection

Northern Powergrid shall own the switchgear and associated equipment essential to ensure the integrity of its system.

Northern Powergrid shall own the switchgear and excess energy protection required to meet its obligations under the ESQCR 2002.

3.11.6.2. Emergency Disconnection Facilities

Northern Powergrid shall provide a means of ensuring compliance with Regulation 12 of the Electricity at Work Regulations 1989 which requires that:

> *Means of cutting off the supply and for isolation:*
>
> *12. '…where necessary to prevent danger, suitable means… …shall be available for*
>
> *(a) cutting off the supply of electrical energy to any electrical equipment'*
>
> *(b) the isolation of any electrical equipment*

Northern Powergrid shall provide and maintain a means of emergency disconnection for HV Customers, or Customers fed from a LV circuit breaker, as required under Electricity at Work Regulation 12. These emergency disconnection facilities shall normally comprise a push button arranged to disconnect the supply by tripping the appropriate item of switchgear. This will be dependent on the Customer's connection arrangement, as below. The push button(s) shall be located at the nearest practicable point to the Point of Supply, i.e.

- HV Customer – Trip HV circuit breaker;
- LV Customer supplied from dedicated HV/LV transformer – Trip LV feeder circuit breaker;[15]
- LV Customer supplied from shared HV/LV transformer – Trip LV feeder circuit breaker.

Where this facility requires a Direct Current tripping supply, Northern Powergrid shall provide the tripping battery and associated equipment. Northern Powergrid tripping circuits shall not be extended beyond the substation premises. If the Customer requires the emergency tripping facility to be extended to some other location, they shall provide the additional apparatus (including any remote tripping battery), except that Northern Powergrid shall provide any interposing relay required at the substation at the Customer's expense. Supplies from the main Northern Powergrid substation battery shall not be extended outside the substation site boundary. Where a customer has more than one point of supply, separate trip control, located adjacent to each other, shall be provided for each circuit. Further details are provided in Appendix 5.

Where the Point of Supply to an Embedded Network is at a LV cut-out or LV link box, it provides a means of isolation in the event of an emergency.

3.11.6.3. Metering

For connections with Settlement Metering connected via current transformers, Northern Powergrid shall own some of the metering equipment including the current and voltage transformers, test terminal block and multicore cable from switchgear to test terminal block. A separate set of current

[15] This arrangement, i.e. tripping the feeder circuit breaker, facilitates a standard arrangement for all LV connections and the connection of future customers to the HV/LV transformer.

transformers (and where appropriate voltage transformer) and test terminal block shall be provided for each Point of Supply together with the associated multicore cable(s).

For connections with whole current Settlement Metering, the Northern Powergrid Point of Supply will be the outgoing terminals of the fused cut-out.

The ownership of Settlement Metering equipment is dependent upon contractual arrangements with the Customers' Supplier and Meter Operator.

For un-metered connections, the Northern Powergrid Point of Supply will be the outgoing terminals of the fused cut-out.

3.11.6.4. Customer Assets

The Customer shall own all equipment at the Point of Supply, other than that set out in 3.11.6.1, 3.11.6.2 and 3.11.6.3, including that required for protection of their circuits connected to the Point of Supply against excess energy required to meet their legal obligations and for operation and protection of the remainder of their electrical installation.

In some situations, for example that described in 3.12.1, provided that appropriate indemnities are agreed with the Customer and documented in the Connection Agreement, it is permissible for Customer to utilise the Northern Powergrid protection system to meet their legal obligations.

Where the customer requires their own protection scheme to be installed at the Point of Supply to comply with their legal obligations to provide excess energy protection, this is acceptable provided that Northern Powergrid have backup protection in order to comply with its obligations under the ESQC Regulations, 2002. If this is this case, where there is sufficient space in the Northern Powergrid Switchgear, the Customer's current transformers may be installed in Northern Powergrid switchgear.[16] The current transformer connections associated with any such current transformers shall be as short as reasonable practicable and shall not extend outside the Northern Powergrid substation site boundary or the site boundary of the Customer's substation provided that it is located immediately adjacent to the Northern Powergrid substation site boundary.[17] If this restriction means that a proposed protection arrangement becomes impractical, provided that appropriate indemnities are agreed with the Customer and documented in the Connection Agreement, it is permissible for the Customer to install the protection equipment associated with their circuit connected to the Point of Supply on a Norther Powergrid relay panel.[18] Any Customer protection relay installed on a Northern Powergrid relay panel shall be an ENA assessed relay. This is to ensure that the relay is designed and manufactured to a standard comparable with Northern Powergrid relays installed on the same relay panel and that any operational concerns with the relay are identified via the ENA National Equipment Defect Reporting Scheme (NEDeRS) and Suspension of Operational Practice (SOP) processes. Where a Customers protection relay is installed on a Northern Powergrid relay panel this shall be recorded in the Connection Agreement which shall address access to and the installation, commissioning, maintenance and future replacement of the Customer's equipment together with a mechanism for recovering any associated costs incurred by Northern Powergrid. Further details are provided in Appendix 7.

Distribution Planning Code DPC6.7.8 sets out a requirement for the Customer to provide their own current transformers and voltage transformers required for their protection, instrumentation and

[16] If there is insufficient space in the Northern Powergrid switchgear normally used for a connection arrangement there may be a need to use different switchgear, e.g. a standalone circuit breaker rather than a RMU.

[17] This is to manage the risk of excessive voltage across the current transformer connections in the event that the connections become open circuit. This risk is dependent on the characteristics of the current transformer and the probability of the connections becoming open circuit. This probability increases as the length of the connections increase and if they are installed in an unprotected environment. Northern Powergrid practice is to manage this risk by prohibiting the extension of current transformer connections outside the substation site boundary.

[18] In most cases it is expected that there would be sufficient space to accommodate the Customers protection relay on the Northern Powergrid Relay panel. If this is not the case, it may be practical to install a standalone relay panel in the same room. Installing the Customer's relay in a metering annex is non-preferred as this would result in the Northern Powergrid DC supplies being extended to an environment not under the control of Northern Powergrid.

management purposes. Where any signals within the scope of DPC6.7.8[19] are provided by Northern Powergrid, this shall be recorded together with appropriate indemnities in the Connection Agreement.

3.11.7. Substation Accommodation and Access

For arrangements 3.1, 3.3 and 3.5 the Customer shall be required to provide or arrange for the provision of a suitably secure, weatherproof environment in which to locate Northern Powergrid equipment and equipment owned by the Meter Operator.

For arrangements 3.2 the Embedded Network Operator shall be required to provide or arrange for the provision of a suitably secure, weatherproof environment to meet the requirements of both Northern Powergrid (to house their distribution equipment) and where appropriate the Meter Operator (for their metering equipment). Enclosures providing a supply to an Embedded Networks should be at ground level with 24-hour vehicular access located on a site agreed between Northern Powergrid and the Embedded Network Operator.

For all other arrangements[20] the Customer shall provide and maintain the substation accommodation designed to meet the requirements of both Northern Powergrid (to house their distribution equipment) and where appropriate the Meter Operator (for their metering equipment). Northern Powergrid requires long term security of tenure where the Customer's substation allows Northern Powergrid operational benefits for other Customers.

All substation sites, accommodation and access shall be provided in accordance with the guidance contained in the Policy CNS/003, Operational Land and Buildings Policy, and its subsidiary documentation.

Substations providing connections to individual Customers premises should normally be located on the curtilage of their premises at ground level with 24-hour vehicular access. Substations providing supplies to Embedded Networks should be at ground level with 24-hour vehicular access located on a site agreed between Northern Powergrid and the Embedded Network Operator.

In order to minimise safety and flood risks and facilitate operational access, new substations shall not be situated on a roof or in the basements of buildings unless there are no other reasonably practicable sites. A new substation shall only be located on a roof or in a basement where a risk assessment indicates that the resultant safety and operational risks are deemed to be acceptable by the System Design Manager. During the design and installation of new substations, the guidance contained within the Construction, Design and Management Regulations shall be followed, in particular, the guidance relating to the future maintenance, renewal and disposal needs of the substation.

All substations and their associated housings shall be installed and arranged in accordance with the guidance set out in the following internal documentation:

- IMP/001/012 Code of Practice for Flood Mitigation at Operational Premises;
- IMP/011 Policy for Fire Mitigation at Operational Premises; and
- NSP/007/020 Guidance on Substation Design: Transformer Noise.

The Customer shall not normally have access to Northern Powergrid equipment except in special cases where the Customer is given permission to operate such equipment or where it is inappropriate to restrict access, for example, a connection arrangement that is provided at LV.

Metering current and voltage transformer test blocks shall be located adjacent to the Point of Supply. The metering current and voltage transformer test blocks shall be readily accessible to the Customer, the Meter Operator and Northern Powergrid. The Customer shall permit the Meter Operator to install such metering equipment as may be reasonably required. The Customer shall also allow the Meter Operator

[19] See Appendix 8.

[20] Apart from arrangement 3.6 where the Point of Supply is associated with a Link Box

and Northern Powergrid access (as reasonably required) to such equipment at all times and shall refrain from interfering with such equipment that they do not own or operate.

3.11.8. Point of Supply

The Point(s) of Supply shall be at the outgoing terminals of Northern Powergrid's equipment, unless otherwise agreed in writing with the Customer.

The standard connection arrangements in this Code of Practice are based on providing one or more Points of Supply to a Customer's premises. Unless the standard arrangement has two Points of Supply, a Customer would not normally be offered a second Point of Supply, particularly where it is requested to provide a supply for use as a source of emergency power, because:

- It cannot be assumed that the second connection will always be available during any given fault scenario;
- It may be necessary to de-energise parts of the network as part of the fault location process or as part of maintenance work – this may interrupt the supplies to a second connection; and
- To be of practical use, the integrity of the second connection would need to be monitored. Northern Powergrid shall not undertake this responsibility.

Under s17(1)(c) of The Electricity Act 1989 (as amended), Northern Powergrid is not obligated to offer to provide a connection to an individual Customer's premises whereby doing so would not be reasonable in all the circumstances. For example, it would be unreasonable to offer more than one Point of Supply to a Customer's premises where there is a credible risk that they might become interconnected.

Customers shall be reminded that stand-by generators or batteries should be used to provide emergency supplies in accordance with BS 9999-2008 Code of Practice for fire safety in the design, management and use of buildings.

3.11.9. Multiple Points of Supply

Some standard connection arrangements, as shown in Appendix 2, comprise multiple Points of Supply. In these situations, all Points of Supply, are provided at the same voltage and should be situated at one location on those premises. This ensures that:

- There is a single location on a Customer's premises i.e. within one switch room where all supplies can be disconnected in an emergency. The emergency disconnection facilities described in section 3.11.6 should be arranged to trip all the Points of Supply on a customer's premises;
- There is only one location on a Customer's premises that needs to be physically secure; and
- The cost of operation and maintenance is minimised.

The provision of multiple Points of Supply, potentially at different voltages at more than one location on a Customer's premises can be provided in exceptional situations with the agreement of the System Design Manager (see Appendix 4 for additional guidance).

The provision of multiple Points of Supply from the Northern Powergrid network to an Embedded Network is acceptable as it could be the most efficient, co-ordinated and economic development of the system. Embedded Networks are operated by licensed Network Operators who have the same responsibilities as Northern Powergrid under The Electricity Act 1989 (as amended) and ESQC Regulations to prevent danger and they should have systems in place to ensure that connections are not interconnected in a way that could give rise to safety implications or have an adverse impact on customers. Multiple Points of Supply to an Embedded Network are permitted provided that no switching is carried out that may affect the Northern Powergrid network (e.g. making parallels across the Northern Powergrid system) without the permission of the appropriate Northern Powergrid Control Centre.

Where multiple LV Points of Supply are provided at one location, due consideration also needs to be taken of:

- The mixing of Separate neutral and earth (SNE) and combined neutral and earth (CNE) systems;
- Neutral current diversion issues with two protective multiple earthing (PME) connections; and
- The mixing of system phasing and vector groups (see Code of Practice for Distribution System Parameters IMP/001/909).

3.11.10. Extensions to Northern Powergrid Equipment

Where equipment (i.e. cable and overhead circuits, switchgear, transformers, protection and control systems) is to be installed by suitably accredited Independent Connection Providers for adoption by Northern Powergrid, such equipment shall comply with appropriate Northern Powergrid's equipment standards. Northern Powergrid shall approve the design of systems and specification of equipment, as part of the design approval process in support of competition in connections in the suite of documentation forming Engineering Recommendation G81.

3.11.11. The Distribution Code

The connection arrangement for each Customer shall take account of the requirements in the Distribution Code. The requirements in relation to security of supply are particularly relevant.

Connections to Northern Powergrid's networks that supply only one Customer premises require special consideration of costs and the Customer's requirements for the level of security of supply.

In summary, Engineering Recommendation P2/7 does not apply to the design of a connection to individual Customer premises, and it is for each Customer to decide, in negotiations with the relevant Network Operator, the level of security required. Where, as a result of applying this guidance, the connection to a single Customer is provided at a level of security less than that prescribed in Engineering Recommendation P2/7 there is no need to seek derogation from Ofgem.

Northern Powergrid's policy is that a Customer shall normally be provided with the offer of a connection that complies with the requirements of Engineering Recommendation P2/7 for the equivalent demand group. Where, in the course of discussions with the Customer it is apparent that they are able and willing to consider a lower standard of security, and such an arrangement is agreeable to both parties, is practicable and offers cost benefits, the Customer can be provided with a connection offer to an agreed lower security standard. In such circumstances the Customer shall be made aware of the potential implications of the lower security standard in writing, and his acceptance of these shall be recorded in the Connection Agreement.

Connections to Customers which offer a standard of security higher than that specified in Engineering Recommendation P2/7 may be provided in special situations, for example where a Customer specifically requires a higher standard of security or where consideration of system losses resulting in a more economic design (for example with duplication of long circuits). In such situations any additional funding required from a Customer will be determined in line with the appropriate Northern Powergrid Northeast and Northern Powergrid Yorkshire Standard Licence Condition 14 statement.

It must be emphasised that the relaxation from providing a connection that is compliant with ER Engineering Recommendation P2/7 applies only to a connection that supplies a single individual Customer. Any part of a connection arrangement that supplies more than one customer shall comply with the normal requirements of Engineering Recommendation P2/7.

All connections to Embedded Networks shall comply with Engineering Recommendation P2/7.[21] Operators of Embedded Networks have the same obligations as Northern Powergrid to comply with Engineering Recommendation P2/7 and any connection provided should be carried out in co-ordination

[21] An exception to this could be where an IDNO provides a connection to an individual single Customer who requests a connection with a lower level of security than that set out in Engineering Recommendation P2/7.

with them to ensure that both parties can comply with the requirements of Engineering Recommendation P2/7.

Under the Distribution Planning Code (DPC 6.2), connections for entry to or exit from Northern Powergrid's system shall incorporate a means whereby Northern Powergrid can disconnect the User's equipment. Such facilities are provided on the standard arrangements described in section 3.12.9 and 3.13.6.

3.11.12. Technical Requirements

The continuous summer rating of equipment, with no account being taken of cyclic capability, should normally be used when determining the capacity of the new assets used to provide a new connection. An assessment of the capability of other, new or existing network assets, forming part of the wider network, should be based on the appropriate demand curve, seasonal asset capability and forecast demand growth. Care shall be taken when selecting items of plant for a connection to ensure that the rating of that plant is sufficient for the situation and configuration in which it is to be used. All new HV and LV connections shall comply with the requirements of the relevant system design policy. (IMP/001/912 – Code of Practice for the Economic Development of the HV System and IMP/001/911 – Code of Practice for the Economic Development of Low Voltage Networks).

3.11.13. Choice of Connection Voltage

The connection voltage will depend upon the type and size of the Customer's demand, and shall be determined by Northern Powergrid and agreed with the Customer as part of the connection application process in accordance with the following principles:

The connection voltage shall be the lowest voltage such that a standard arrangement can be used without exceeding the rating of any equipment. This ensures that:

- There is an enduring opportunity to supply existing and future Customers from Northern Powergrid assets thus developing an economical efficient and co-ordinated system;
- The total assets (i.e. Northern Powergrid and Customer assets) forming the overall electricity infrastructure are generally minimised; and
- It generally results in a fairer allocation of the DUoS charges across the whole customer base.

However, in exceptional circumstances a higher voltage Point of Supply may be provided where:

- The Customer specifically requests a higher voltage connection, and it is technically and commercially reasonable for us to do so;
- The location of the Point of Supply substation is such that there are very limited opportunities for supplying other Customers from it; or
- The nature of the customer demand is such that there would be technical difficulties in supplying other Customers from common assets e.g. if the connection would create a 'dirty busbar'.

In practice these principles mean that the Point of Supply shall normally be at LV unless the Customer's maximum demand is expected to exceed 1MVA within a relatively short period[22] of time, or where the nature of the Customer's load will cause disturbance to other Customers. In situations where the Customer explicitly requests a higher capacity LV supply e.g. supply to a supermarket, a supply at LV up to 1.6MVA can be made available.

Connections with a capacity greater than 1MVA shall normally be provided at HV. The actual supply capacity available will be dependent upon the nominal voltage of the HV network at the Point of Connection and the spare capacity on that part of the system.

[22] For example, within a two-year period

Connections less than 200kVA should not be provided at HV unless specifically requested by the Customer.

The 6kV system is a legacy system with limited load capability and which will incur higher losses compared to delivering the same energy from an 11kV system. Where the HV system in a geographic area operates at 6kV or a combination of 6kV and 11kV, a new connection shall be provided at 11kV unless a 6kV connection is significantly more economical. Where a 6kV busbar is provided only for the benefit of one Customer, this shall not subsequently be developed to connect other Customers. Where the provision of a connection would require the installation of a new primary substation, the Point of Supply shall normally be provided at 11kV (or 20kV where appropriate) as this provides an economical means of developing the HV network.

If it is significantly more economical[23] to provide a connection at 6kV, in order to facilitate future conversion from 6kV to 11kV, all new HV equipment connected to the 6kV network should be capable of operating at 11kV. This may require the use of dual ratio transformers.

When designing connections with a firm capacity in excess of what can be provided by two 630A[24] circuits (12MVA at 11kV and 22MVA at 20kV) consideration should be given to providing a Point of Supply at EHV.

3.11.14. Connection Capacity

The connection capacity that can be provided by a particular connection arrangement at a given point on the network is dependent on a number of factors including, the capacity of transformers, switchgear, cable (influenced by its environment and proximity to other cables) and overhead lines, the voltage at the Point of Connection and the characteristics of the existing and additional demand. Hence it is not possible to state definitive values for the capability of individual connection arrangements. Approximate capacities are provided throughout this document to give guidance to Design Engineers of the typical demand that can be provided by each connection arrangement. It is important to note that the rating of switchgear should be considered to be absolute as it does not have a recognised cyclic capacity.

3.11.15. Short Circuit Level

The design of the Northern Powergrid HV system is based on the use of two standard impedance EHV/HV transformers operating in parallel. Similarly, the design LV system is based on the use of a single standard impedance HV/LV transformer supplying an LV busbar. The resulting maximum prospective design short circuit levels are presented in the Code of Practice for Distribution System Parameters, IMP/001/909.

Customer's equipment shall be capable of accommodating these values as a minimum, but they should aware that design short circuit levels may increase in the future, for example to permit connection of additional generation. New Customer's equipment should therefore be capable of accommodating the 'minimum break rating for new switchgear' as defined in IMP/001/909 to avoid incurring additional future costs of equipment replacement.

3.11.16. Information Required for Proposed New Connections

To assist in the production of the Distribution Load Estimates and to enable updating of generation details, the following information, relating to load or generation greater than 250kVA[25] shall be kept electronically in an internally accessible format:

- The name of the primary substation that will supply the new or additional load / generation;

[23] When making this assessment, consideration should be given to the system losses which will be greater for a 6kV supply compared to one provided at 11kV.

[24] i.e. the rating of a typical primary HV circuit breakers and metering units, although consideration should be given to the ratings of the HV cables (especially if installed in ducting) used to provide a connection, which may restrict this capacity.

[25] It is recognised that data on load or generators 250kVA and above may not be currently available. However, with the development of CRM it is envisaged that this will be captured in the future.

- The name of the organisation requesting the new or additional load / generation;
- Whether the load / generation is additional or new;
- The magnitude of the additional or new load / generation;
- Whether the connection is a Flexible Connection or is part of an Active Network Management system;
- Whether the customer proposed to contract to provide a Flexibility Service to wither Northern Powergrid or NGESO; and
- The after-diversity magnitude of the additional or new load.

3.11.17. Northern Powergrid / Customer Interface Protection

These general requirements shall apply to all Points of Supply:

- Northern Powergrid shall provide interface protection to safeguard the integrity of its network, in accordance with its statutory duty under section 9 of the Electricity Act 1989 (as amended) to develop and maintain an efficient, co-ordinated and economical system[26]. This shall include reasonable precautions against:
    - the dangers associated with prevent excess current, consistent with ESQC regulation 6;
    - faults on the Customer's system causing protection operation on Northern Powergrid's system (other than at the interface), consistent with ESQC regulation 23(1); and
    - where appropriate, danger caused by generation attempting to energise a faulted network;
- Northern Powergrid shall provide a means of isolation.[27] This shall generally be achieved by removing fuses from their carriers (separate isolating switches are not required), or by isolating metered circuit breakers, as appropriate to the individual connection;
- The Customer need not install their own protection in series with Northern Powergrid's protection if they accept that the equipment and scheme used to protect the Northern Powergrid system will also protect his system. This is permitted under BS 7671 (regulation 473-02-02);
- Northern Powergrid's protection may be used to protect Customer's equipment, provided the Customer grants an indemnity for use of the protection equipment, and for the adequacy of the protection scheme to protect their equipment. Where the Customer considers that the Northern Powergrid protection scheme does not adequately protect their assets, or where the Customer does not provide adequate indemnity, they shall install their own protection and control equipment;
- It should be noted that Ofgem has determined (paragraph 6.8 of Ofgem determination S/23/R/155[28]) that protective measures should be applied by the owner of electric lines and apparatus; and that distributors (DNOs) are not obliged to provide protection for plant or equipment owned by a Customer (or other third parties). This reinforces the point already made in this Code of Practice, that Northern Powergrid shall provide a scheme to protect its network,

[26] It is accepted that in some situations e.g. where the Point of Supply is at the outgoing terminals of a LV link box the interface protection will be provided by the Embedded Network Operator.

[27] Where the Point of Supply is at the outgoing terminals of a LV-cut out or LV link box, isolation is provided by the fuses / links.

[28] Determination by the Gas and Electricity Markets Authority of a dispute referred to in under section 23 of the Electricity Act 1989 concerning the charges proposed for an electricity connection; S23-R-155, dated 02-May-2003.

which customers or other distributors may also use, at their choice and risk, if the characteristics of that scheme also protect their downstream assets; and

- The metering circuit breakers shall be equipped with protection, in accordance with IMP/001/014 – Code of Practice for the Protection of Distribution Networks.

3.12. Connection of High Voltage Customers

This section describes the standard connection arrangements for the provision of Points of Supply at HV. In addition to the general requirements applicable to both HV and LV described in Section 3.11, the following issues should be considered:

3.12.1. General Requirements

Where a Point of Supply is provided at a Customer's premises their equipment shall be located as close as is reasonably practicable to the Point of Supply in order to minimise the length of HV cable between the Point of Supply and the Customer's equipment. This cable is the responsibility of the Customer and where the Customer has agreed that the Northern Powergrid protection is sufficient for them to meet their legal obligations, the cable shall be installed in a controlled environment where there is negligible risk of any future interference and, to minimise the possibility of the metering circuit breaker operating due to a fault on the HV cable, the length should normally be limited to 20m.[29]

Customers connected at HV shall be advised of the network's maximum fault level at the Point of Supply. Generally, switchgear with a short circuit rating of 20kA for 3 seconds will be adequate for connections made directly to a primary substation or distribution substation installation, respectively. There will be a few special cases, for example where generation plant or large motors are connected, where higher switchgear ratings may be required.

3.12.2. Jointly Owned Switchboards

Switchboards that are jointly owned by Customers and Northern Powergrid impose undesirable procedural and procurement implications and shall be avoided wherever it is reasonably practicable and economical to do so. Cable couplers between Northern Powergrid's and the Customer's equipment shall be used wherever practicable. In those circumstances where a jointly owned switchboard is the only reasonably practicable option, for example to facilitate unit protected incoming feeders, the following shall apply:

- The switchgear specification and manufacturer are approved by Northern Powergrid; and
- Acceptable terms are negotiated covering responsibility for maintenance and eventual replacement, and these shall be written into the Connection Agreement.

In the case of jointly owned switchboards, where failure of any battery on the joint board would impact on other Customers or incur risk of damage to Northern Powergrid equipment, the battery shall be owned by Northern Powergrid. In cases where failure of the battery only impacts on the Customer, the Customer shall own the joint board battery.

3.12.3. Sterilisation of Northern Powergrid Assets

The design of Customer connections or connections to an Embedded Network shall be such that the capacity available at an EHV to HV substation, i.e. electrical capacity and space to install additional equipment, to meet future Customer requirements is not unduly restricted. Where there is limited space to install additional circuit breakers, dedicated circuit breakers shall not be used to provide a new connection if their use would limit the capability of Northern Powergrid to discharge its legal obligation to develop an efficient, co-ordinated and economical system by preventing the use of any unutilised electrical capacity to supply future Customers due to the lack of space to install further circuit breakers

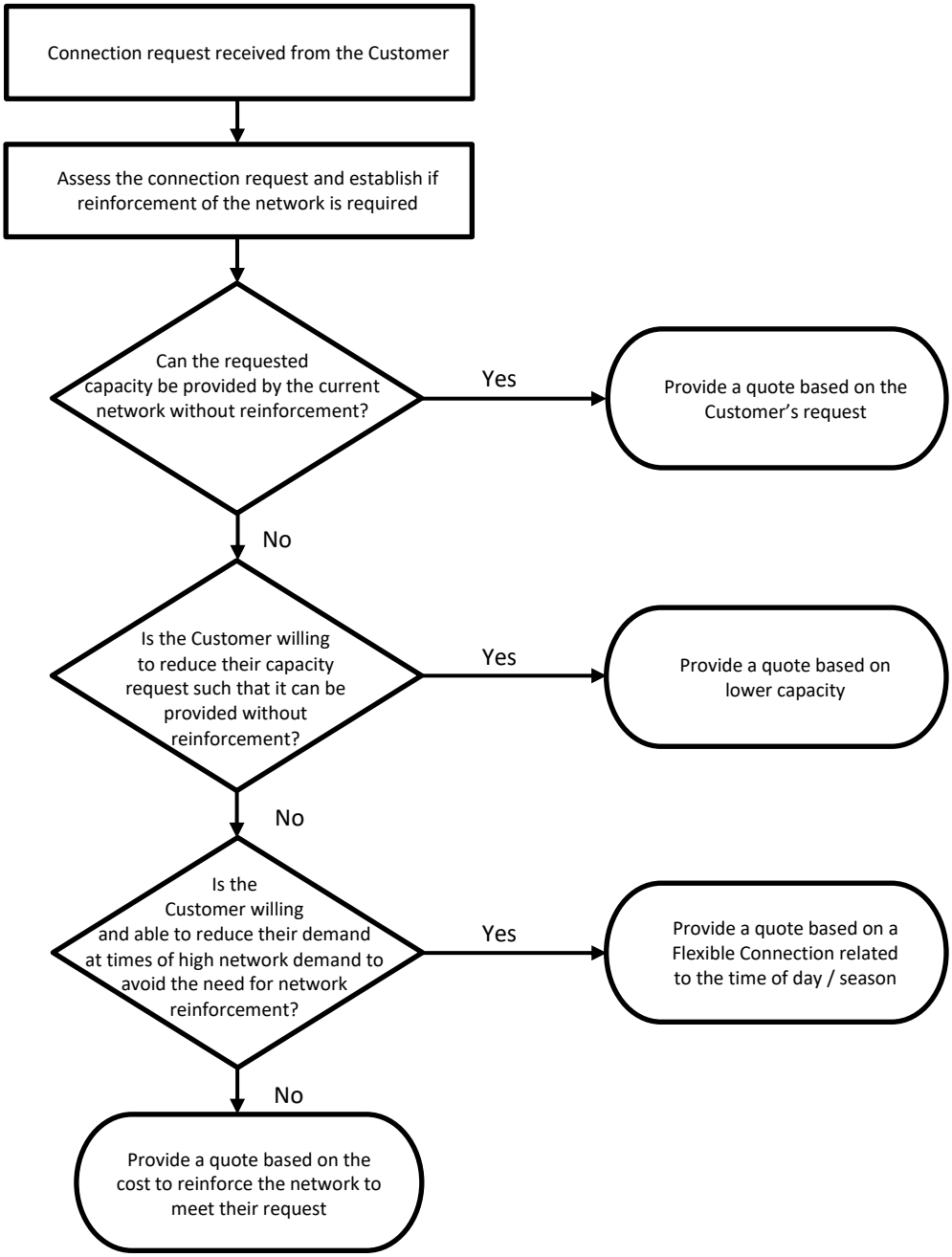
[29] 20m is considered to be a reasonable length to allow the Customer to install his HV equipment adjacent to the Point of Supply.

or other equipment. Such 'sterilisation' of system capacity, which would prevent the efficient connection of future Customers, is not permitted by this policy and all system development shall avoid this situation arising by properly considering this issue at the design stage.

3.12.4. Design of Customer Connections

The connection offer made to a Customer should be based on providing the required capacity on an unconstrained basis. Where the capacity cannot be economically provided on an unconstrained basis, consideration should be given to providing the capacity on a constrained basis. The following flow chart demonstrates the design process that should be followed.

Where a Customer has more than one Point of Supply to provide security, both the constrained and unconstrained capacity available via each Point of Supply may be different.



3.12.5. Alternative Connection Design

The initial assessment of the existing network capacity should be based on standard ratings for the assets. Where the requested capacity cannot be economically provided on an unconstrained basis to meet a Customer's connection request the following alternatives should be considered:

a) A bespoke assessment of the assets limiting the connection capacity to see if an enhanced static continuous rating can be established. This may enable the Customers connection capacity to be provided on an unconstrained basis; or

b) A bespoke assessment of the assets limiting the connection capacity to see if an enhanced static seasonal or time-based rating can be established. This may enable the Customers connection capacity to be provided on a seasonally constrained basis.

Alternative technologies can be considered to allow the required Customers capacity to be provided without network reinforcement; however, this will be dependent on the nature of the Customer's load and the ability for the Customer to reduce their demand on request.

It is noted that not all alternative technologies may be viable, and each connection request will require assessment on its own merits.

Any alternative connection cost (including any enduring operational costs) should be compared against the cost of reinforcement to ensure that Northern Powergrid is developing, maintaining and operating an efficient co-ordinated and economic system.

3.12.6. Monitoring of Constrained Capacity Connections

Connection Agreements that offer constrained capacity using seasonal asset ratings or alternative technologies may require continuous monitoring of the system and/or the Customer's load both when the system is configured normally and during outages. Where a Customer requires a connection capacity in excess of the available unconstrained capacity, a load management scheme providing both alarm and trip signals shall be applied following consultation with the System Design Manager. The details of such schemes shall be recorded in the Connection Agreement and on an Operational Interface drawing retained at the substation where the Point of Supply is provided.

3.12.7. Substation Auxiliary Supplies

The Customer shall provide a 230V single-phase AC supply for lighting, heating, and battery charging together with a 13-amp socket outlet to provide a supply for testing equipment. Only in exceptional circumstances should a separate supply be provided from the Northern Powergrid LV network (at the Customer's cost), in which case a notice identifying the source of the LV supply shall be fixed to any Earth Fault Indicator in the substation[30].

The auxiliary supplies shall be for the sole use of Northern Powergrid and shall not be made available to the Customer. Should the Customer require an alternative auxiliary supply, this would constitute a multiple Point of Supply and section 3.11.9 applies.

If the substation is a primary substation with two or more transformers owned by Northern Powergrid, the auxiliary supplies shall be derived from the Northern Powergrid auxiliary transformers at that substation.

3.12.8. Point of Supply Switching

In appropriate cases the Customer may be authorised by Northern Powergrid to close the normally open circuit breaker to restore his supply if it is located at the same place as the equipment that forms the Customer's connection.

[30] This is to avoid any confusion when the LV supply is restored post fault which will reset the Earth Fault Indicator.

3.12.9. HV Standard Arrangements

3.12.9.1. Connections to an Existing Ring Network (arrangement 2.1)

Arrangement 2.1 with a loop-in shall be the first arrangement considered for Customers requiring a connection up to 160A.[31] Arrangement 2.1 with a tee off may be proposed if a single Customer explicitly confirms that they do not want the level of security provided by a loop-in arrangement.

Arrangement 2.1 with a tee-off should not be offered where there is an existing tee between two circuit breakers or switches and where the total load between those circuit breakers or switches would exceed 1MW, i.e. the resulting network shall always continue to comply with the requirement of Engineering Recommendation P2/7.

Arrangement 2.1 provides non-firm connections via a single Point of Supply and an outage of the Northern Powergrid metering circuit breaker would result in interruption of the supply.

All connections to the existing HV network will be dependent on the capacity available in that network. It may be necessary, in some circumstances, to implement substantial network re-configuration or reinforcement in order to accommodate the Customer's new load requirements in full.

If it is likely that a Customer connected at 20kV will require additional capacity in the short to medium term such that his maximum demand will exceed 160A, the Customer should be encouraged to agree to the use of extensible switchgear, rated at up to 630A as per Arrangement 2.3. Unless there is no possibility of future expansion, the Customer should be encouraged to provide a switch room large enough to facilitate future development.

Arrangement 2.1 is permitted for connections to Embedded Networks with a demand of less than 1MW[32] or where the IDNO supplies a single Customer, and that Customer agrees to a security of supply less than the Engineering Recommendation P2/7 requirements. Where the demand is over 1MW, two 'Arrangement 2.1' connections could be used to provide a connection with a capacity up to the rating of RMU and / or Metering Units.

3.12.9.2. Increase in Existing RMU Supply through a Dedicated Feeder (arrangement 2.2)

Arrangement 2.2 shall only be used when developing an existing HV connection and where it provides an economical alternative to providing the Customer with one of Arrangements 2.3 – 2.7. The normal supply is via the dedicated feeder from the primary substation, with the alternative supply being provided by the existing network connection. It may be necessary to adopt different protection settings on the normal and alternative Points of Supply. The dedicated feeder shall not be connected in parallel with the alternative network connection under normal operating conditions.

This connection arrangement provides a firm connection as there are two Points of Supply, however firm capacity available will generally be limited by the capacity of the alternative feeder which will, in the vast majority of cases, be incapable of supplying the load that can be provided by the dedicated feeder. In this arrangement Customer supplies can be restored by switching[33] in the event of a failure of the normal dedicated feeder. However, the customer will still experience an interruption of supply for switching time.

Where the capacity of the alternative feeder is less than the load requested by the Customer, a load management scheme, providing both alarm and trip signals, should be incorporated. The details of such a scheme shall be recorded in the Connection Agreement.

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[31] The installed circuit breaker is rated at 200A; a restriction is applied to the 200A circuit breaker due to the maximum current settings that can be selected on the VIP300 protection relay. The requirement in DSS / 007 / 010 – Code of Practice for the protection and control of HV circuits us that relays are set to 125% of the installed capacity. 160A x 125% = 200A.

[32] An operator of an Embedded Network is required to comply with Engineering Recommendation P2/7 and for demand greater than 1MW, an outage of the single Northern Powergrid interface circuit breaker would be non-complaint.

[33] Switching may be carried out manually or, if the switchgear is suitably equipped, by remote control.

Given that this arrangement is only permitted as a development of an existing connection it is unlikely to be appropriate for an Embedded Network connection. For connections greater than 1MW to comply with Engineering Recommendation P2/7 the Embedded Network Operator would need to be able to operate the Point of Supply switchgear or arrange for Northern Powergrid to operate it within the required timescales.

3.12.9.3. Dedicated Connection from a Primary Substation (arrangement 2.3)

Connection arrangement 2.3 provides a non-firm connection as there is only a single Point of Supply and an outage of the Northern Powergrid metering circuit breaker would result in interruption of the supply although supplies to the substation can be restored by switching in the event of a failure of one of the incoming feeders. The Customer will experience a loss of supply during the switching / restoration period.

Where extensible switchgear is installed, it may be possible to install unit protection on each of the incoming feeders so that they can be operated in parallel. This would provide continuity of supply in the event of a failure of one of the two feeders.

The capacity available on both the normal and switched alternative network feeder shall be sufficient for supplying the full load requirements of the Customer. Care needs to be taken to ensure that voltage drop on the circuit does not limit the capacity of the arrangement.

This arrangement is permitted for Embedded Network connections only below 1MW, as it would otherwise be inconsistent with Engineering Recommendation P2/7, being subject to a single outage of the interface Northern Powergrid circuit breaker.

3.12.9.4. Firm Connection to an Individual Customer Premises (arrangement 2.4)

Arrangement 2.4 provides a firm connection to an individual Customer's premises. This provides a firm connection as there are two Points of Supply and an outage of one of the Northern Powergrid metering circuit breaker or feeders would not interrupt the supply to the other Point of Supply.

The capacity available on both the normal and switched alternative network feeder shall be sufficient for supplying the full load requirements of the Customer unless agreed with the Customer. Care needs to be taken to ensure that voltage drop on the circuit does not limit the capacity of the arrangement.

In exceptional circumstances, where it is agreed that a Point of Supply can be provided at a primary substation,[34] such that the Customer owns the outgoing circuits, Northern Powergrid will provide metering circuit breakers at the source substation provided that the ownership and suitability of the protection for the Customer's circuits is agreed. This arrangement is similar to that shown in Arrangement 2.6, but with metering installed at the Point of Supply.

The circuit breakers shall be equipped with discriminating protection (unit or directional overcurrent), in accordance with the IMP/001/014 – Code of Practice for the Protection of Distribution Networks. Where feeder circuits operate in parallel, switchable (dual) protection settings shall be provided. It is the provision of this type of protection that permits parallel operation of both circuits and hence ensures the uninterrupted continuity of Customer supplies under first circuit outage conditions.

If this connection arrangement is proposed, it is essential to open early discussions with the Customer on protection at the interface, specifically to understand the relative roles of incoming Northern Powergrid and Customer-owned circuit breakers.

Under this arrangement, the HV feeders are dedicated to the specific Customer (by protection requirements as well as any commercial considerations). Arrangement 2.7 is a potential development from Arrangement 2.4, which enables any spare capacity of the incoming circuits to be used to support

[34] See paragraph 3.12.3 relating to the sterilisation of Northern Powergrid assets

existing or future Northern Powergrid demand, however practical issues such as the space in the switch room may limit the occasions when this development could be realised.

3.12.9.5. Firm Connection to Embedded Networks (arrangement 2.5 and 2.6)

Arrangement 2.5 provides a firm connection to an Embedded Network. In this arrangement the Point of Supply is at the incoming busbar connections of the Embedded Network Operator's equipment.[35]

In exceptional circumstances, where it is agreed that a Point of Supply at the primary substation is acceptable, arrangement 2.6 can be used. In this arrangement the protection is located in the Northern Powergrid owned Point of Supply circuit breakers although the Embedded Network Operator shall ensure that space is available to accommodate any interface equipment within their switchgear located in their substation in the event that there is a future need for Northern Powergrid to supply other customers from these circuit breakers and feeder cables. Section 3.12.3 requires that consideration be given to avoid sterilising electrical capacity and physical space at a Northern Powergrid substation when designing a new connection.

3.12.9.6. Firm Connections and Creating Additional Capacity to Supply Other Customers (arrangement 2.7)

Arrangement 2.7 provides a firm connection to a Customer and provides additional capacity to supply other Northern Powergrid network demand. The arrangement provides a continuous firm connection to an individual Customer and the additional feature of facilitating network reinforcement directly from the new Northern Powergrid HV busbar.

Any network assets, at the Customer substation or at the remote ends of the circuits that are not required to facilitate the connection of the Customer should be funded by Northern Powergrid as they would be required to provide the network support rather than to meet the Customer's requirements. This will require the apportionment of cost of the network assets between the Customer and Northern Powergrid.

The details relating to the sterilisation of Northern Powergrid assets (see section 3.12.3) are also applicable to this arrangement. This arrangement is permitted for connections to Embedded Network connections.

3.13. Connection of Low Voltage Customers

This section describes the standard connection arrangements for Customer connections provided at LV. The standard arrangements shown in Appendix 3, should meet the requirements of the majority of LV Customers.

3.13.1. General Requirements

These arrangements are for connections to individual Customer's premises, and where applicable connections to Embedded Networks, provide a means of isolation between the Customer's equipment and the Northern Powergrid LV system at which, wherever possible, protection is installed. In addition to the general requirements applicable to both HV and LV, the following issues should be considered:

Where the Customer's proposed load is approaching the limit of a particular connection arrangement, the Customer shall be made aware of the constraint and, where appropriate, encouraged to agree a connection arrangement with greater capacity to cater for load growth.

Consideration should be given to the balancing of single-phase loads across the three phases of an LV circuit when a Customer applies for a new connection. This will minimise voltage unbalance and reduce losses.

A Customer's three phase load shall be balanced as closely as possible across the three phases. If the nature of a Customer's load is such that unbalance cannot be avoided but can be maintained within acceptable limits at the point of common coupling with other Customers, then this is acceptable provided

[35] This arrangement is in accordance with Engineering Recommendation G88 Fig A.5.

the loading on each phase of the connection does not exceed the nominal rating of any conductor forming the connection.

The declared voltage for new LV connections shall be 230V (single phase) and 400V (three phase).

Customers should be encouraged to aim for a power factor of between 0.95 lagging and unity at the Point of Supply in order to contribute to maintaining an efficient electrical distribution network.

3.13.2. Standard LV Fault Level Ratings

The rating of Customer's busbars and connections up to the Customer's sub-circuit fuses shall be of adequate rating to be protected by Northern Powergrid's fuses. IMP/001/911 – Economic Development of the LV Network, states the maximum design values and typical values for fault infeeds dependent on the connection arrangements.

For ease of reference, the relevant chapter is replicated below; however, IMP/001/911 should be referenced to confirm that they have not changed.

Equipment shall be specified to the following fault levels to accommodate infeed from the higher network and LV-connected generation:

I. 18 kA at the service termination for connections up to 100A, consistent with BS 7657;

II. 30 kA at the service termination for other connections; and

III. 35.5 kA for equipment at general network substations.

These figures may be quoted to ICPs and customers as 'maximum design values', i.e. the performance standards to which they should specify their equipment.

Typical, maximum values of fault infeeds are:

- 16 kA at the service termination for connections up to 100A, consistent with BS 7657;
- 22 kA at the service termination equipment for other connections; and
- 26 kA at substation LV busbars.

3.13.3. Connections to an Embedded Network

Where a single-phase connection or a three-phase connection is provided to an Embedded Network, a point of isolation shall be installed to allow isolation of the Embedded Network from the Northern Powergrid network in accordance with Engineering Recommendation G88.

Where a connection with a maximum demand requirement of up to 55kVA is provided to an Embedded Network, a point of isolation shall be provided at a Northern Powergrid owned cut-out as shown in Appendix A3.2 and Appendix A3.4 to allow isolation of the Embedded Network. Northern Powergrid will request the right for operational access to the cut-out under emergency situations in line with Engineering Recommendation G88. The Northern Powergrid cut-out shall be fitted with fuses.

Where a connection with a maximum demand requirement greater than 55kVA is provided to an Embedded Network, a point of isolation (link box) shall be installed to allow isolation of the Embedded Network. If the Embedded Network Operator does not wish to install a point of isolation, Northern Powergrid will install one for sole use by Northern Powergrid and as such, it will be funded, owned and operated by Northern Powergrid. Should the Embedded Network Operator decide to install a link box then Northern Powergrid will request the right for operational access of that link box under emergency situations in line with Engineering Recommendation G88.

The Northern Powergrid link box shall be fitted with fuses unless the Embedded Network Operator is satisfied that the Northern Powergrid upstream protection will adequately protect their equipment, in which case links can be used. In the case where fuses are not installed in either the Embedded Network Operator's link box or the Northern Powergrid link box, the Embedded Network Operator shall grant an

indemnity for the adequacy of the Northern Powergrid protection scheme to protect their equipment. It shall be the Embedded Network Operator's responsibility to provide suitable accommodation for any interface protection they require.[36]

3.13.4. Connections to Individual Customer Premises

Customers shall provide accommodation adjacent to the Point of Supply to house suitable means of isolation, and where appropriate, protection for their installation. Unless a Customer has an unmetered Connection Agreement, they shall also provide suitable accommodation for metering equipment adjacent to the Point of Supply. Where appropriate, the total multicore cable route length from metering current transformers at the Point of Supply shall be as short as reasonably practicable.

Where whole-current metering is used, meters should be sited directly above Northern Powergrid's cut-out, with the length of tails to the meter being as short as reasonably practicable and not exceeding 1m, although this may need to be increased to no more than 3m for multiway distribution boards.[37]

Where an Industrial Service Unit, Heavy Duty Cut-out or LV circuit breaker is installed, Northern Powergrid's metering test terminal block shall be mounted on a separate panel adjacent to the metering position, from which the Meter Operator shall run a multicore cable to his adjacent metering panel.

To ensure discrimination between HV and LV protection, the maximum length of LV tails from a transformer shall normally be 10m. For supplies from the general network, protection discrimination on the Northern Powergrid system shall be secured by grading with fuses at the substation. The maximum length of tails from cut-out fuses or an LVCB shall normally be 20m, which provides for clearance in 5s, in accordance with BS 7671.

Where Northern Powergrid installs any additional equipment to meet any special needs of a Customer, the additional expenditure (including capitalised maintenance charges and an appropriate return) shall be chargeable to the Customer following the principles in the appropriate Standard Licence Condition 14 Statement.

In accordance with ESQC regulation 24(4), earthing terminals shall be made available unless unsafe to do so, as detailed in IMP/010/011 – Code of Practice for earthing LV networks and HV Distribution Substations. Service cables with combined neutral and earth conductors shall be used only where a distributor is Protective Multiple Earth along its length.

3.13.5. Unmetered Connections

With the exception of connections to public unmetered electric vehicle charging points, unmetered connections may only be provided in line with the guidance contained within the Electricity (Unmetered Supply) Regulations 2001 and the guidance contained within the latest version of the Balancing and Settlement Code. These requirements are explained in more detail in Code of Practice for the maximum load of unmetered supplies, CNN/006/001. The key requirement of both these documents is that, subject to other conditions, an unmetered supply may be given in the following situations:

- where the electrical load is of a predictable nature, and either:
    - the electrical load is less than 1.38kW; or
    - it is not practical for a supply of electricity to be given through an appropriate meter at the premises due to:

[36] In the case of Arrangement 3.6 the link box cable joint on the Embedded Network Operator's side of the Northern Powergrid link box will be provided by Northern Powergrid.

[37] The connections between the Northern Powergrid cut-out and the meter are the provided by the Supplier, or his agent, and the physical and electrical protection of them is his responsibility. However, minimising the length of these connections generally reduces the opportunity for tampering and unlawful extraction to which Northern Powergrid is exposed. The lengths indicated are those that experience shows need not be exceeded.

- the anticipated metering costs in the particular case being significantly higher than the usual metering costs associated with that size of electrical load;
- technical difficulties associated with providing such a meter in the particular case; or
- Operation of law so as to prohibit or make excessively difficult the provision of such a meter in the particular case.

- Where the connection is to a public unmetered electric vehicle charging point and supply is metered via an approved metered Central Management Systems (mCMS) scheme.

Subject to other regulations, an unmetered supply shall only be given where the authorised distributor, authorised supplier and the Customer have agreed to such a supply and that the equipment to be connected has an Elexon Charge Code. Elexon publishes a list of approved Central Management Systems (CMS) on their website.

3.13.6. Standard LV Connection Arrangements

The standard LV connection arrangements, together with their approximate capabilities, are shown in Appendix 3.

The preferred method of providing LV connections shall be via LV underground cables that comply with the current Northern Powergrid Specification NPS/002/019 – Technical Specification for LV Distribution and Service Cables. Where LV overhead services are proposed they shall also comply with the current Northern Powergrid Specification NPS/001/007 – Technical Specification for Overhead Line Conductors.

The kVA capabilities of the connection arrangements are based on a nominal LV network voltage of 230V.

3.13.6.1. Connection from the LV Network to Individual Customers (arrangements 3.1, 3.3 and 3.5)

All new LV connections shall comply with the current Northern Powergrid design policy IMP/001/911 – Code of Practice for the Economic Development of Low Voltage Network, and shall make available to an individual Customer's premises, via an earth terminal, the supply neutral conductor or, if appropriate, the network Protective Conductor for connection to the protective conductor of the Customer's installation, unless unsafe so to do (e.g. at petrol stations).

Where a connection is provided to an individual Customers' premises:

- The Point of Supply shall be as close as practicable to the service entry into the Customer's site. Where a Customer provides accommodation remote from the point where the service enters his site, any additional expenditure involved shall be recovered from the Customer.
- Outdoor meter cabinets can affect likelihood of vandalism and interference, while indoor service positions can affect the likelihood of fire risk and inadvertent contact. Both are permissible, so long as appropriate precautions are taken.
- Indoor positions should be provided at ground floor level however, where unavoidable, first floor service positions are permitted provided that there is sufficient access to the service termination equipment and for the installation of the service cable. Any indoor service position shall be located so as to provide air circulation and minimise the risk of damage (including that triggered by moisture ingress).
- In accordance with the precautionary recommendations made by SAGE,[38] wherever practicable, service positions should be located at least a metre away where people are likely to spend a

[38] Stakeholder Advisory Group on ELF EMFs (SAGE) Precautionary approaches to ELF EMFs First Interim Assessment: Power Lines and Property, Wiring in Homes, and Electrical Equipment in Homes, 2007.

significant proportion of time (e.g. a bedhead position). This will minimise any concerns associated with a concentration of electrical apparatus and wiring related to the service position.

- It is not permitted for cut-outs etc. to be installed in below-ground chambers, as these assets are not approved for this duty.

Northern Powergrid does not require the installation of double-pole isolating switches on the Customers side of the meter. Switches fitted by Northern Powergrid at the Customer's request, whether under fault conditions or to facilitate refurbishment, shall be treated as engineering contracting work and Northern Powergrid will not maintain ownership of such assets.

3.13.6.2. Single Phase Supply up to 18kVA (arrangement 3.1)

For single-phase connections up to approximately 18kVA a 35 mm^2 Al concentric service cable shall be installed to a cut-out either in an external duct or a cavity duct as shown in Arrangement 3.1. The use of a 35mm^2 cable allows for the derating associated with localised heating where the service cable is installed in either an external duct or a duct installed in the cavity.

The service cable shall be terminated in a single phase 100A cut-out fitted with a 80A[39] fuse to the current Northern Powergrid Specification – NPS/002/006 – Technical Specification for Service Cut-outs, Terminal Blocks, Meter Tail Protectors and Pole Mounted Fuse Units.

3.13.6.3. Single Phase Supply up to 18kVA for an Embedded Network (arrangement 3.2)

The preferred arrangement for single phase connections up to 18kVA to an Embedded Network is shown in Arrangement 3.2. As such an Embedded Networks would be operated by a licensed Network Operator; multiple connections of these types are permitted to an Embedded Network. The Embedded Network Operator should be made aware of the risks from the possible interconnection of the LV connections.

Where a connection is provided to an Embedded Network clause 13.3.3 applies.

3.13.6.4. Two or Three Phase Supplies up to 46kVA / 69kVA (arrangement 3.3)

The preferred arrangement for two phase and three phase connections are shown in Appendix 3, Arrangement 3.3. Split single phase connections are not considered standard arrangements and therefore are only to be offered after a bespoke design has been conducted.

For a two-phase arrangement up to continuous 37kVA or three phase 55kVA, the service cable shall be terminated in a three-phase 100A cut-out fitted with 80A[40] fuses to the current Northern Powergrid Specification – NPS/002/006 – Technical Specification for Service Cut-outs, Terminal Blocks, Meter Tail Protectors and Pole Mounted Fuse Units.

3.13.6.5. Two or Three Phase Supplies up to 37kVA / 55kVA for an Embedded Network (arrangement 3.4)

The preferred arrangement for three phase connections up to 55kVA to an Embedded Network is shown in Arrangement 3.4. As such an Embedded Networks would be operated by a licensed Network Operator; multiple connections of these types are permitted to an Embedded Network. The Embedded Network Operator should be made aware of the risks from the possible interconnection of the LV connections.

[39] For new installations, a 100A fuse may be used provided that the rating of all assets (cut-out, meter and service cable) is adequate to carry the load. The likelihood of any of the assets experiencing high temperatures (for example by being in an enclosed location or in cavity walls) must be considered as it could impact their continuous rating and potentially de-rate them.

[40] A 100A fused continuous 69kVA supply may be installed with a 200A cut-out, suitably rated cable and without CT metering (on the basis that the customer's supplier's meter operator is prepared to install 100A continuous rated whole-current metering in this configuration). Such an installation would be regarded as a "small project demand connection" and we would dispatch the quotation within the timescale specified by the associated guaranteed standard which, currently as of 27th August 2024, is 15 working days.

Where a connection is provided to an Embedded Network clause 13.3.3 applies.

3.13.6.6. Three Phase Supplies up to 276kVA (arrangement 3.5)

The preferred arrangement for three phase connections above 55kVA and up to approximately 276kVA is shown in Arrangement 3.5 for individual Customers. The service cable shall be terminated in an Industrial Service Unit or Heavy-Duty Cut-out to the current Northern Powergrid Specification – NPS/002/006 – Technical Specification for Service Cut-outs, Terminal Blocks, Meter Tail Protectors and Pole Mounted Fuse Units.

3.13.6.7. Three Phase Supplies up to 345kVA for an Embedded Network (arrangement 3.6)

The preferred arrangement for three phase connections above 55kVA up to approximately 345kVA to an Embedded Network is shown in Arrangement 3.6. As such a network would be operated by a licensed DNO or IDNO, multiple connections of these types are permitted to an Embedded Network in the same way as a Northern Powergrid LV network design. The Embedded Network Operator should be made aware of the risks from the possible interconnection of the LV connections.

Where a connection is provided to an Embedded Network clause 13.3.3 applies.

3.13.6.8. Three Phase Supplies up to 1,100kVA (arrangements 3.7 & 3.8)

Where a three-phase supply is provided via a dedicated feeder or substation:-

- All circuit breaker and Settlement Metering current transformers shall be installed in an enclosed housing;
- If the Customer has not been granted access to Northern Powergrid equipment, the metering equipment shall be contained in an enclosure adjacent to the Northern Powergrid substation;
- The Point of Supply shall be at the outgoing terminals of the LV circuit breaker;
- The Customer shall provide a suitable point of isolation and protection; however, it may not be possible to fully grade this protection with Northern Powergrid's LV circuit breaker. The Customer's cable between the Point of Supply and his point of isolation shall be suitable for terminating in the LV circuit breaker and comply with BS 7671 as appropriate; and
- All LV circuit breakers shall be provided with an emergency trip button adjacent to the Point of Supply or the Metering equipment which is accessible to the Customer.

3.13.6.9. Three Phase Supplies up to 1,100kVA (arrangement 3.7)

Arrangement 3.7 may be used to provide a supply up to 1,100kVA. In this arrangement the Customer will not usually have access to the metering circuit breaker which will be located in an enclosure provided by the Customer on their site. The metering equipment shall be contained in an enclosure adjacent to the metering circuit breaker.

Arrangement 3.7 can be used to provide capacity for interconnection at LV and future use of spare capacity. In this scenario the transformer can be upgraded to 1,000kVA, with 1,600A circuit breakers.

3.13.6.10. Three Phase Supplies up to 1,700kVA (arrangement 3.8)

The preferred standard arrangement for connections up to 1,730kVA is shown in Arrangement 3.8. This arrangement may also be used for connections below 1,000kVA where there are economic benefits, or the Customer requests it. In these circumstances the Customer shall be provided with the protection settings on the Northern Powergrid equipment to enable the Customer to grade their system accordingly.

The substation on an individual Customer's premises shall be located as close as practicable to the entry of Northern Powergrid's HV mains cable to the Customer's curtilage. Where the Customer provides

accommodation remote from this point, the additional expenditure involved shall be chargeable to the Customer.

3.14. Limitations to Maximum Demands of Standard Arrangements

In addition to situations where existing LV fuse boards limit the maximum size of the LV fuse to 400A, there will be some cases where the transformer rating is less than 750/800kVA and the maximum rating of the LV fuse is restricted to 400A or less to obtain discrimination with the HV fuse. All fuses shall be used in conjunction with the guidance contained in IMP/001/921 – Code of Practice on Fusing.

3.15. Multiple Occupancy Buildings

The Electricity Act 1989 (as amended) and the Utilities Act 2000 (as amended) enables parties other than licensed electricity distributors (such as Landlords/property owners) to distribute electricity (and own and operate electricity distribution networks) if they are exempt from holding an electricity distribution licence.

Installations in multiple occupancy buildings beyond the Point of Supply are fundamentally different to the general public network, requiring different equipment to be purchased and different methods of installation (for example, there is no ENA technical specification for LSF/LSOH[41] cables). They are also subject to regulations that do not apply to the core activity of electricity distribution. It is therefore inappropriate for Northern Powergrid's licensed distribution business to undertake this work.

Taking all this into consideration, it is no longer reasonable in all the circumstances for Northern Powergrid's licensed distribution business to provide any new risers or laterals within multiple occupancy premises beyond the Point of Supply. Hence Northern Powergrid shall not install, own nor operate any new risers or laterals beyond the Point of Supply. Northern Powergrid's preferred arrangement is therefore to provide a single Point of Supply for each of the individual premises at a ground floor communal location within the curtilage of the multiple occupancy building.

If this is not practical, in order to avoid Northern Powergrid providing new risers or laterals, the property is to be treated as single premises with a single Point of Supply to the Northern Powergrid system with connections to individual premises being provided via risers and laterals installed, owned, operated and maintained by a Building Network Operator.

3.15.1. New or Converted Domestic Premises

When providing connections to domestic premises[42] in new or converted multi-storey buildings[43] it is unlikely to be practical to provide a single Point of Supply for each of the individual premises at a ground floor communal location within the curtilage of the multiple occupancy building. In this case a bulk supply, typically at LV, shall be provided to a Building Network Operator, who will take responsibility for the installation, operation and maintenance of the risers, laterals, cut-outs etc. associated with the provision of a supply to each premises.

The BNO shall enter into a Connection Agreement with Northern Powergrid, setting out, as a minimum:

- The location of the Point of Supply;
- The requirement to display a single line electrical diagram at the Point of Supply showing the assets owned by Northern Powergrid and the BNO;
- The agreed import and export capacity at the Point of Supply;

[41] Low Smoke & Fume, Low Smoke Zero Halogen

[42] The 'Landlords Supply' shall be a metered supply as per the supply to a domestic premises; the BNO is not permitted to provide any unmetered supplies.

[43] The connection arrangements in section 3.15.1 are intended to apply to new or conversion developments, rather than the conversion of houses into flats where the connection arrangement set out in EREC G87 Figure A1 should be provided – see table below.

- Contact details of the BNO for operational, maintenance and long-term asset management issues; and
- A list of MPANs that have been issued by Northern Powergrid associated with the Point of Supply.

Engineering Recommendation G87 – Guidelines for the Provision of Low Voltage Connections to Multiple Occupancy Buildings, sets out the agreed DNOs position on the provision of connections to multiple occupancy buildings. EREC G87 describes a number of connection arrangements. The permitted connection arrangements for multiple occupancy buildings in multi-storey properties are set out in the following table:

Engineering Recommendation G87 Appendix A		Application
Figure A1	Typical arrangements for terraced-type Multiple Occupancy Building	These are the Northern Powergrid preferred arrangements for two storey developments, apart from the supply to Premises 3 (where a service termination position at ground floor would be expected) and Premises 5 (where a service termination position at ground floor would be expected rather than a BNO owning the equipment between the cut out and meter).
Figure A2	LV connection from DNO LV network (small development with Grouped Metering at Intake Position)	This is the Northern Powergrid preferred arrangement for developments with three or more storeys. The Standard 100A cut-out is suitable to provide three customer supplies; if more than three are required the arrangement in Figure A4 should be used. See Note 1.
Figure A3	LV connection from DNO LV network (larger development)	This diagram shows the LV connection to the DNO network associated with the arrangements in Figures A5 and A6.
Figure A4	LV connection from DNO LV network (Grouped Metering at Intake Position)	This is the Northern Powergrid preferred arrangement for developments with more than three or more storeys where more than three supplies are required.
Figure A5	BNO Network with a Grouped Metering arrangement	Typical BNO network with grouped metering.
Figure A6	BNO Network with a Dispersed Metering arrangement	Typical BNO network with dispersed metering.
Figure A7	Difference Metering of BNO Network	The standard Northern Powergrid arrangement does not currently cater for difference metering.

Note 1: Where supplies to more than three customers is required, a three-phase multiple-way distribution unit, with the appropriate number of ways and overall rating complying with the current Northern Powergrid Specification – NPS/003/018 – Technical Specification for Multi Service Distribution Boards (MSDBs). Appendix 2 of NPS/003/018 sets out the ten variations of 'multi service distribution boards'. The smallest of these is relatively compact and provides the facilities for up to six 100A cut outs fuses. Diversity shall not be applied to the rating when such a unit is used for multiple commercial premises.

3.16. Mobile Telephone Base Station Supplies

The supply to a mobile telephone base station (or equivalent) must not use existing building risers or laterals used to supply a multiple occupancy buildings. The preferred arrangement is for a separate Point of Supply from Northern Powergrid that is sufficiently separated and labelled to mitigate any safety risks.

4. References

4.1. External Documentation

Reference	Title	Version and Date
BS7671	Requirement for Wiring Regulations 18th Edition	January 2018
BS9999 – 2017	Code of practice for fire safety in the design, management and use of buildings	January 2017
BSC, Baseline version 115	Balancing and Settlement Code Procedure on Unmetered Supplies Registered in Supplier Meter Recording System	June 2013
Building Regulations – Part B	Buildings Regulations 2010 (Fire Safety) Part B; Volume 1 Dwellings and houses 2006 version incorporating the 2010 and 2013 amendments	April 2013
Building Regulations – Part P	Buildings Regulations 2010 (Electrical Safety – Dwellings) Part P; P1 Design and Installation of Electrical Installations	April 2013
Distribution Code	The Distribution Code and The Guide to the Distribution Code of Licensed Distribution Network Operators of Great Britain. Issue 45	2020
Engineering Recommendation G12	Requirements for the application of protective multiple earthing to low voltage networks	Issue 4, 2013
Engineering Recommendation G5	Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom	Issue 5 2020
Engineering Recommendation G81	Framework for design and planning, materials specification and installation and record for Greenfield low voltage housing estate installations and associated, new, HV/LV distribution substations. Part 1: Design and Planning	2016
Engineering Recommendation G81	Framework for design and planning, materials specification and installation and record for Greenfield low voltage housing estate installations and associated, new, HV/LV distribution substations. Part 2: Materials Specification	2016
Engineering Recommendation G81	Framework for design and planning, materials specification, installation and record for Greenfield low voltage housing estate underground networks and associated, new, HV/LV distribution substations. Part 3: Installation and Records	2016
Engineering Recommendation G87	Guidelines for the Provision of Low Voltage Supplies to Multiple Occupancy Buildings Guidelines	2015
Engineering Recommendation G88	Principles For The Planning, Connection And Operation Of Electricity Distribution Networks At The Interface Between Distribution Network Operators (DNOs) And Independent Distribution Network Operators (IDNOs)	Issue 3 2019
Engineering Recommendation G98	Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019.	Issue 1 Amendment 1 July 2018
Engineering Recommendation G99	Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019.	Issue 1 Amendment 6 March 2020
Engineering Recommendation P14	Preferred switchgear ratings	1971
Engineering Recommendation P2/7	Security of Supply	2019
Engineering Recommendation P24	AC traction supplies to British Rail	1984
Engineering Recommendation P25	The short-circuit characteristics of single-phase and three-phase low voltage distribution networks.	Issue 2 2018

Reference	Title	Version and Date
Engineering Recommendation P28	Voltage fluctuations and the connection of disturbing equipment to transmission systems and distribution networks in the United Kingdom	Issue 2 2019
Engineering Recommendation P29	Planning Limits For Voltage Unbalance In The UK For 132kv And Below	1990
Engineering Recommendation S34	Guide for assessing the rise of earth potential at substation sites	Issue 1 1986
Northern Powergrid Losses Strategy	Losses Strategy	February 2018
S23-R-155	Determination by the Gas and Electricity Markets Authority of a dispute referred to it under section 23 of The Electricity Act 1989 concerning the charges proposed for an electricity connection.	May 2003
SAGE Precautionary approaches to ELF EMFs	Stakeholder Advisory Group on ELF EMFs (SAGE) Precautionary approaches to ELF EMFs First Interim Assessment: Power Lines and Property, Wiring in Homes, and Electrical Equipment in Homes	April 2007
SI 1989 No 635	The Electricity Act 1989	1989
SI 2001 No. 3263	Electricity (Unmetered Supply) Regulations 2001	October 2001
SI 2002 No. 2665	The Electricity Safety, Quality and Continuity Regulations 2002	January 2003
SI 2006 No. 1521	The Electricity Safety, Quality and Continuity (Amendment) Regulations 2002	October 2006
SI 2009 No. 639	The Electricity Safety, Quality and Continuity (Amendment) Regulations 2002	April 2009
Standard Licence Conditions	Gas and Electricity Markets Authority – Standard conditions of the Electricity Distribution Licence	February 2020
Technical Specification 41-24	Guidance for the design, installation, testing and maintenance of main earthing systems in substations	2018

4.2. Internal Documentation

Reference	Title
CNN/006/001	Code of Practice for the Maximum Load of Unmetered Supplies
CNS/003	Operational Land and Buildings Policy
CUS/008	Unmetered Supplies (UMS) Connection Policy
IMP/001/007	Code of Practice for the Economic Development of Distribution Systems with Distributed Generation
IMP/001/012	Code of Practice for Flood Risk Mitigation at Operational Premises
IMP/001/014	Code of Practice for the Protection of Distribution Networks
IMP/001/018	The Setting of Protection and Associated Equipment
IMP/001/909	Code of Practice for Distribution System Parameters
IMP/001/911	Code of Practice for the Economic Development of LV System
IMP/001/912	Code of Practice for the Economic Development of the HV System
IMP/001/913	Code of Practice for the Economic Development of the EHV System
IMP/001/914	Code of Practice for the Economic Development of the 132kV System
IMP/001/921	Code of Practice on Fusing
IMP/005	Policy for the Renewal of Outdoor HV Distribution Substations
IMP/010/011	Code of Practice for Earthing LV Networks and HV Distribution Substations
IMP/011	Policy for Fire Mitigation at Operational Premises
MNT/008	Policy for Maintenance and Inspection of Protection Systems
NPS/001/007	Technical Specification for Overhead Line Conductors
NPS/002/006	Technical Specification for Service Cut-outs, Terminal Blocks, Meter Tail Protectors and Pole Mounted Fuse Units
NPS/002/019	Technical Specification for LV Distribution and Service Cables
NPS/003/005	Technical Specification for LV PENDA ASSEMBLIES and TFX ASSEMBLIES

NPS/003/011	Technical Specification for Ground Mounted Distribution Transformers up to and including 20kV
NPS/003/018	Technical Specification for Multi Service Distribution Boards (MSDBs)
NSP/002	Policy for the Installation of Distribution Power Cables
NSP/007/020	Guidance on Substation Design: Transformer Noise

4.3. Amendments from Previous Version

Reference	Description
General	Correction of a several typographical and formatting errors. Updates to document references.
2	Clarification that the principles in the Code of Practice apply to 132kV connections.
3.11.6	Section restructured to add numbered subsections to improve clarity.
3.11.6.2	Reference to powering emergency disconnection facilities via a VT removed as this is no longer current practice.
3.11.6.4	Substantially rewritten to clarify that the customer is responsible for the provision and operation of equipment to protect their assets and that, subject to some conditions, it is acceptable for the customer to install their CTs in Norther Powergrid switchgear and their relays on Northern Powergrid relay panels.
3.12.1	Clarification of the ownership of cable downstream of HV Point of Supply.
3.12.9.2	Clarification added that the arrangement where the PoS is at the primary substation is shown in Arrangement 2.6.
3.13.6.4	Footnote 40 corrected to show the connection arrangements and applicable standard for a 3-phase single customer with a 100A fuse and 200A cut-out.
4.1	Updates to document references.
4.2	Updates to document references.
5	New definition of Connection Agreement included.
Arrangement 2.6	Note added to clarify that in exceptional circumstances this arrangement can be used to provide a firm connection to an individual Customer's premises.
Appendix 5	Reference to powering emergency disconnection facilities via a VT removed as this is no longer current practice.
Appendix 6	New appendix describing the application of the Code of Practice to EHV and 132kV connections.
Appendix 7	New appendix describing the Connection Agreement requirement where customer's protection relays are installed on Northern Powergrid relay panels.
Appendix 8	New appendix containing the draft Distribution Code text for DPC6.7.8

5. Definitions

Term	Definition
Boundary Metering	Metering equipment that may be installed at the interface between the Northern Powergrid and an Embedded Network for calculating the Use of System charges at the interface
Building Network Operator	The organisation that owns or operates the electricity distribution network within a Multiple Occupancy Building, between the Point of Supply and Customers' Installations.
Connection Agreement	An agreement between the Customer and Northern Powergrid which: (a) governs the terms under which the Customer shall be entitled to be connected and remain connected to the Northern Powergrid system; and (b) details the ownership, operational and maintenance responsibilities and procedures in respect of the equipment at the Point of Supply.
Constrained connection	A connection where the capacity available to a Customer via a Point of Supply is restricted at certain times. (Not to be confused with Firm / Non-Firm Capacity which relates to the capacity available to a Customer with multiple Points of Supply under system intact / first circuit outage conditions respectively)
Customer	A person who is already connected to or is seeking a connection to Northern Powergrid's distribution system, including an Embedded Network Operator.
Customer's Substation	A substation building provided by the Customer containing Northern Powergrid plant, where it provides a connection to an individual Customers premises, located on their site.
Design Manager	The manager responsible for tactical decisions associated with implementing this Code of Practice who can be i) the Policy and Standards Manager for discretionary HV/LV replacement designs, ii) the System Design Manager
EHV	Means a voltage at 33,000V and above
Embedded Network	A distribution system owned and operated by Licensed Distribution Network Operators operating outside their regional boundary or Licensed Independent Distribution Network Operators.
Firm Capacity	The maximum connection capacity available to a Customer who has a connection with more than one Point of Supply following the outage or loss of the largest item of plant in the distribution system
HV	Means a voltage greater than 1000V, but less than 33,000V
IDNO	Independent Distribution Network Operator: a person other than Northern Powergrid who owns and operates a distribution network within the Northern Powergrid distribution services area
LSF	Low smoke and fumes
LSOH	Low smoke, zero halogen
LV	Means a voltage up to and including 1000V
MPAN	Metering Point Administration Number (the unique identifier under settlements for a Point of Supply)
Multiple occupancy buildings	Any single building that has been sub-divided into more than one premises, for example flats (including conversions) or factories that have been broken up into smaller industrial units. It includes communal areas (if any).
Non-Firm Capacity	The connection capacity available to a Customer who has a connection with more than one Point of Supply that can be secured by the connection arrangement when the distribution system is operating without any outages or restriction applied. It will generally be greater than the Firm capacity.
Planning Manager	The manager responsible for strategic decisions who can be i) the System Planning Manager for issues relating to the strategic planning and development of the system ii) the Head of Smart Grid Implementation for all other policy related issues.
Point of Connection (POC)	The point on the existing Northern Powergrid Network at which the new assets will be connected.
Point of Supply (POS)	The Northern Powergrid ownership boundary and point of isolation from the Customer's equipment.

Riser / Laterals	Cables within a multiple occupancy building between the Northern Powergrid Point of Supply to the property and the Customers Installation in each of the Customers' premises.
Settlement Metering	Metering equipment for the measurement of a customer's electrical energy usage for the Electricity supplier. Previously known as tariff metering.

6. Authority for Issue

6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Deb Dovinson	Governance Administrator	02/09/2024

6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period.

Standard CDS review of 3 years?	Non-Standard Review Period & Reason	
Yes	**Period:** N/A	**Reason:** N/A
Should this document be displayed on the Northern Powergrid external website?		Yes

		Date
Muddasser Razzaq	Smart Grid Development Engineer	02/09/2024

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
Iain Miller	Head of Connections Design	02/09/2024

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Mark Callum	Smart Grid Development Manager	02/09/2024

Appendix 1 – Connection Equipment Ratings Tables

Table A1.1 – Equipment ratings

Equipment type – Cut-outs / ISUs / Link boxes	Rating Amps	Network Product Specification reference
Single phase cut-out	100	NPS/002/006
Three phase cut-out	100	NPS/002/006
Heavy duty cut-out	200 or 400 or 500	NPS/002/006
Industrial service unit	500	NPS/002/005
Link box[44]	500	NPS/002/012
LV circuit breakers		
HV circuit breaker	200	Not listed in a NPS
LV circuit breaker	800	NPS/003/005
LV circuit breaker	1,600	NPS/003/005
LV circuit breaker	2,500	NPS/003/005
HV circuit breakers		
HV circuit breaker	630	NPS/003/006
HV circuit breaker	800	NPS/003/006
HV circuit breaker	1,250	NPS/003/006
HV circuit breaker	2,000	NPS/003/006
HV circuit breaker	2,500	NPS/003/006

Table A1.2 – HV/LV nominal transformer ratings

Nominal transformer rating[45]
kVA
315
500
800
1,000
1,250
1,600

[44] NPS/002/012 – Technical Specification for low voltage underground link boxes does not specify a current rating, however it does specify that the link box must be able to accept up to a 300mm^2 conductor, which in table A1.1 is rated at approximately 465 Amp.

[45] NPS/003/011 – Technical Specification for Ground Mounted Distribution Transformers up to and including 20kV

Appendix 2 - High Voltage Standard Connection Arrangements

The table below gives guidance on the maximum capacities that can be connected based on the standard equipment that Northern Powergrid approves for each of the standard arrangements. The table below is general guidance and some of the connections may not be available at the rating prescribed due to external factors (i.e. ratings of network assets and the load of other Customers connected to the same part of the network).

Table A2.1 – nominal capacities, limiting factor and standard arrangements

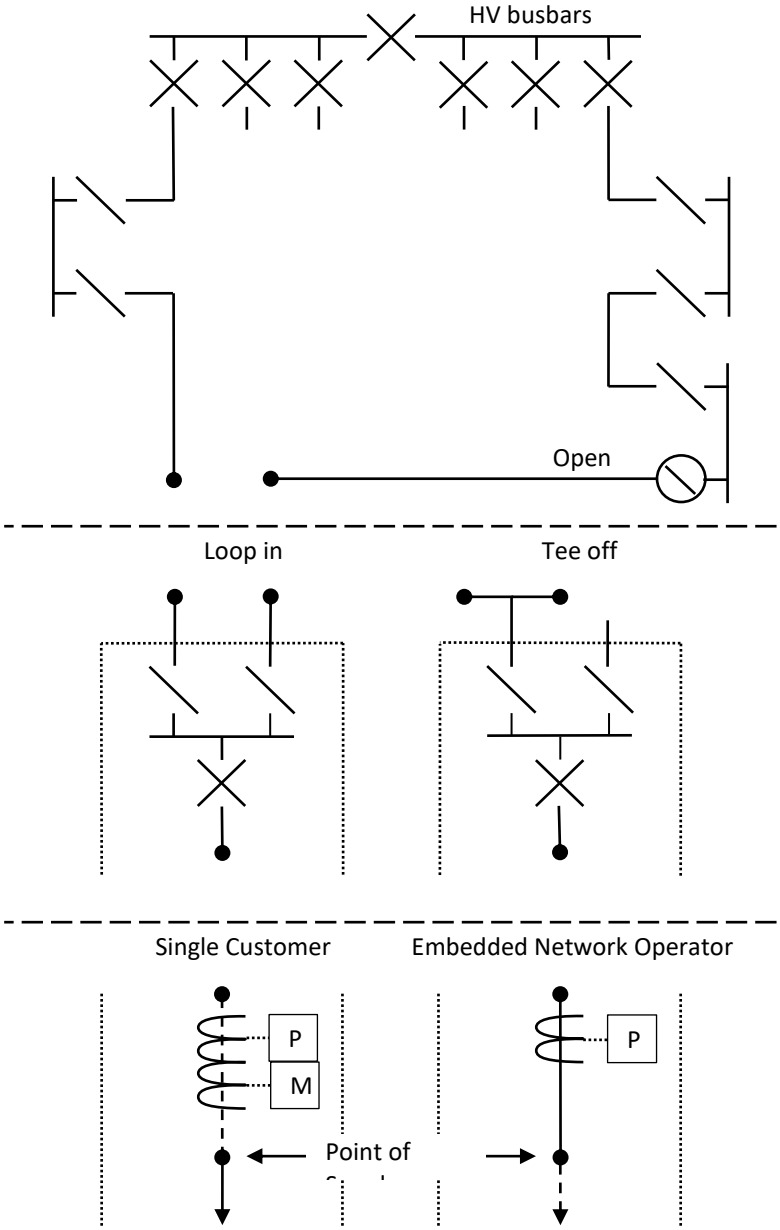
Voltage	Nominal maximum capacity	Arrangement
kV	**MVA**	
11	3[46]	2.1; 2.2
	6.8[47]	2.2, 2.3, 2.4; 2.5; 2.6; 2.7
	8.7[48]	2.2, 2.3, 2.4; 2.5; 2.6; 2.7
	8.9	2.3, 2.4; 2.5; 2.6; 2.7
20	8.7	2.1; 2.2
	20.3	2.3; 2.4; 2.5; 2.6; 2.7

[46] Limited by the metering circuit breaker

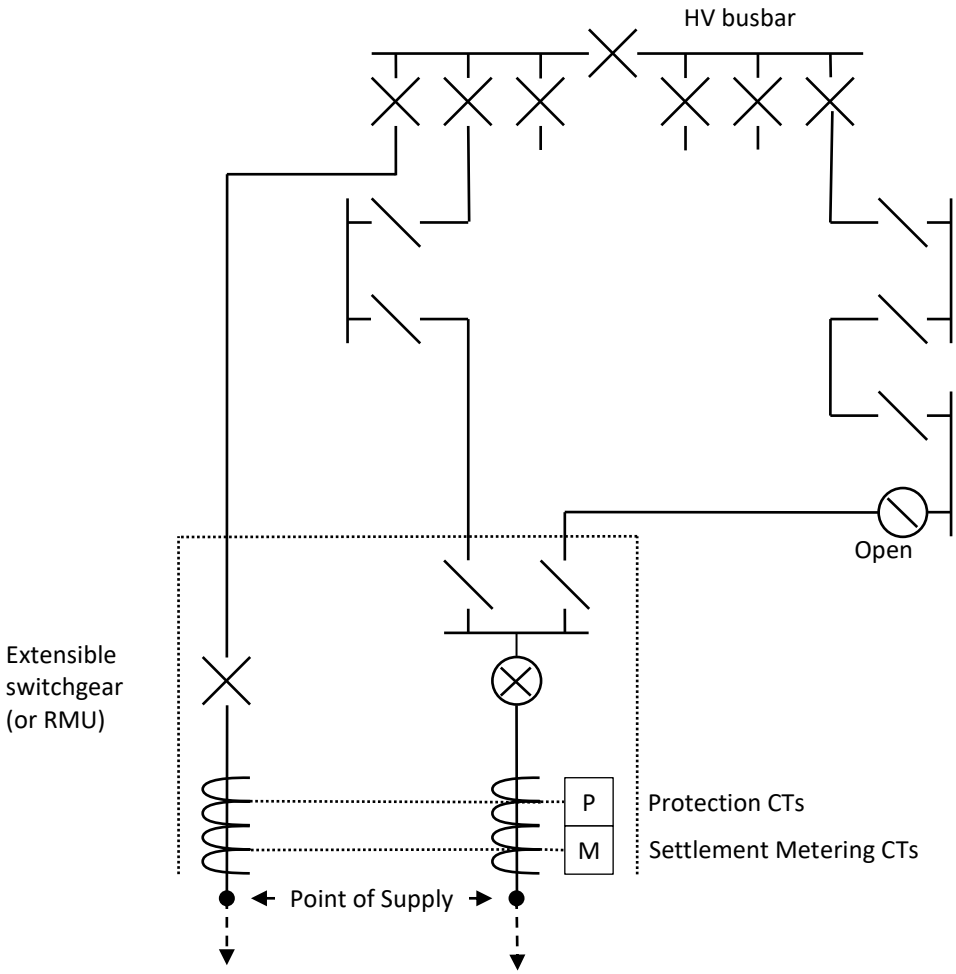
[47] Limited by the HV cable

[48] Limited by the HV cable

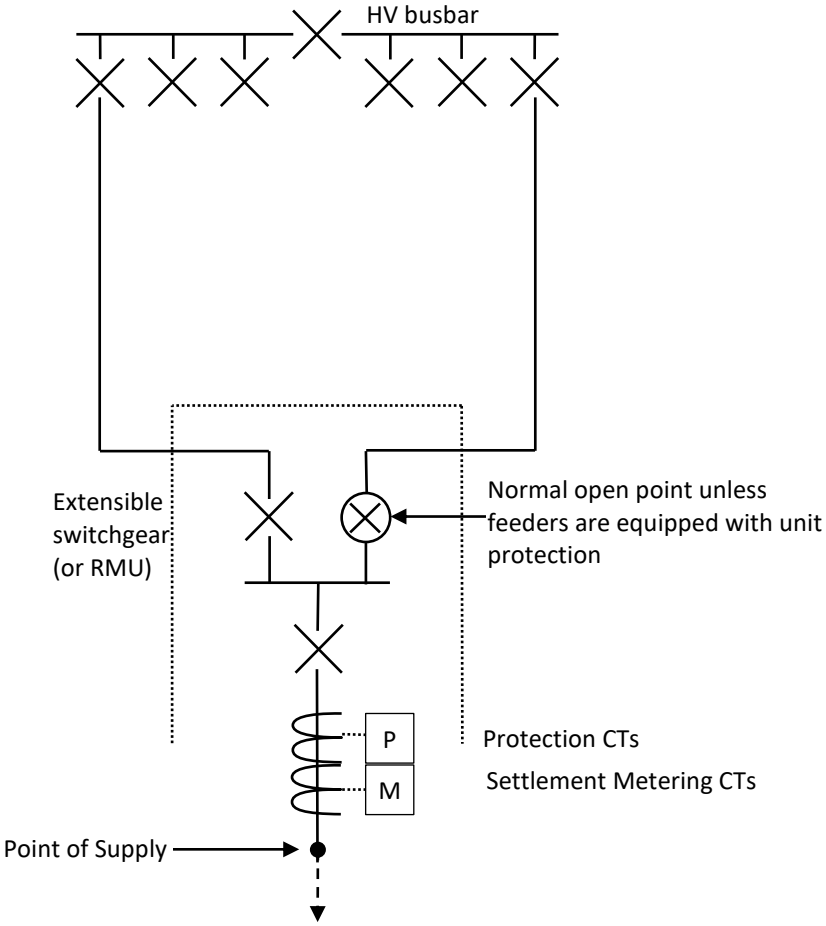
Arrangement 2.1 – Connection to Existing Ring Network



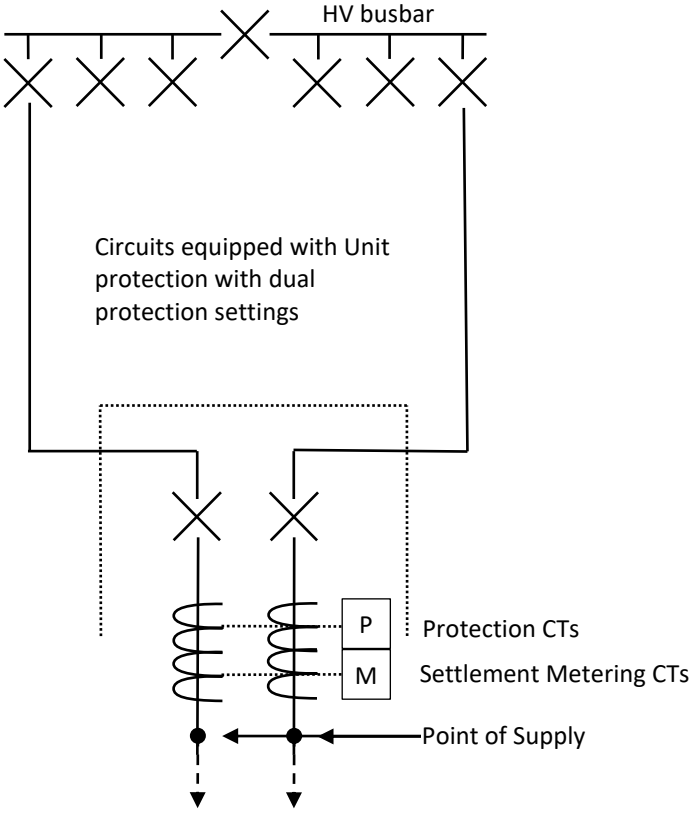
Arrangement 2.2 – Increase in Existing RMU Connection through Dedicated Feeder



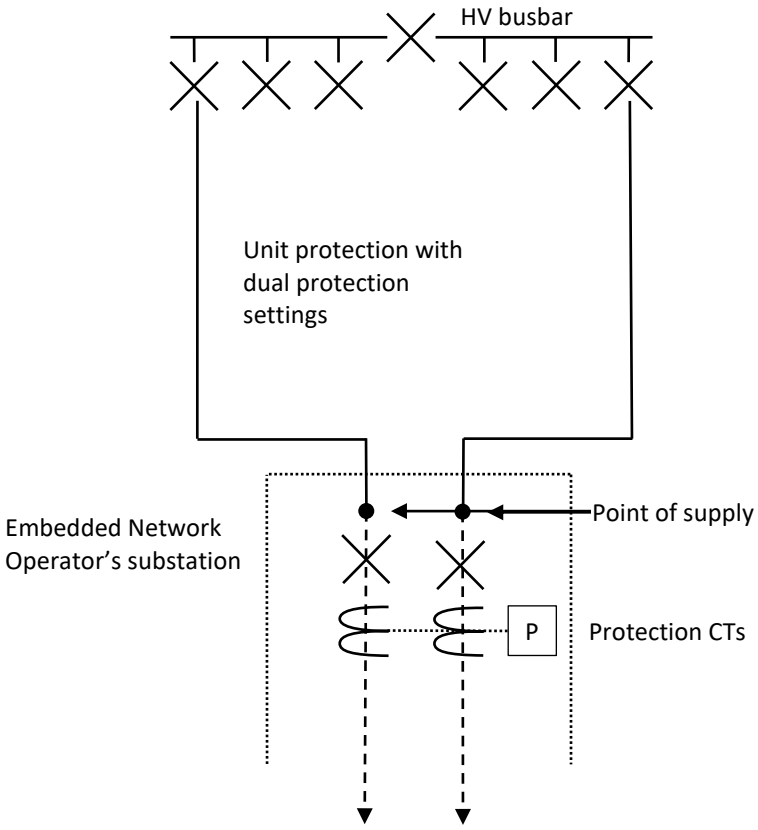
Arrangement 2.3 – Dedicated Connection from a Primary Substation



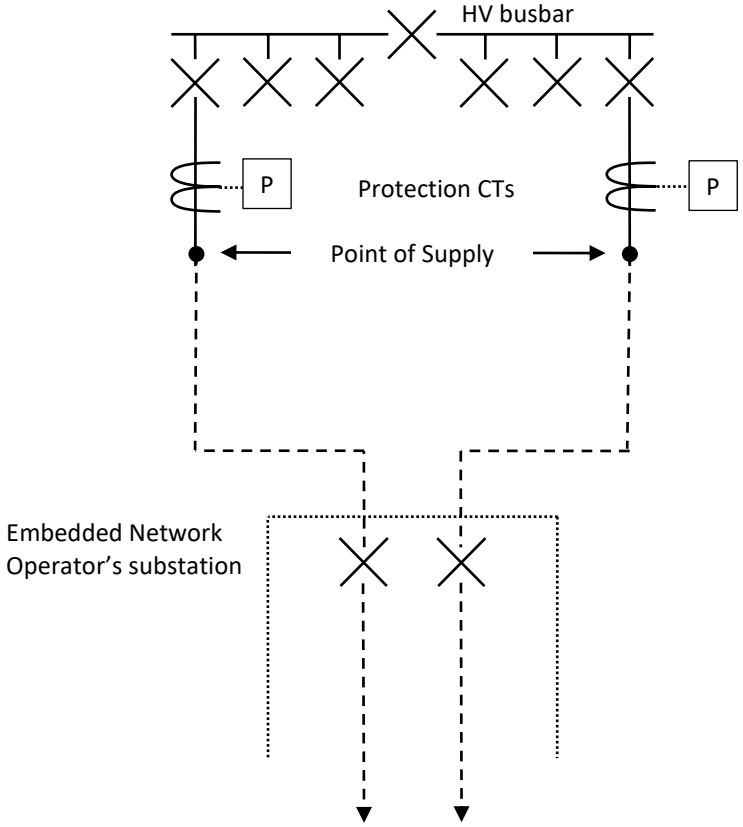
Arrangement 2.4 - Firm Connection for Individual Customer



Arrangement 2.5 - Firm Connection for Embedded Network

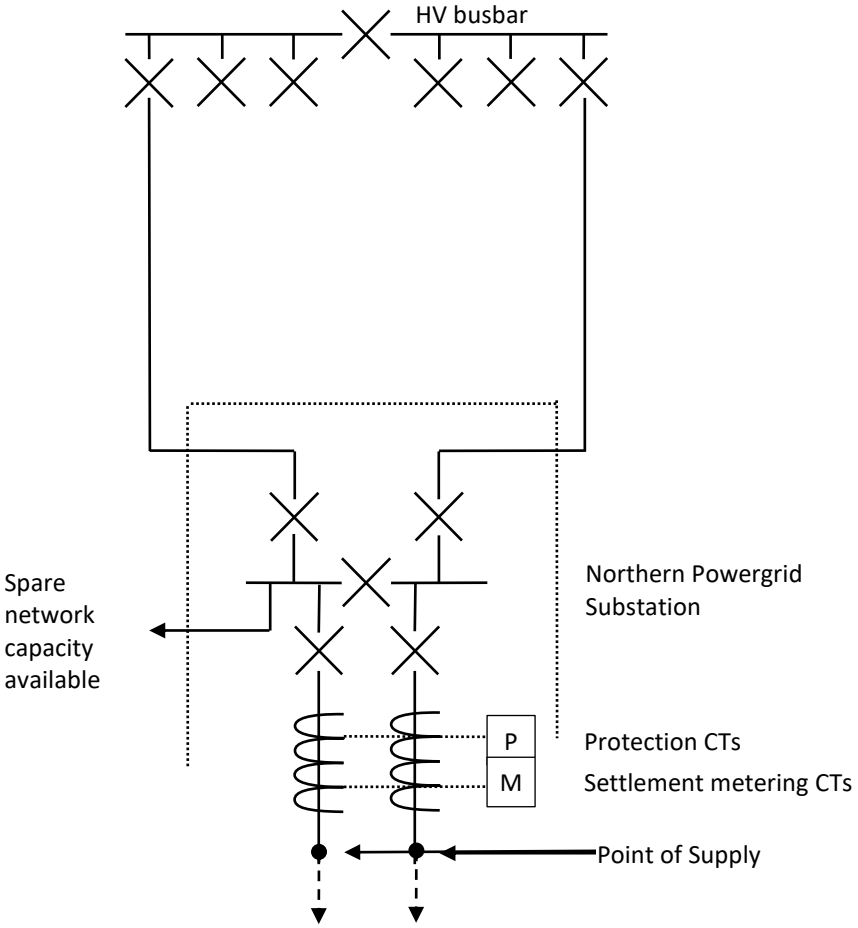


Arrangement 2.6 - Firm Connection for Embedded Network (alternative) *



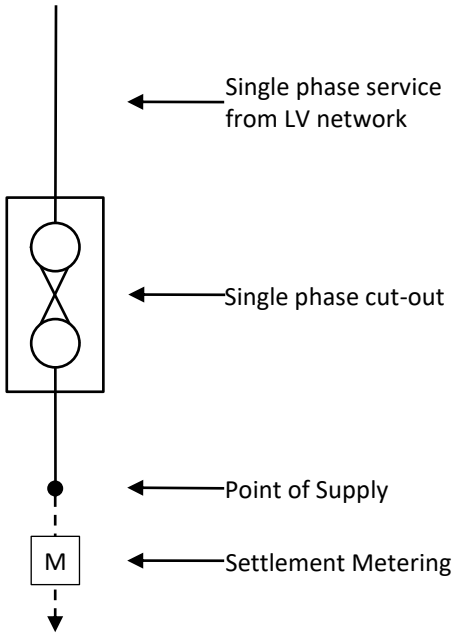
* A similar arrangement can be used to provide a firm connection to an individual Customer's premises. See 13.12.9.4.

Arrangement 2.7 – Firm Connection with Additional Network Capacity



Appendix 3 – Low Voltage Connection Arrangements

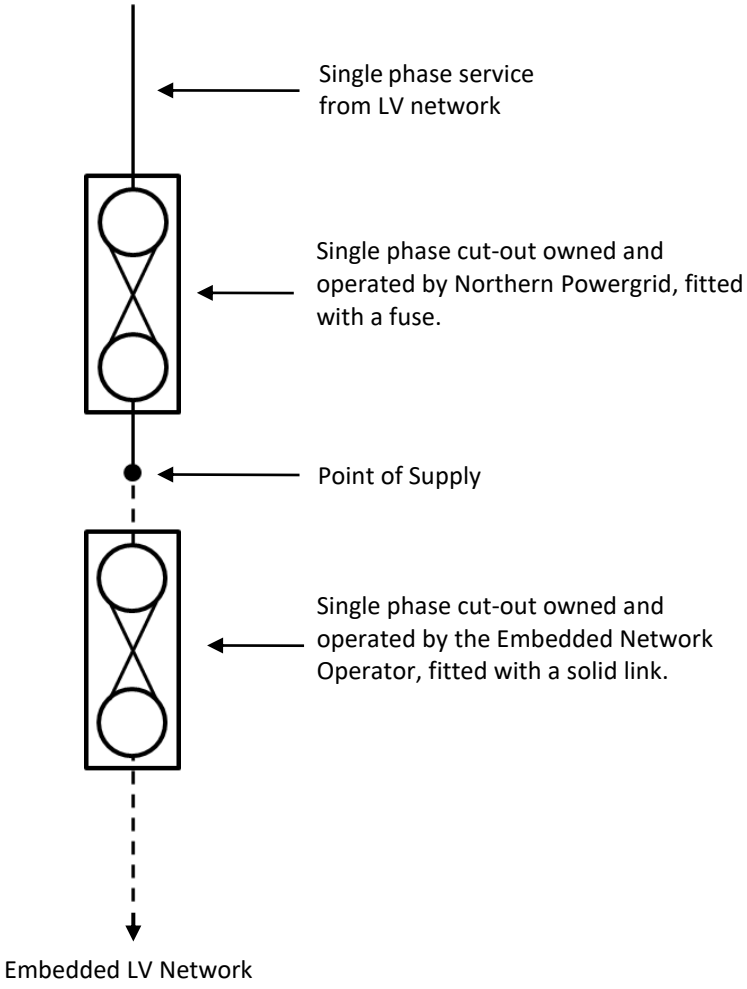
Arrangement 3.1 – Single Phase Connection for Domestic Use



Nominal Voltage	Nominal fuse rating	Nominal capacity	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm^2
230	80[49]	18	Single phase cut-out	100	35 Al

[49] For new installations, a 100A fuse may be used provided that the rating of all assets (cut-out, meter and service cable) is adequate to carry the load. The likelihood of any of the assets experiencing high temperatures (for example by being in an enclosed location or in cavity walls) must be considered as it could impact their continuous rating and potentially de-rate them.

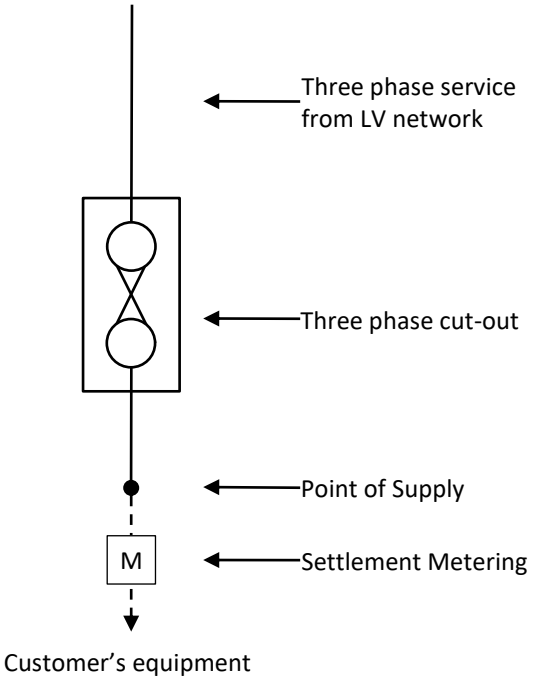
Arrangement 3.2 – Single Phase Supply to an Embedded Network



Nominal Voltage	Nominal fuse rating	Nominal capacity[50]	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm^2
230	80	18	Single phase cut-out	100	35 Al

[50] Limited by the rating of the fuse / circuit breaker

Arrangement 3.3 – Two or Three Phase supply for Commercial Use

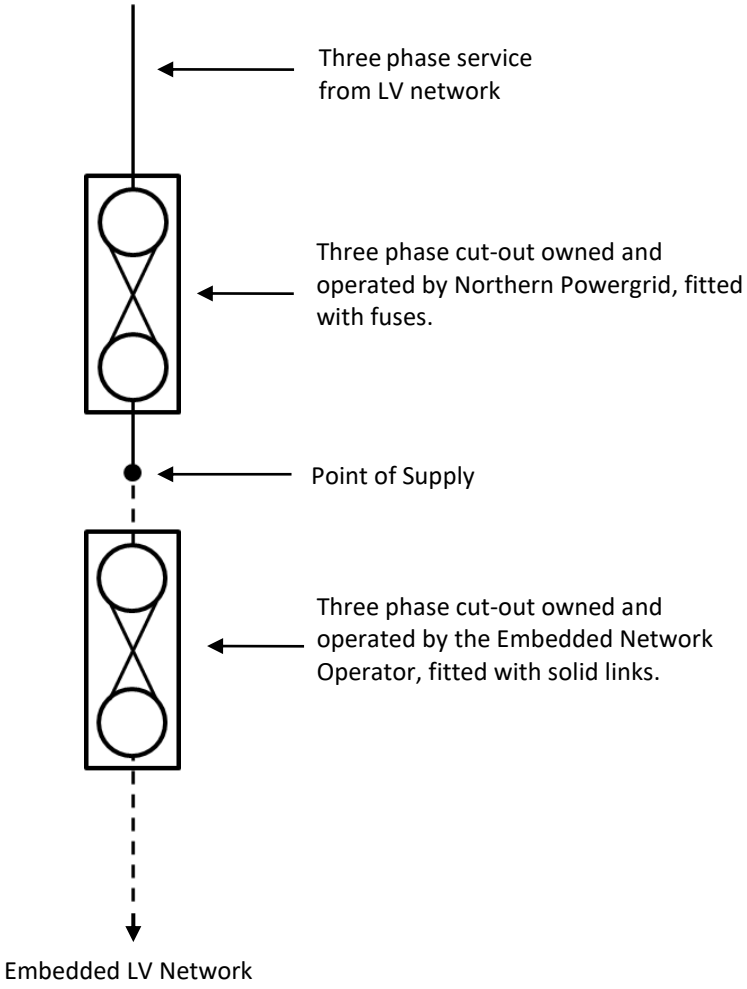


Nominal Voltage	Nominal fuse rating	Nominal capacity	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm²
230	80[51]	37	3Ø cut-out (2 in use)	100	35 Al
400		55	3Ø cut-out (3 in use)		
230	100[52]	46	3Ø cut-out (2 in use)	200	35 Al
400		69	3Ø cut-out (3 in use)		

[51] For new installations, a 100A fuse may be used provided that the rating of all assets (cut-out, meter and service cable) is adequate to carry the load. The likelihood of any of the assets experiencing high temperatures (for example by being in an enclosed location or in cavity walls) must be considered as it could impact their continuous rating and potentially de-rate them

[52] A 100A fused continuous 69kVA supply may be installed with a 200A cut-out, suitably rated cable and without CT metering (on the basis that the customer's supplier's meter operator is prepared to install 100A continuous rated whole-current metering in this configuration). Such an installation would be regarded as a "small project demand connection" and we would dispatch the quotation within the timescale specified by the associated guaranteed standard which, currently as of 27th August 2024, is 15 working days.

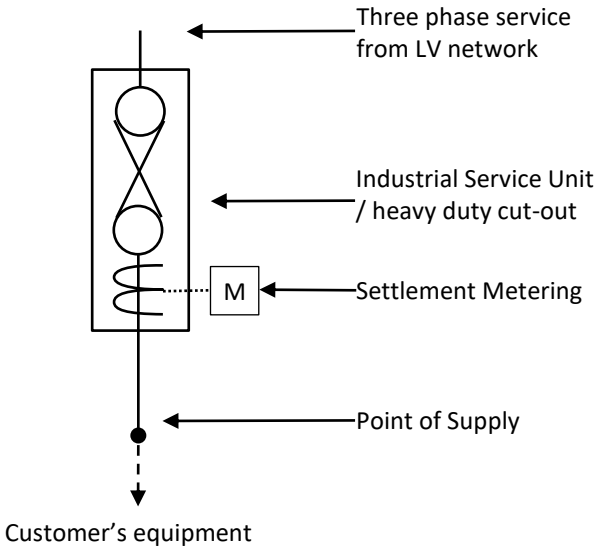
Arrangement 3.4 – Two or Three Phase Supply to an Embedded Network (Up to 55kVA)



Nominal Voltage	Nominal fuse rating	Nominal capacity[53]	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm^2
230	80	37	3Ø cut-out (2Ø in use)	100	35 Al
230	80	55	3Ø cut-out	100	35 Al

[53] Limited by the rating of the fuse

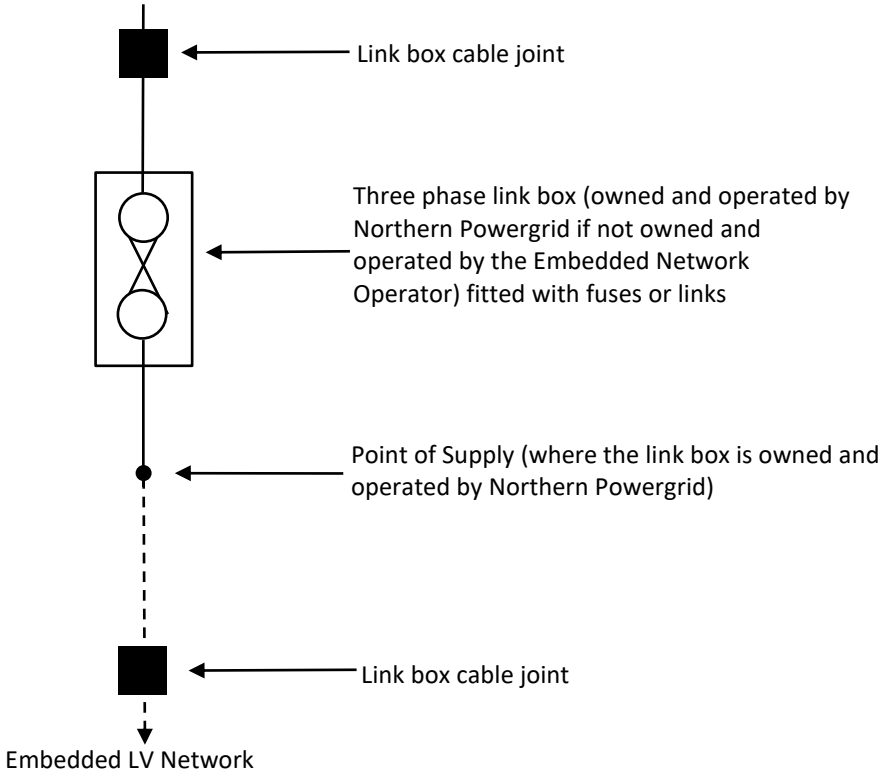
Arrangement 3.5 – Three Phase Supply



Nominal Voltage	Nominal fuse rating	Nominal capacity[54]	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm^2
400	160	111	Heavy duty cut-out or Industrial Service Unit	500	95 Al
	200	139			
	250	173			300 Al
	315	218			
	400	276			

[54] Limited by the rating of the fuse / circuit breaker

Arrangement 3.6 – Three Phase Supply to an Embedded Network

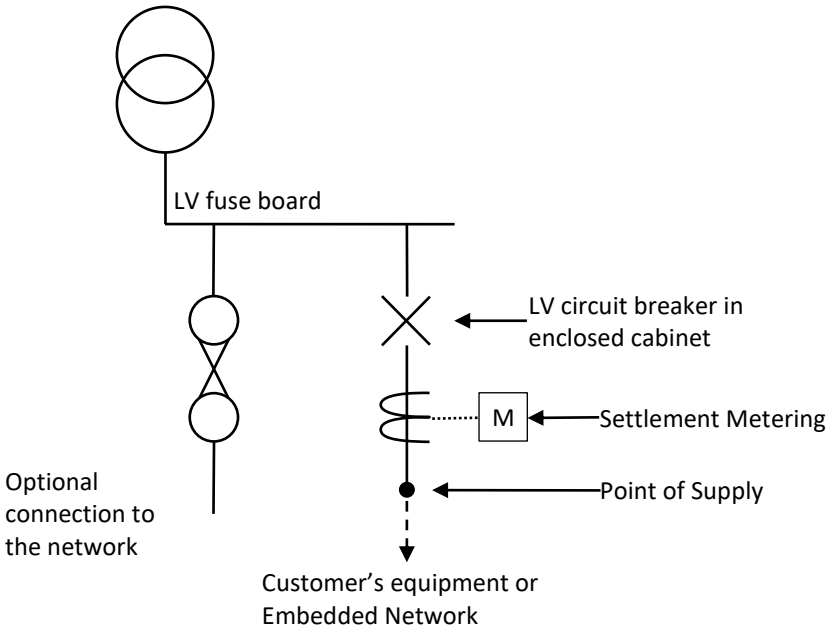


Note
The diagram shows the Point of Supply where the link box is owned and operated by Northern Powergrid. The link box may be owned and operated by the Embedded Network Operator, in which case the Point of Supply is at the Northern Powergrid side of the link box. See *section 3.13.3.*

Nominal voltage	***Nominal fuse / CB rating***	***Nominal capacity[55]***	***Standard equipment***	***Standard equipment rating***	***Standard cable size***
V	***Amp***	***kVA***		***Amp***	***mm²***
400	300	208	Link box	Link box	300 Al
	400	277			

[55] Limited by the rating of the fuse / circuit breaker

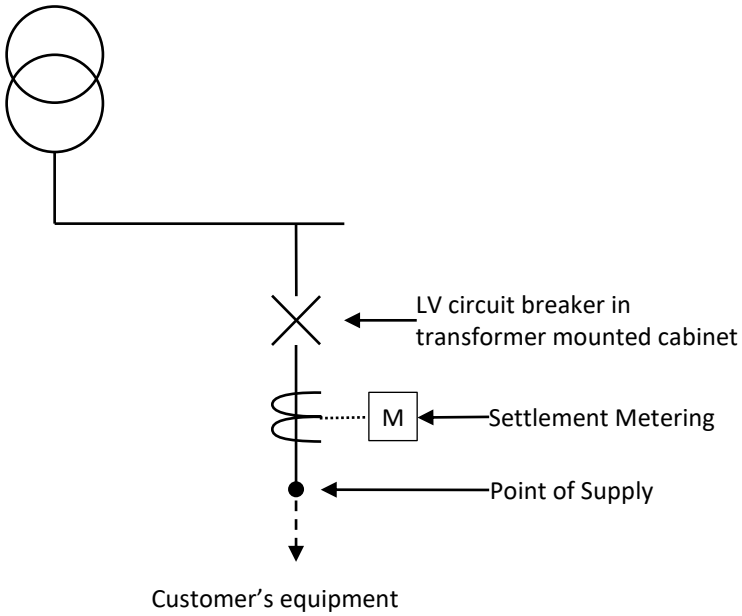
Arrangement 3.7 – Three Phase Supply through Dedicated Feeder



Nominal voltage	Nominal CB rating	Nominal capacity[56]	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm^2
400	800	550	LV air circuit breaker	800	TX coupled
	1,600	1,100		1,600	

[56] Limited by the rating of the fuse / circuit breaker

Arrangement 3.8 – Three Phase Supply through a Dedicated Substation



Nominal voltage	Nominal CB rating	Nominal capacity	Standard equipment	Standard equipment rating	Standard cable size
V	Amp	kVA		Amp	mm^2
400	2,500	1,730	LV air circuit breaker	2,500	TX coupled

Appendix 4 – Multiple Points of Supply

Section 3.11.9 of this document indicates that there may be some circumstances where it is reasonable for Northern Powergrid to offer a non-standard connection arrangement comprising multiple Points of Supply to a Customer's premises at different locations on that site and potentially at different voltages. This appendix provides guidance on the issues that need to be considered before any such connection offer is made.

A4.1 Awareness of the presence of multiple Points of Supply

There is a need for all parties to be aware of the presence of multiple Points of Supply at a Customer's premises so that the appropriate precautions can be taken[57]. The issues should be identified to the Customer at the design stage and the provision of multiple Points of Supply is conditional on the developments of systems and procedures to address the risks identified in this appendix. Provisions should be made to manage these risks on an enduring basis, by the inclusion of appropriate information in the Connection Agreement, the Operational Interface Document and physical notices prominently displayed at the location of each of the Points of Supply on site.

A4.2 Isolation of all incoming supplies in an emergency situation

Where the connection comprises multiple Points of Supply, they shall be situated at one location on those premises except in exceptional circumstances. This ensures that:

- There is a single location on a Customer's premises where all supplies can be disconnected in an emergency. Where ever practical the points of isolation shall be adjacent. In the case of Points of Supply at the same voltage this would be the natural arrangement. Where the Points of Supply are at different voltages e.g. 11kV and LV the physical Points of Supply should be as close to each other as reasonable practicable; where whole current metering is installed the LV Point of Supply will need to be adjacent to the LV metering which, along with the 11kV metering, would be installed in a metering annexe.
- There is only one location on a Customer's premises that needs to be physically secure; and
- The cost of operation and maintenance is minimised.

A4.3 Provision of emergency disconnection facilities

The emergency disconnection facilities as described in section 3.11.6 should be arranged to disconnect all the Points of Supply on a Customer's premises including those at LV and HV, simultaneously. HV Points of Supply normally have a remote tripping facility provided for the Customer. This facility should be extended to include any LV Point of Supply, which will therefore require the use of a LV circuit breaker which can be remotely tripped.

A4.4 Paralleling of multiple points of supply

A Customer with two metered circuit breakers equipped with unit protection on the incoming feeders, should ensure that the multiple Points of Supply should not be connected in parallel, unless the multiple Points of Supply have been specifically intended to be operated in parallel.

Parallel operations shall typically be achieved by 'break before make' changeover facilities and / or castell interlocking. This changeover facility should wherever practicable be provided at the Points of Supply. In exceptional circumstances where the only changeover facilities are embedded within the Customer's network and not under Northern Powergrid's control the location and operation of this changeover switch will have to be clearly identified and documented in the Connection Agreement and Operational Interface Document.

[57] It is considered unlikely that domestic Customers would have an adequate understanding of the issues associated with the provision of Multiple Points of Supply and hence they should not normally be offered to domestic Customers.

An alternative to installing systems to ensure that multiple Points of Supply cannot be paralleled is for the Customer to ensure that there is enduring physical separation between the parts of his premises supplied from each of the Points of Supply.

Where the multiple Points of Supply are specifically designed to operate in parallel formal arrangements should be established to ensure that no parallels which could have an effect on the Northern Powergrid network are made between multiple Points of Supply without the permission of the appropriate Northern Powergrid Control Centre.

A4.5 Premises with generation plant

The design of connections for generation plant should be in accordance with IMP/001/007 - Code of practice for the connection of Distributed Generation. Where standby generation plant is installed, in order to comply with ESQC Regulation 21 systems will need to be in place to ensure that the standby generation plant is not able to operate in parallel with any of the Points of Supply. Where generation plant is designed to operate in parallel with some, but not all of the Points of Supply, appropriate interlocking will be required to be installed to ensure that the generation can only operate in parallel with the Points of Supply for which it is designed. The requirements of ESQC Regulation 22 will also need to be complied with.

A4.6 The requirement for operational procedures

Where more than one Point of Supply to a Customer's premises is provided there are additional operational and safety related aspects that need to be properly understood and managed by the Customer. Whilst not directly relevant, as it applies to installations with generation, the principles of ESQC Regulation 22 should be applied.

A4.7 The requirement for load management schemes

Unless each of the multiple Points of Supply has the same capacity there will be a need for a load management scheme to ensure that each Point of Supply is not exposed to a load beyond its design capacity. Where the Points of Supply each have a broadly similar capacity, as may be the case when they are provided at the same voltage, this may be achieved by an 'alarm and trip' load management scheme. Where the Points of Supply have significantly different capacity, as would be the case if they were of different voltages, such a scheme could result in unacceptable short time overloading on the lower voltage connection and there will be a need to ensure that the demand that can be connected to the lower voltage Point of Supply is limited by the design of the Customer's installation. This would typically require an appropriately sized part of the Customer's demand to be segregated so that it can be supplied via either Point of Supply via a 'break before make' changeover scheme.

A4.8 Metering

Each Point of Supply must be appropriately metered in relation to the capacity of the installed equipment at each Point of Supply.

A4.9 Earthing

Where the Points of Supply are from more than one source, especially if they are at different voltages careful consideration should be given to the earthing system and the provision of earth terminals. ESQC Regulation 24 (4) requires that an earth terminal is provided to the customer for a new low voltage supply unless it is unsafe to do so.

Appendix 5 – Emergency Trip Control

Section 3.11.6 states the requirements to provide Emergency Trip Control facilities to certain customers. This Appendix provides additional detail relating to the provision of this facility.

A5.1 Joint Northern Powergrid and Customer switchboard

The remote emergency trip control shall be located in the metering annexe that is provided at the substation and to which the Customer has access. The control shall be connected in parallel with the trip control on our switchgear, the trip supply thus being derived from the substation main operating battery.

A5.2 Customer's Switchgear Located in a Separate Room within the Curtilage of the Northern Powergrid Substation Site

The remote emergency trip control shall be located in the Customer's control/switch room. The control shall be connected in parallel with the trip control on our switchgear, the trip supply thus being derived from the substation main operating battery.

A5.3 Customer's switchgear or transformer located in a building outside the curtilage of the Northern Powergrid substation site

The remote emergency trip control shall be located in the metering annexe that is provided at Northern Powergrid's substation and to which the Customer has access. This control shall be connected in parallel with the normal trip control at the substation, the trip supply thus being derived from the substation main operating battery. In addition to this facility, where the supply voltage is at HV, Northern Powergrid recommends that the remote emergency trip control should also be provided in the Customer's switch room or at some suitable manned location.

If the Customer requires the additional remote emergency trip control, they shall provide, own and be responsible for the maintenance of the additional equipment to provide this control. This equipment will include pilots, separate DC supply, push buttons and indicating lamps. Northern Powergrid shall provide any interposing equipment required at our substation at the Customer's expense and shall omit indicating lamps from the control in the annexe. This additional remote tripping facility will thus be installed at the discretion of the Customer.

Appendix 6 – Application to EHV and 132kV connections

IMP/001/010 applies to LV and HV connections; although the scope confirms that connections at EHV and 132kV shall be considered on an individual based applying the principles in IMP/001/010. This Appendix provides some guidance on the application of protection where the Point of Supply it is located at an EHV or 132kV switchboard at a grid supply point substation or a 132/EHV substation.

Where a Point of Supply it is located at a EHV or 132kV switchboard at a grid supply point substation or a 132/EHV substation, in accordance with the principle set out in 3.11.6, it is permissible for a Customer's current transformers to be located in Northern Powergrid switchgear and for a Customer's protection relays, and associated equipment, to be installed on a Northern Powergrid relay panel.

In accordance with the principles of IMP/001/014 - Code of Practice for the Protection of Distribution Networks, the Customer shall monitor their main protection and inter tripping schemes and alarms relating to main protection and inter tripping scheme failure shall be provided to Northern Powergrid at the Point of Supply. The information provided by these alarms will be used by a Northern Powergrid Control Engineer to establish if any actions are required to safeguard the supplies to other Northern Powergrid customers. For example, i) there may be a need to switch in to service the Northern Powergrid Standby Main protection at the Point of Supply or ii) there may be a need to de-energise the Point of Supply where there is an infeed from the Customer's installation and the loss of the Customers intertripping may have implications for clearing a subsequent busbar fault.

The Customer's protection for the part of their system protected by Northern Powergrid switchgear at the Point of Supply shall be set to clear faults as fast as reasonably practicable and shall be no longer than the relevant clearance times set out in IMP/001/014 - Code of Practice for the Protection of Distribution Networks and IMP/001/018 - The Setting of Protection and Associated Equipment. The agreed protection settings shall be documented in the Connection Agreement.

Appendix 7 – Accommodation of customer relays - Connection Agreements

Where Northern Powergrid and the Customer agree that the Customer can install protection relays and associated equipment on a relay panel in a substation under the operational control of Northern Powergrid, there are additional requirements that shall be included in the Connection Agreement addressing the following:

1. Design: The location of the protection relays and associated equipment including the current transformers, and the integration with other related Northern Powergrid equipment shall be agreed as part of the detailed design stage after a connection offer has been accepted by the Customer.

2. Ownership: The ownership and operational responsibility for the Customer's equipment shall be documented in a Site Responsibility Schedule forming part of the Connection Agreement.

3. Installation: The detailed installation, testing and commissioning arrangements shall be agreed before the on-site work commences. On site work should be carried out during normal business hours. The Customer, or their agent[58], will need to be supervised at all times whilst working in the Northern Powergrid substation. This supervision shall be funded by the Customer as part of the connection application process. For new switchgear, Customer owned current transformers would typically be installed by the manufacturer.

4. Routine maintenance: The Customer's protection system should be tested and maintained at least as frequently as set out in MNT/008 Policy for Maintenance and Inspection of Protection Systems. The maintenance frequency shall be recorded in the Connection Agreement. Access to the northern Powergrid substation to facilitate testing shall be arranged via mutual agreement during normal business hours. The Customer, or their agent, will need to be supervised at all times whilst working in the Northern Powergrid Substation. This supervision shall be funded by the Customer.

5. Operation: The customer shall provide Northern Powergrid with alarms relating to the failure of their protection and intertripping systems. Such alarms will initiate a conversation between the Northern Powergrid Control Engineer and the Customer regarding the most appropriate course or action. Such actions may include switching into service Northern Powergrid Standby Main protection, requiring the Customer to return to service any faulty equipment within specific period of time, or opening the circuit breaker at the Point of Supply. The Connection Agreement should cater for the situation where the Customer cannot be contacted by Northern Powergrid Control Engineer.

6. Asset Replacement: The Customer will be able to replace, upgrade and modify their protection system on application to Northern Powergrid. If Northern Powergrid chooses to replace, upgrade or modify its equipment in a way that may affect the Customer's equipment, Northern Powergrid will issue a Modification Notice to the Customer providing reasonable notice of the works. Any costs related to the Customers protection equipment and its associated equipment shall be funded by the customer.

[58] There may be an option for the Customer to contract with Northern Powergrid for the installation, testing, commissioning and ongoing maintenance of their protection equipment.

Appendix 8 – Access to DNOs' Current and Voltage Signals from DNOs' Instrument Transformers and/or Transducers

Section 3.11.6.4 makes reference to a Distribution Code clause, DPC6.7.8. At the time of publication of this version of this Code of Practice, this Distribution Code clause was in draft form. The draft version of this clause has been replicated below, for completeness, and will be superseded when the final version of DPC6.7.8. is included in the Distribution Code.

DPC6.7.8 Access to DNOs' Current and Voltage Signals from DNOs' Instrument Transformers and/or Transducers

DPC6.7.8.1
DPC6.7.8 applies where **Customer**s need access to current and voltage signals at the **Connection Point** for their own purposes, such as energy management or for export or import limitation schemes.

DPC6.7.8.2 Current
In general **Customer**s will not have access to the **DNO**'s current transformers. Where the **Connection Point** is at **Low Voltage Customer**s shall generally provide their own current transformers. At all voltages **DNO**s will look to provide accommodation for appropriate current transformers in the **DNO**'s termination equipment if possible.

As an alternative the **DNO** may provide transducers with agreed outputs, or in some cases, be able to accommodate the **Customer**'s ring current transformers on the **DNO**'s secondary wiring. In all cases this is only possible if:

- **BSC** Code of Practice 1 or Code of Practice 2 metering is not supplied from those current transformers; and
- the burden can be shown to be acceptable.

Split current transformers where the components of the magnetic circuit are clamped or held secure in a similar way are acceptable. Clip-on current transformers and any current transformer that depends on spring pressure to maintain the magnetic circuit are deprecated because of the risks of the magnetic circuit becoming air gapped and the consequential inaccuracies.

DPC6.7.8.3 Voltage
Where the **Connection Point** is at **Low Voltage Customer**s will generally be able to provide appropriate voltage signals themselves.

Where the **Connection Point** is at **HV**, **Customer**s will generally provide their own voltage transformers. For existing installations only, the **DNO** may be able to provide voltage signals from the **DNO**'s voltage transformer if:

- **BSC** Code of Practice 1 or Code of Practice 2 metering is not supplied from those voltage transformers;
- the voltage supply is sub fused; and
- the burden can be shown to be acceptable.

In the case where a voltage supply is provided from the **DNO**'s voltage transformer the **Customer** shall not make or change any connections or connected equipment without prior agreement with the **DNO** as this could adversely affect the **DNO**'s equipment.

Note that terms in bold font are defined terms in the Distribution Code.