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ENGINEERING DESIGN STANDARD

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ACTIVE NETWORK MANAGEMENT - FLEXIBLE CONNECTIONS REQUIREMENTS

Network(s):	EPN, LPN, SPN
Summary:	This document details the requirements of UK Power Networks for a Flexible Connection Customer managed by Active Network Management (ANM) system

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New standard to specify the interface design and control requirements for flexible connections customers to connect to the UK Power Networks Active Network Management equipment.			

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1 Introduction

This document provides the specific technical requirements of UK Power Networks for a flexible connections customer managed by the Active Network Management (ANM) system.

This document presents guidance to all parties working on behalf of flexible connections customers to carry out the design of the customer's plant and its associated control system to meet the requirements for the interface and integration with the ANM system.

This document specifies both functional and non-functional requirements. It also clarifies responsibilities and demarcations, and where relevant makes reference to specific industry standards or good practices.

2 Scope

This standard applies to:

- New customers operating Distributed Energy Resources wishing to connect to UK Power Networks at HV and EHV voltage levels with a flexible connections.
- Existing customers operating Distributed Energy Resources connected at HV and EHV voltage levels who currently have a firm connection but wish to connect additional resources as a flexible connections.

This document covers the specific requirements that a flexible connections customer is required to meet that supplement UK Power Networks' standard technical requirements for customer demand and generation connection detailed in EDS 08-3100, and EDS 08-4100. The civils and the electrical design of flexible connections is detailed in EDS 08-5061.

Note: Standard technical requirements may include requirements such as civil or protection design, which are required by customers for connection to the network but are not specifically associated with the ANM solution (and hence, the customer is required to refer to the relevant standards and drawings as necessary).

3 Glossary and Abbreviations

Term	Definition
Active Network Management (ANM)	Autonomous, software-based control system that monitors grid conditions and issues instructions to flexible connections or other field devices in order to maintain the distribution network within operating limits.
Customer DER Control System / DER controller	The native control system used by the flexible connections customer to operate and control the DER plant. DER controller is customer's equipment that interfaces with the UK Power Networks' equipment or the ANM system.
Distributed Energy Resource (DER)	Distributed Generation, Electricity Storage, or Demand Side Response.
Distributed Generation (DG)	Electricity generation connected to the distribution network.
Distributed Network Protocol (DNP3)	Communication protocol widely used currently in the utilities industry and the UK Power Networks standard communication protocol used to interface and exchange operational data with the DER customers local control system. Communication protocol widely used currently in the utilities industry and also used by UK Power Networks for its SCADA system.
Electricity Storage	Electricity Storage in the electricity system is the conversion of electrical energy in to a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy.
Flexible Connections/ Flexible Connection Customer	Customers operating either Distributed Generation, Load assets capable of DSR or storage Distributed Energy Resources capable of both importing and/or exporting, connected to the distribution network whose output can be controlled by the DNO for operational purposes.
Point of connection (POC)	The interface between the UK Power Networks' equipment (main fuse, energy meter) and the consumer's equipment (supply panel).
Ramp rate	
(Ramp-up rate and Ramp-down rate)	The ramp-up and ramp-down rate refers to the rate-of-change of site export/import. This is typically defined in kilowatts per second (kW/s). The ramp-up and ramp-down rates must be configured and managed by the flexible connections customer and are not managed by the ANM scheme. The specified ramp-up rate is the maximum rate-of-change value, in the increasing export/import direction, that the flexible connections asset shall not exceed at any condition. The ramp-down rate is the minimum rate-of-change value, in the decreasing export/import direction, that the flexible DER shall achieve when meeting an export/import set-point established by the ANM scheme. Failure to meet an export/import reduction set-point within a suitable interval will result in escalating action to reduce site export/import.
SCADA	Supervisory Control and Data Acquisition: centralised computer-based systems that monitor and control the electricity distribution network.
RTU	UK Power Networks Remote Terminal Unit: Device that interfaces with a flexible connections customer control system and acts as the connection between central ANM system and the customer.

4 Flexible Connections System Components

This section provides an overview to the components used by UK Power Networks to facilitate flexible connections as follows:

- Central ANM system;
- Remote Terminal Unit (RTU);
- Communication links;
- Customer Control System.

4.1 Central ANM System

This is a UK Power Networks managed server-based platform located at the UK Power Networks control centre. It interfaces with all the required systems within the distribution network architecture and is responsible for taking real time actions for control of flexible connections.

4.2 Remote Terminal Unit

This is a UK Power Networks managed RTU deployed at each flexible connections customer substation. It receives signals from the central ANM system and transmits these to the flexible connections Control System. This is critical to the fail-safe mechanism of the ANM system as it is responsible to take fail-safe actions in the event of loss of communications to the central ANM controller, the customer or in the event of customer non-compliance.

4.3 Communications links

The central ANM controller interfaces with the UK Power Networks RTU and substation monitoring equipment using the UK Power Networks' owned communications infrastructure.

The RTU interfaces with the flexible connections control system using the customer owned communications infrastructure.

4.4 Customer DER Controller

Customer owned control equipment that interfaces with UK Power Networks RTU. This is an important component of the overall system as it is responsible for fulfilling most of the requirements specified within this document. Key functions include monitoring and complying with the limits set by UK Power Networks ANM system and carrying out fail-safe action in the event of loss of communication with the UK Power Networks RTU.

4.5 Flexible Connections Site Overview

Figure 4-1 presents a high-level system architecture of the flexible connections substation showing core components as described above. The dotted line represents demarcation between the UK Power Networks domain and the customer's domain. This diagram does not represent the actual layout of the equipment on site nor does it show the central ANM system.

Full responsibilities of the site will be covered by the Site Responsibility Schedule document as required in section 4.5.3.

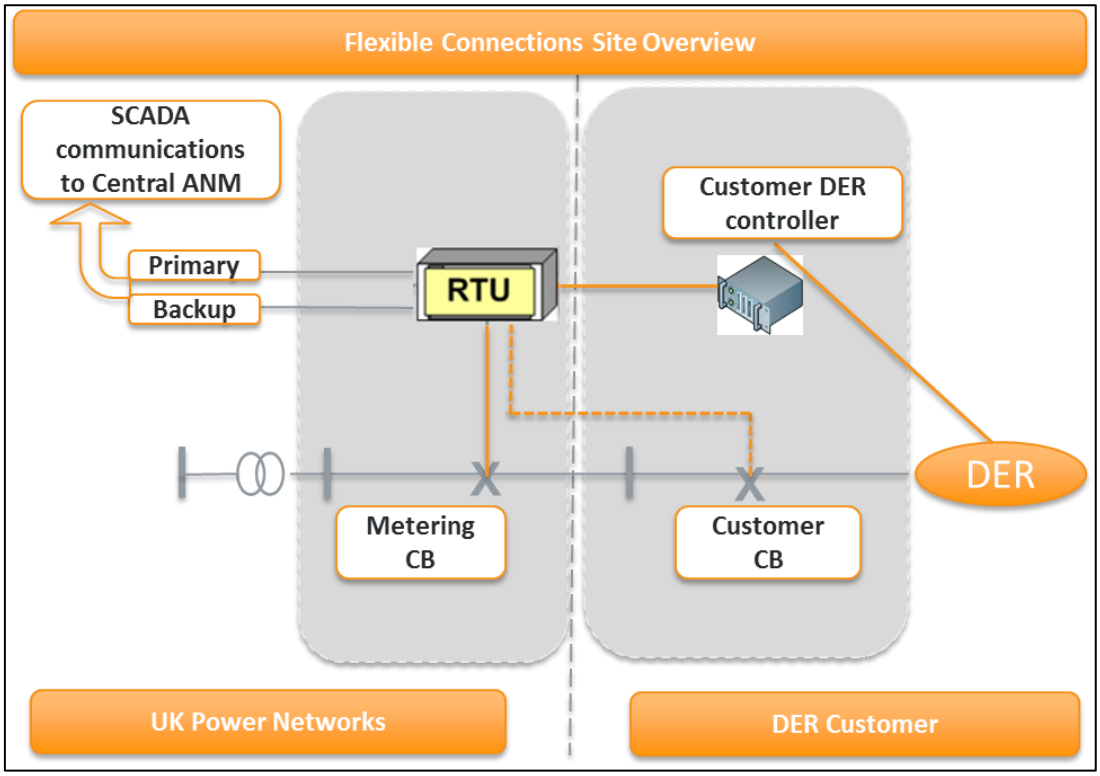

Figure 4-1 - Flexible connections site overview

4.5.1 Responsibility of UK Power Networks

The UK Power Networks is responsible to own and maintain all the equipment shown in Figure 4-1 (left hand side of the diagram) and may not include the building structure, if owned by the flexible connections customer. The structure shall be designed to have capability of supporting all the wall mounted equipment; should the walls require structural strengthening this will be the responsibility of the flexible connections customer and is to be completed prior to the installation of UK Power Networks equipment. Note clearances dimensions are to be maintained for access and maintenance.

Substation building structures shall be constructed in accordance with the relevant civil design standards depending on the type of connection:

- EDS 07-0020 'Civil Requirements for New Customer Supplies and Generation Connections'.
- EDS 07-4000 'Grid and Primary Civil Design Standards'.

Refer to relevant standard drawings for an indicative schematic layout with equipment details.

For HV secondary flexible connections, the civil design differs from standard secondary substations. Indicative civil and electrical drawings have been included in EDS 08-5061.

4.5.2 Responsibility of Flexible Connections Customer

The flexible connections customer is responsible to own and maintain all the equipment shown in Figure 4-1 (right hand side of the diagram). As per Figure 4-1, the UK Power Networks RTU interfaces with the flexible connections Control System equipment via a wired communications link that is also owned by the customer.

4.5.3 Site Responsibility Schedule

Prior to energisation a Site Responsibility Schedule shall be completed.

In addition to the standard requirements, the Site Responsibility Schedule shall specify the requirements for UK Power Networks and for the customer with respect to flexible connections. Table 4-1 details the general flexible connections responsibilities for each party.

Full responsibilities for the site are covered by the Site Responsibility Schedule document.

Refer to CON 05 112 and NOP 10 015 for further information.

Table 4-1 - Responsibility Matrix

No	Items	UK Power Networks	Flexible Connection Customer
1	UK Power Network RTU	Responsible for supplying, installing, commissioning and maintaining the equipment	N/A
2	Flexible Connection Control System	Responsible for specifying the interface requirements between the UK Power Network RTU and the flexible connections control system	Responsible for supplying, installing, commissioning and maintaining the equipment
3	Communication link: RTU and the Flexible Connection Control System	Responsible for specifying the cables and terminating within the equipment	Responsible for supplying, installing, commissioning and maintaining the cables
4	Local Area Network (interface between UK Power Networks RTU and Flexible Connection Control System)	Responsible for specifying the IP addressing for both flexible connections Control System and UK Power Networks RTU	Responsible for configuring and maintaining the IP addressing of supplied by UK Power Networks.
5	Cyber Security	Responsible to design and maintain cyber security of the equipment as per contractual agreement.	Responsible to design and maintain cyber security of its own equipment as defined in this document and the contractual agreement.

5 Functional Requirements

The following functional requirements shall be met by the flexible connections customer in order to commission the flexible connections customer's asset onto the UK Power Networks' system.

The customer must consult the expertise of appropriate parties at the earliest stage of the project to be able to plan, procure, design and deliver the solution in accordance with the detailed requirements set out in this document.

5.1 Real Power Control

As a core requirement, UK Power Networks must have control over the real power export (or import if specified) of the flexible connections customer. To this effect, UK Power Networks shall continuously issue a signal with the maximum real power limit and the flexible connections Control System must ensure the real power (import or export) does not exceed these limits.

For DER with generating modules, the real power setpoint is an **upper export limit** to UK Power Networks and as such, the DER equipment is not under the control of UK Power Networks as long as the DER is operating under the specified limit.

The flexible connections Control System shall accept a control signal, which controls the real power (import or export) of the DER over its full rated range (i.e. granular control between 0-100% and not just simply on/off).

5.2 Controlled Ramping of DER Asset

The flexible connections customer's DER controller must support controlled ramping up or down of their asset to prevent distribution system unbalance triggered by abrupt change in power flows. Table 5-1 specifies the maximum time allowed for the generating module of the DER to ramp down from its full exported output to zero exported output based on the generating capacity of the DER when a curtailment signal is received from the ANM system.

The customer's DER controller shall be configured with appropriate ramp down rates to comply with the specified ramp down times and proven as part of the commissioning tests. Where a DER has a minimum stable operating level the customer must get agreement from UK Power Networks for a non-zero fail-safe parameter prior to the acceptance of the connection offer.

Where a customer connection has additional generation or demand, the specified ramp down time only applies to the flexible export capacity rather than the total generation output. This means the customer's DER control system can optimise its demand and generation internally to comply with any export restrictions.

The ANM system releases capacity in a controlled manner after the curtailment and as such, the ramp up times are not specified in this document.

Table 5-1 - Maximum Allowed Ramp Down Times

EREC G99 types	Generating module capacity	Maximum time allowed to ramp down from full capacity to 0kW
Type C / D	> = 50000kW	145 seconds
	> = 40000kW and < 50000kW	125 seconds
	> = 30000kW and < 40000kW	120 seconds
	> = 20000kW and < 30000kW	120 seconds
	> = 10000kW and < 20000kW	120 seconds
Type B	> = 5000kW and < 10000kW	90 seconds
	> = 2000kW and < 5000kW	80 seconds
	> = 1000kW and < 2000kW	60 seconds
Type A	> = 500kW and < 1000kW	45 seconds
	> = 200kW and < 500kW	30 seconds

5.3 Operational Tripping

In addition to real power control, the ANM system electrically disconnects (trips) flexible connections at the Point of Connection (PoC) only in an abnormal scenario as a fail-to-safe action to mitigate risk to the network asset. The ANM system electrically disconnects a flexible connections in two scenarios:

1. During non-compliance with the Upper Limit kW set-point by the customer's DER within the agreed time duration.
2. During extreme overload scenarios on the network where a trip signal is issued from the central ANM system to protect the network asset.

Specific scenarios for flexible generation connected to the network are detailed in section 5.3.1 and 5.3.2 for directly connected DER and behind the meter embedded DER respectively.

5.3.1 Directly Connected Generation

In this type of configuration, the DER has its own UK Power Networks metering circuit breaker and ANM issues a trip signal to the circuit breaker to disconnect the DER from the network as a fail-to-safe action during the abnormal scenarios.

When a UK Power Networks metering circuit breaker is opened by ANM, the circuit breaker must be closed manually either by UK Power Networks Control Engineer remotely or by an authorised Operational Engineer on site.

5.3.2 Behind the Meter Embedded Generation

In this type of configuration, the DER is directly connected to the ANM system through a hardwired connection to the DER relay (i.e. G99 relay). The ANM system issues a trip signal to disconnect the generator as a fail-to-safe during the abnormal scenarios, avoiding other services from being interrupted. Failure to resolve tripping via the DER CB would result in manual tripping of the metering CB, meaning other services may be affected.

When a customer's circuit breaker is opened by ANM, the circuit breaker must be closed manually by the customer's authorised engineer. UK Power Networks Control Engineers will liaise with the customer around supply restoration in accordance with the Site Responsibility Schedule.

The majority of customer connection scenarios are covered by the following trip arrangements:

1. Send a trip signal to the Customers G99 Interface Protection Relay;
2. Send a trip signal to the Customers Generation/Load Circuit Breaker;
3. Send a trip signal to the UK Power Networks Metering Circuit Breaker.

For embedded circuit breakers, the circuit breaker control signal and back-indications will be run over a separate hard-wired link. The details of the flexible connections configurations and electrical schematics are covered in EDS 08-5061.

5.4 Fail-safe Function

The design of the ANM system includes fail-safe functionality, which is critical to the protection of distribution assets and quality of supply. The fail-safe design shall be implemented by both UK Power Networks and the DER customer as follows;

5.4.1 UK Power Networks' ANM system is designed to take fail-safe action under abnormal operating conditions such as the failure of a critical component of the architecture or a non-compliance from the DER. The consequence of the fail-safe action usually means the issue of DER fail-safe setpoint by UK Power Networks to the customer's DER controller. The DER fail-safe setpoint is zero kW by default unless a non-zero fail-safe setpoint is specified in the connection offer and the connection agreement. In extreme scenarios, the ANM system is designed to disconnect the DER from the network as detailed in section 5.3.

5.4.2 The customer is responsible for implementing the following fail-safe functions:

5.4.3 The customer's flexible connections control system shall continuously monitor its communications link to the UK Power Networks RTU using the UK Power Networks watchdog signal.

5.4.4 In the event of the loss of the ANM watchdog signal, the flexible connections customer's DER controller shall apply the specified fail-safe set point within the specified time as per EDS-08-5060a flexible connections interface schedule.

5.4.5 In the event of the loss of the mains power supply to the customer's flexible connections control system, it must apply the specified fail-safe set point before the battery backup depletes (Refer to section 6.9 below).

5.4.6 The customer's flexible connections control system must continuously provide a watchdog signal to the UK Power Networks RTU so that the UK Power Networks RTU can monitor the health of the control system and communications link, and take fail-safe action accordingly.

5.5 System Availability

It is recommended for the customer to design their control system architecture with the highest possible level of system availability. Any downtime on the customer's system leading to sustained non-compliance of the requirements specified in section 5 will result on the ANM taking the relevant fail-safe actions flexible connections. As such, maintaining the quality and the performance of the customer's DER controller and the associated infrastructure is critical to minimising unnecessary curtailment of DER (usually export power) and consequent loss of customer revenues (usually export revenues). .

6 Non-Functional Requirements

The following non-functional requirements shall be met by the customer in order to commission the flexible connections of the customer's asset onto the UK Power Networks' system.

Where a requirement is fully related to the customer's solution, UK Power Networks only provides a recommendation or guidance based on good industry practice. The customer must consult appropriate parties at the earliest stage of the project to be able to plan, procure, design and deliver the solutions in accordance with the detailed requirements set in this document. NM signal exchange

The customer shall design the DER controller to comply with the ANM signal specification within the EDS 08-5060a flexible connections Interface Schedule document. This section covers the key non-functional requirements and the detailed specification of the installation and wiring is covered in EDS 08-5061.

6.1 Communications Protocol

The communications protocol for the interface between the UK Power Networks RTU and flexible connections Control System shall be DNP3 over Transmission Control Protocol/Internet Protocol (TCP/IP).

The UK Power Networks equipment (usually the RTU) shall be the DNP3.0 Master and the flexible connections DER controller shall be the DNP3.0 Slave. The DER controller must be compliant with DNP3.0 subset level 2 as a minimum with some features beyond level 2, specifically for the support of float data types.

6.2 IP Addressing

The IP address and the subnet mask of the interface of the flexible connections Control System is specified by UK Power Networks within EDS-08-5060a flexible connections Interface Schedule.

6.3 Communication Link

6.3.1 Communication link between the customer's DER controller and the UKPN equipment (RTU)

The customer is responsible for the provision and maintenance of all communication cables from the flexible connections customer's DER controller to UK Power Networks' RTU equipment. UK Power Networks recommends the customer to adopt the appropriate standards to ensure the reliability of this link as the flexible connections customer's energy export/import will be impacted whenever this link fails as described in section 5.5.

The communications link shall be based on Ethernet technology. An additional cable shall be provided for connections with behind the meter embedded DER as covered in section 5.3.2. The specification of this cable is covered in EDS 08-5061.

The Ethernet link can be CAT5e or CAT6 cable if the total length of the cable run is under 100 metres and only runs indoors (not between buildings).

The Ethernet link shall be singlemode Optical Fibre cable if the total length of the cable run is over 100 metres or runs outdoors between buildings. Wireless radio link is not permitted. The customer shall be responsible to provide the singlemode fibre cable with LC connector at the UK Power Networks equipment (usually the RTU).

If optical fibre is used, the customer fibre transceiver must be compatible with the UK Power Networks fibre transceiver of 100-BaseLX standard and single mode 1310/1310 nm (Tx/Rx) wavelength.

The customer shall **not** terminate the communication cables onto UK Power Networks equipment; UK Power Networks or suitably authorised ICP staff shall connect the customer's cable to the UK Power Networks equipment (RTU).

6.3.2 SCADA Communications Link to the UK Power Networks RTU

SCADA Communications equipment shall be provided by UK Power Networks in accordance with the Operational Communications and Technology Strategy detailed in EDS 05-9110. The selection of the communications technology is dependent on the Operational Communications Hierarchy requirements detailed in in EDS 05-9111.

Unless otherwise specified during the design stage, the following communication technologies shall be the default communications;

- **EPN/SPN:** VSAT Satellite as Main comms, GPRS/3G/4G as Backup comms.
- **LPN:** Copper – SHDSL (UK Power Networks owned) as Main comms, GPRS/3G/4G as Backup comms.

6.4 Cable Installations

The communications cable shall be adequately protected. UK Power Networks recommends using galvanised steel copex tubing of 25mm diameter, low smoke and fume sheath and IP54 rating.

An insulated copex gland shall be supplied for entry to the UK Power Networks cabinet.

The fibre installation work shall be carried out by qualified operatives. Installation, testing and commissioning of fibre circuits shall be strictly carried out according to the good industry practice. Fibre patch panel is not specified by UK Power Networks as a requirement but it is recommended for installation as the general good practice. If fibre patch panel is installed the customer shall follow the industry best practice. The installers shall ensure the minimum bending radius of fibre cables is allowed throughout the cable run.

A minimum length of 3 metres of spare cable shall be presented at the UK Power Networks cabinet. The detailed specification of the installation and wiring is covered in EDS 08-5061.

6.5 Analogue Measurements

The UK Power Networks RTU shall monitor flexible connections customer's analogue measurement data from the UK Power Networks owned measurement equipment in the flexible connections substation.

A maximum of 5% tolerance above the upper export limit shall be applied by the ANM system on the DER export or import measurement value before any fail-safe action is taken.

If available from the customer's DER controller, UK Power Networks RTU shall also monitor the optional analogue measurement data through the communication interface as per Section 6.1. The list of analogue measurement signals required are detailed in the EDS 08-5060a flexible connections Interface Schedule.

6.6 Digital Indications and Alarms

The UK Power Networks RTU provides a number of digital indications and alarms to the flexible connections customer's DER controller. These signals shall be used by the customer's operational or DER control team to maintain real time visibility of the system events and the overall ANM system operation.

UK Power Networks recommends the customer to present these signals directly to their asset operations and control systems user interface. This will ensure the customer operations team has relevant information on ANM events so that unnecessary liaisons with UK Power Networks Control desk can be avoided. The list of digital indication and alarm signals required are detailed in the EDS 08-5060a Flexible Connections Interface Schedule.

6.7 Cyber Security Design

UK Power Networks maintains and operates multiple layers of cyber security controls within its infrastructure in accordance with the relevant regulations and industry guidelines. There will be appropriate cyber security controls implemented at the UK Power Networks interface to the customer.

In order to minimise risk to the operation of the distribution network, the customer shall design their network in accordance with the relevant regulations and industry guidelines and in compliance with the relevant clauses specified in the connection agreement. The relevant cyber security design requirements from the connection agreement are also outlined below.

6.7.1 Security Incident Management

The flexible connections customers shall implement adequate security monitoring and business processes to manage and report any anticipated or known Security Incidents to UK Power Networks ANM Service Desk that directly or indirectly affect the flexible connections customer's IT Environment as connected to the UK Power Networks IT Environment. The details of the security incident management responsibilities are covered by the Cyber Security clauses of the connection agreement.

6.7.2 Physical and Environment Security

The following shall apply to all new build flexible connections substations as well as existing firmly connected customer's wishing to move to a flexible connections may already have installations with most of the equipment pre-installed.

6.7.3 The flexible connections customer shall protect its IT environment against unauthorised physical access and criminal or terrorist attack. The Flexible customer shall protect its equipment against fire, flood, environmental and other natural hazards. The flexible connections Customer shall protect its IT environment against power outages.

6.7.4 The flexible connections customer shall restrict physical access to the Information and the IT Environment to those persons who require access in relation to performance of the obligations under this document.

6.7.5 The flexible connections customer will ensure physical access control mechanisms are in operation for communications rooms, server rooms or any rooms providing storage, connectivity or transport of Information used in the relation to this document.

6.7.6 The flexible connections customer shall ensure that any third party requiring access to provide support or maintenance for any equipment that is directly or indirectly involved under this document shall be logged into and out of the relevant premises, the reason for the visiting recorded and the persons supervising their visit.

6.7.7 The flexible connections customer will ensure that logs will be maintained recording access to those parts of the premises that host Information used in the delivery of the flexible connections Service. The flexible connections customer shall monitor these logs for any breaches of security procedures.

6.8 Site Communications and Control Equipment Interface Requirements

6.8.1 The flexible connections customer shall comply with all the technical and cyber security requirements as specified by UK Power Networks and as stated in this document and varied from time to time and shall be governed by the following core principles:

6.8.2 Where the interfaces between UK Power Networks' communications and control equipment and the flexible connections customer's communications and control equipment are provided by Serial data communications links, these shall be secured physically to the same standard as normally used for control system cabling. Where the data communications protocol allows, UK Power Networks' communications and control equipment and the flexible connections customer's communications and control equipment shall use known master/slave node address pairings only.

6.8.3 Where the interfaces between UK Power Networks' communications and control equipment and the flexible connections customer's communications and control equipment are provided by Ethernet data communications links, these shall be secured physically to the same standard as normally used for control cabling.

6.8.4 Where UK Power Networks' communications and control equipment and the flexible connections customer's communications are connected by a point to point Ethernet data communications link such requirement will be configured to use known master/slave node address pairings only.

6.8.5 Where UK Power Networks' communications and control equipment is connected to flexible connections customer's equipment via a LAN or other IP-based network, all communications will use an agreed IP addresses and system protocols (e.g. DNP3) with agreed protocol commands. UK Power Networks' IT/OT environments will enforce technical controls to ensure only the allowed IP addresses, protocols and

commands are permitted to communicate with UK Power Networks' IT/OT equipment.

6.8.6 UK Power Networks may temporarily cease or permanently deny data communications with the flexible connections customer's communications and control equipment if the communications being received from the flexible connections customer presents a tangible risk to the security or operational health of UK Power Networks' IT/OT environment.

6.9 Power Supply Requirements

The flexible connections customer shall ensure they design their DER control system with a backup battery power supply. The backup power supply shall be capable of providing power to the customers local control system, and any ancillary connected equipment for a minimum of 15 minutes in the event of a loss of mains supply to the customer's DER control system. This will ensure the customer's DER control system can detect the failure of the mains supply and apply the pre-defined fail-safe setpoint as defined in section 5.4.5

7 Commissioning

A flexible connections customer is only allowed to export/import to/from the network once the end-to-end ANM has been successfully commissioned in accordance with ECP 11-0701.

The full commissioning requirements for a flexible connections are detailed in ECP 11-0701.

The customer is required to support flexible connections Customer Interface Testing required for commissioning the flexible connections. This shall be completed in two phases:

- Customer interface testing, and;
- On Site Testing

7.1 Customer Interface Testing

Once the ANM interface design of the DER controller is completed based on the signals in EDS 08-5060a flexible connections Interface Schedule, the Laboratory Testing shall be scheduled as early as possible preferably, at least 2 weeks prior to on-site testing. The objective of this laboratory testing is to prove that the customer's DER controller successfully integrates with the UK Power Networks equipment (RTU) before progressing with the onsite testing.

It is recommended that, prior to attending the test laboratory, the customers simulate the UK Power Networks RTU with their local control system and provide the results in packet capture format for analysis by UK Power Networks.

Where a customer had previously tested and proven the integration of the DER controller with UK Power Networks' equipment in the past, this test does not need to be repeated. The testing is carried out at one of the UK Power Networks laboratories usually based in London. During the laboratory testing, the customer shall provide a test DER controller equipment and a test engineer appropriately trained on the operation and the integration of the DER controller equipment.

7.2 On-site Testing and Commissioning

The on-site testing and commissioning of the flexible connections customer shall be carried out following the successful integration of the DER controller to the UK Power Networks equipment (RTU)

The customer shall provide a test and commissioning engineer appropriately trained on the operation and the integration of the DER controller equipment.

8 References

8.1 UK Power Networks Standards

EDS 07-0020	Civil Requirements for New Customer Supplies and Generation Connections
EDS 07-4000	Grid and Primary Substation Civil Design
EDS 08-3100	HV Customer Demand and Generation Supplies
EDS 08-4100	EHV Customer Demand and Generation Supplies
EDS 08-5060a	Flexible Connection Interface Schedule
EDS 08-5061	Flexible Connection Design
ECP 11-0701	Flexible Connection Commissioning Procedure
ECP 11-0704	Flexible Connection Commissioning Requirements
CON 05 112	Creating a Site Responsibility Schedule – HV Customer Supplies
NOP 10 015	Site Responsibility Schedules for HV Supplies from Secondary Substations

8.2 National and International Standards

ENA EREC G99	Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019

9 Dependent Documents

The documents below are dependent on the content of this document and may be affected by any changes.

EDS 08-5060a	Flexible Connection Interface Schedule
ECP 11-0701	Flexible Connection Commissioning Procedure
ECP 11-0701a	Flexible Connection Commissioning Form
ECP 11-0704	Flexible Connection Commissioning Requirements