

## ***STCP 18-5 Issue 002 CATO-TO Connections***

### ***STC Procedure Document Authorisation***

Party	Name of Party Representative	Signature	Date
National Grid Electricity System Operator Ltd			
National Grid Electricity Transmission plc			
SP Transmission plc			
Scottish Hydro Electric Transmission plc			
Competitively Appointed Transmission Owners			
Offshore Transmission Owners			

To be replaced by reference to STC Parties in new Schedule 1

### ***STC Procedure Change Control History***

Issue 001	15/04/2025	Issue 001 First Issue supporting the introduction of CATOs - PM0136
Issue 002	26/11/2025	Issue 002 incorporating Competitively Appointed Transmission Owners to TO Lists on all Definitions – PM0151

# 1 Introduction

## 1.1 Scope

- 1.1.1 This procedure details the process to be followed for the connection of a **CATO** to a **Pre-existing Transmission Owner (PTO)** and the roles and responsibilities of the PTO, the CATO and The Company (the “Lead Parties”).
- 1.1.2 This procedure describes the process following the award of the status of Preferred Bidder to a CATO and their subsequent accession to the STC as an Onshore Transmission Owner. It defines the tasks, formal documentation, interface requirements, timescales and responsibilities between the Lead Parties and Affected TO(s).
- 1.1.3 The Lead Parties are required to cooperate fully as STC parties to progress the connection project and are governed by:
- their status as STC Parties
  - The relevant clauses of STC Section D, Planning Coordination
  - their responsibilities under the Investment Planning provisions of the STC (STCP 16.1); and
  - the formation of a CATO-TO Connection Sub-Group(s) for the CATO Connection Project.
  - As signatories to the **CATO Connection Schedule** (Appendix A)
- 1.1.4 Each TO in coordination with The Company is responsible for the design of the connection and the infrastructure of its Transmission System, initial Outage requirements, programme of works and asset details.
- 1.1.5 This procedure applies to each TO and The Company.
- 1.1.6 For the purposes of this document, the TOs are:
- NGET;
  - SPT;
  - SHET;
  - All Offshore Transmission License holders as appointed by Ofgem; and
  - All Competitively Appointed Transmission License holders as appointed by Ofgem.

## 1.2 Objectives

- 1.2.1 The objective of this procedure is to detail:
- How the CATO-TO Connection Project is addressed across the Company - PTO interface, the TO-CATO interface, and the implications on any Affected TO;
  - The creation and population of the **CATO Connection Schedule** (Appendix A) which shall include the Grid Interface Data File Structure (GIDFS) (located in STCP 19-7 Appendix A7/8) and CATO Transmission Interface Site Specification (CTISS);
  - the requirements for exchange of information in relation to these activities; and
  - the lines of communication to be used.

## 2 Key Definitions

### 2.1 *For the purposes of STCP 18-5:*

- 2.1.1 **Affected TO(s)**- means any Transmission Owner (other than the PTO & CATO) in relation to whose Transmission System the Relevant Connection Site satisfies the criteria set out in the STC, Schedule four. (see STC Section D, part 2, paragraph 2.2.2). For the avoidance of doubt, no OFTO has a role under this STCP until an OFTO has been appointed under the Tender Process
- 2.1.2 **CATO-TO Connection Project:** Means the project undertaken under the provisions of Investment Planning to progress and complete the connection of the CATO asset to the transmission system of the PTO.
- 2.1.3 **CATO Connection Schedule:** Means the Schedule (Appendix A) that forms the inventory of documents that underpin the project and instruct the deliverables and timescales.
- 2.1.4 **Pre-existing Transmission Owner (PTO)** – The Transmission Owner, whose Transmission System is located at the CATO Interface Site for the CATO.
- 2.1.5 **Lead Parties-** Means the parties forming the CATO-TO Connection Sub-Group. These will normally be the PTO, CATO and The Company.
- 2.1.6 **Lead Persons-** means representatives from The Company, the PTO and CATO. The “Lead Person(s)”, shall oversee the connection of the CATO. The remit of the Lead Person(s) is to agree the **CATO Connection Schedule** and associated documents (GIDFS, CTISS etc), monitor progress and agree any changes. The Lead Person(s) are also responsible for resolving any disagreements at first instance, prior to any necessary escalation. Dialogue will take place in person, by email, telephone or video conferencing as appropriate.
- 2.1.7 **CATO Transmission Interface Site Specification (CTISS)-** means the technical appendices contained within the CATO-TO Connection Schedule, detailing the specific requirements in relation to the CATO Transmission Interface

## 3 Procedure

### 3.1 *Nuclear Site Licence Provision*

- 3.1.1 Where this process may interact with, impact upon or fall within the boundary of a Nuclear Site Licence holder's site, or may otherwise have any form of effect and/or implication for a nuclear power station, consideration must be given to the relevant provisions of the applicable Nuclear Site Licence Provisions Agreement, the CUSC Bilateral Connection Agreement for that site, paragraph 6.9.5 of the CUSC and Section G3 of the SO/TO Code to ensure compliance with all of these obligations.

### **3.2 Basic Process**

#### **3.2.1 CATO Awarded Preferred Bidder Status**

- 3.2.1.1 Following a tender process (see Appendix A for Network Competition models) the preferred bidder is appointed and shall follow the Admission of New Parties process, detailed in Section B3 and accede to the STC as an STC Party (Onshore Transmission Licensee).

#### **3.2.2 CATO-TO Connection Sub-Group established for the asset connection project**

- 3.2.2.1 A CATO-TO Connection Sub-Group shall be established for the connection project. This will be established under the provisions of STCP 16-1-Investment Planning. The Joint Planning Committee (JPC), consisting of named representatives (Lead Persons) from The Company and each TO shall facilitate and coordinate the establishment of the CATO-TO Connection Sub-Group for the CATO-TO Connection Project.

- 3.2.2.2 The CATO-TO Connection Sub-Group shall consist of relevant representatives (Lead Persons) from the Lead Parties (PTO(s), CATO and The Company)

- 3.2.2.3 The CATO-TO Connection Sub-Group shall meet as required and when requested by any of the Lead Parties.

- 3.2.2.4 If any of the Lead Parties requests clarification on certain aspects of the project or requests a meeting to clarify certain aspects of the CATO-TO Connection Project, the other Lead Parties shall provide all reasonable assistance to answer the queries raised. All Lead Parties shall accommodate any reasonable request for a meeting at the convenience of all other Lead Parties.

#### **3.2.3 CATO Transmission Interface Site Specification (CTISS) Populated & Signed off.**

- 3.2.3.1 The Company and the PTO shall populate the CTISS. A generic template for HVDC and HVAC connections can be found in Appendix A.

- 3.2.3.2 Following the population of the CTISS the CATO shall review and sign the document, followed by the PTO and The Company.

- 3.2.3.3 In the event of any points of contention the contending party shall call a meeting to discuss and resolve issue/s. All parties must make all reasonable efforts to accommodate the meeting promptly.

- 3.2.3.4 Points of contention that cannot be resolved within the forums of the CATO-TO Connection Sub-Group shall be referred to the CATO-TO Independent Engineer (as per the Disputes Process in this STCP) to consider and provide a decision. If any party continues to contend post CATO-TO Independent Engineer review the Disputes process described in this STCP shall be followed.

- 3.2.3.5 Following completion of the above the CTISS shall be signed by all Lead Parties.

#### **3.2.4 Establishment of CATO Connection Schedule**

- 3.2.4.1 The CATO Connection Schedule (Appendix A) shall be established. This primarily comprises the templates for the CTISS, the GIDFS and the table of Milestones and Deliverables. These items will be signed off by the Lead Parties of the CATO-TO Connection Sub-Group as appropriate and all Lead Parties shall agree as to the contents of these items prior to the issue of the FON.

### **3.2.5 CATO Develops Asset Design**

3.2.5.1 The CATO shall develop the full asset design based upon the design that was submitted and led to the project award. This will inform the connection requirements.

### **3.2.6 CATO Asset Development Project entered into CATO's Investment Plan**

3.2.6.1 The CATO shall enter the full asset delivery project into their "Project Listings Document" (PLD). The detail that shall be included in the PLD is listed in STCP 16-1- Investment Planning and may include the following items:

- project name;
- confirmation of ownership boundaries;
- brief narrative;
- any changes to node and line data;
- schematic diagram;
- key dates (including commissioning date, date by which stage by stage drawings will be available and date of initial Commissioning Panel meeting);
- Deliverables Dates
- mathematical models in Laplace transform block diagram format to represent any dynamic control schemes present in the Transmission System.

Note that outage data shall not necessarily be included in a PLD as this is only normally available after detailed design and development and shall thus be provided by the outage planning process of STCP11-1 for years 3-6 and beyond.

### **3.2.7 Identification and Notification of Affected TOs**

3.2.7.1 Based upon the PLD submitted by the CATO into their Transmission Investment Plan, The Company shall assess the project and notify any Affected TOs.

3.2.7.2 Once identified all Affected TOs shall liaise directly with the Lead Parties to ensure all necessary adjustments are made.

### **3.2.8 Grid Interface Data File Structure (GIDFS) Populated**

3.2.8.1 The Grid Interface Data File Structure is the definitive document that defines the items and actions that are required to be put in place or completed prior to the energisation of the equipment through the interface. The generic template for the GIDFS can be found in Appendix A7/8 of STCP 19-7.

3.2.8.2 The PTO and The Company shall provide information to the CATO to assist in the population of the GIDFS as requested.

3.2.8.3 The CATO shall populate the GIDFS with its required items, to be considered and approved by the other Lead Parties involved in the delivery of the CATO Connection Project.

3.2.9.4 The Lead Parties of the CATO-TO Connection Sub-Group shall be signatories to the GIDFS. The document along with the process itself is iterative and subject to change. To be agreed by all Lead Parties at each revision.

### **3.2.9 Design of the Interface**

3.2.9.1 Based upon the information provided from the PLD and the initial draft of the GIDFS the PTO shall work up the connection and infrastructure design proposals in further detail for the preferred option. The grid interface design shall be submitted to the CATO-TO Connection Sub-Group for its review, feedback and approval.

3.2.9.2 As part of the detailed connection and infrastructure design, the PTO shall develop their designs in accordance with relevant standards and the interface equipment specification as defined in Appendix A of STCP 19-7 (CATO-TO Compliance Processes). The interface equipment specification covers the requirements for the provision of interface equipment.

3.2.9.3 The PTO may include, but shall not be limited in including, secondary plant and apparatus but not limited to protection of light current interfaces LVAC and LVDC supplies in its detailed design provision as appropriate for the following schedules within the interface equipment specification:

- Schedule A Telecommunication Equipment; and
- Schedule B SCADA Data.

3.2.9.4 During the interface design process the PTO(s) shall discuss with The Company any requirements The Company may have for additional communications infrastructure so that delivery by the PTO can be optimised.

3.2.9.5 When changes are made to the relevant standards and interface equipment specification schedules, they shall not normally be retrospectively applicable unless otherwise agreed between the Parties.

3.2.9.6 The CATO Transmission Interface Site shall follow the requirements detailed in Section D Part 1 Paragraph 2.9 and shall follow the European Connection Conditions of the Grid Code. While following this requirement the design of the CATO-TO Interface shall follow the principle of selecting the interface solution with the best value for customers, not requiring unnecessary over specification.

### **3.2.10 Design Assurance Panel**

3.2.10.1 Following publication of the first draft of the Grid Interface Design(s) the Design Assurance Panel shall be established. The Design Assurance Panel will be made up of representatives from the Lead Parties.

3.2.10.2 The representatives on the Design Assurance Panel shall review the grid interface design(s).

3.2.10.3 The remit of the review of the Design Assurance Panel is the PTO's Plant and Apparatus within the busbar protection zone (principles of paragraph 3.2.2.7 should be followed). The Relevant Electrical Standards of the PTO shall apply within this zone.

3.2.10.4 The Design Assurance Panel shall meet to assess the effectiveness of the interface designs and discuss any points of query or contention.

3.2.10.5 Cooperation and negotiation within the Design Assurance Panel should be committed to and fully pursued to resolve any points of contention.

3.2.10.6 Any points of dispute shall be referred to the CATO-TO Independent Engineer who will determine what the most reasonable and efficient option is and provide their decision to the members of the Design Assurance Panel. If any of the parties cannot accept the decision of the CATO-TO Independent Engineer, they shall escalate the matter as per the Dispute Process described later in this STCP.

### **3.2.11 GIDFS Second Review**

3.2.11.1 Following the finalisation and review of the grid interface design the PTO, the CATO and The Company shall review the GIDFS and make any necessary updates. These shall be submitted to the CATO-TO Connection Sub-Group for consideration. If any of the Lead Parties consider a meeting is required to discuss any element, they shall call a meeting of the CATO-TO Connection Sub-Group.

3.2.11.2 The CATO-TO Connection Sub-Group shall consider and agree the frequency of further meetings to review the GIDFS.

### **3.2.12 GIDFS & CATO Connection Schedule Baseline Milestone and Delivery Timescales Agreed**

3.2.12.1 Following the review of the GIDFS and CATO-TO Schedule and agreement of the baseline milestones and timescales (Appendix A2). The baseline timescales for the project shall then be submitted to the Authority.

3.2.12.2 The GIDFS shall be a living, iterative document throughout the entire connection process and shall be continually revisited, as necessary. Events that could lead to revision of the GIDFS include changes to electrical parameters or models or interface design. All changes to the GIDFS (particularly those impacting CATO-TO Connection Schedule, timescales and milestones) must be reported to the CATO-TO Connection Sub-Group, together with the rationale and justification for those changes.

3.2.12.3 It may be necessary at any stage of the CATO-TO Connection Project for changes to deliverables and timescales. Where a Party identifies the need for a revision in deliverables or timescales, this shall be discussed at a meeting of the CATO-TO Connection Sub-Group. If the Parties agree that there is a need for revisions The Company representative shall then submit an application to the Authority for an extension in timescales. The Leading Parties shall provide any relevant information reasonably requested to enable The Company to make a timely submission for such an application.

### **3.2.14 Outage Timings**

3.2.14.1 The PTO shall notify The Company of the outage timings which shall be in accordance with the requirements of STCP 11-1.

### **3.2.15 Preliminary Works Phase**

3.2.15.1 A feature of some forms of Network Competition (e.g. Early Competition) is the Preliminary works phase, during which the CATO will undertake the planning, consenting and the initial groundworks. This phase can last for a number of years. During this phase there is likely to be a lesser requirement for activity and meetings of the CATO-TO Connection Sub-Group for a CATO connection. However, if the CATO becomes aware of any factor that could materially affect the CATO-TO Connection Project during this phase it shall make the Lead Parties of the CATO-TO Connection Sub-Group aware of that factor and the GIDFS and CATO Connection Schedule shall be reviewed and the revision process undertaken if required. If a revision is required a meeting of the CATO-TO Connection Sub-Group shall be called to discuss/approve the required revisions.

3.2.15.2 Any adjustments to the project timescales must be reported to the Authority by the Lead Person for The Company, along with the justification for the adjustment.

### **3.2.16 Post Preliminary Works Review**

3.2.16.1 Following the Preliminary Works phase the CATO shall undertake a review of the GIDFS, CTISS and Deliverables Timetable (see Appendix A) to ensure that any changes to the asset design as a result of the preliminary works are considered and any necessary resultant changes to the Appendix A documents made. The CATO shall report to the CATO-TO Connection Sub-Group following the completion of the Preliminary Works phase whether it considers there needs to be any change to the Appendix A documents. If any changes are made post the Preliminary Works phase the Lead Parties shall review the revised documents and make any resultant changes. Any resultant changes to the CATO-TO Connection Project timescales shall be reported to The Authority.

### **3.2.17 Disputes Process**

3.2.17.1 The CATO-TO Connection Sub-Group and the meeting forums that underpin it shall be considered the primary function to resolve points of contention met in the CATO Connection Project.

3.2.17.2 In the event that agreement is not able to be reached through cooperation and negotiation, a party shall raise its concern and seek to resolve the matter within 16 business days via meetings (including by agreement telephone). If the parties are unable to resolve within 16 business days of the meeting (or within such longer period as they may agree within that initial 16 Business Day period, both parties acting reasonably as to the length of the period). Either party may then refer the dispute to the CATO-TO Independent Engineer for their review and recommendation. The Independent Engineer shall provide their recommendation within 60 days.

3.2.17.3 If a party does not accept the recommendation of the CATO-TO Independent Engineer they may raise a dispute by issuing a dispute notice to the Authority and each of the other dispute parties and the CATO-TO Independent Engineer.

3.2.17.4 In the event that a dispute is raised the CATO-TO Independent Engineer shall provide a report to the Authority within 30 days.

3.2.17.5 The Authority's determination of a dispute shall (without prejudice to any ability to apply for judicial review of any determination) be final and binding on the parties to the dispute and shall be enforceable in the courts.

### **3.2.18 CATO-TO Independent Engineer**

- 3.2.18.1 Parties agree and shall procure that the CATO- TO Independent Engineer shall act as an expert and not as an arbitrator and shall decide those matters referred or reserved to them under CATO-TO Connection Agreement by reference to Good Industry Practice using their skill, experience and knowledge and with regard to such other matters as the Independent Engineer in their sole discretion considers appropriate.
- 3.2.18.2 All references to the CATO-TO Independent Engineer shall be made in writing by a Lead Party with notice to the others being given contemporaneously as soon as reasonably practicable and in any event within 16 days of the occurrence of the dispute to be referred to the CATO-TO Independent Engineer. The Lead Parties shall promptly supply the CATO-TO Independent Engineer with such documents and information as they may request when considering such question.
- 3.2.18.3 The CATO-TO Independent Engineer shall use their best endeavours to give their decision upon the question before them as soon as possible following its referral to them. The Lead Parties shall share equally the fees and expenses of the Independent Engineer.
- 3.2.18.4 The Lead Parties expressly acknowledge that submission of disputes for resolution by the CATO-TO Independent Engineer does not preclude subsequent submission of disputes for resolution by arbitration as provided in 3.2.16. Pending any such submission the parties shall treat the CATO-TO Independent Engineer's decision as final and binding unless referred to the authority.



## Appendix A- CATO Connection Schedule

### Opening statement to Appendix A- CATO Connection Schedule

Lead Parties	Lead Person	Signature
The Company	[NAME]	
CATO	[NAME]	
PTO	[NAME]	

The Lead Parties forming the CATO-TO Connection Sub-Group, [at the first meeting of the Sub-Group or at the earliest available opportunity since its establishment] commit to the development and progression of the deliverables required in Appendix A.

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### Effectiveness Statement

All Lead Parties agree that at the date of the issue of the ION:

- all items listed in the Deliverables Timetable are effective and complete
- the information populating the GIDFS and CTISS remain accurate and complete and should be notified to the Company and PTO if this changes.

Lead Parties	Lead Person	Signature
The Company	[NAME]	
CATO	[NAME]	
PTO	[NAME]	

The CTISS, Deliverables Timetable, Construction Programme & Completion Report applying to the CATO Transmission Interface Site are set out in Appendices [A] CATO Connection Schedule (the GIDFS is set out in Appendix A8. No variation to this CATO Connection Schedule shall be effective unless made in writing and signed by or on behalf of the Lead Parties.

## **Appendix A1.i CATO TRANSMISSION INTERFACE SITE SPECIFICATION- HVAC**

### **\*TEMPLATE\***

This template (Ai) is only an example, The Company retain the right to change them on a case by case basis

**Pre-existing Transmission  
Owner (PTO):**

**Competitively Appointed  
Transmission Owner (CATO):**

**Transmission Interface Site:**

### **CONTENTS**

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### **Electrical Standards**

These appendices contain references to the Relevant Transmission Licensee's Relevant Electrical Standards (RES) and/or [The Scottish Electrical Standards for SPT's Transmission System (SPTS)/ Scottish Electrical Standards for SHET's Transmission System (SHETS)] throughout. The CATO shall ensure that all CATO equipment contained within Relevant Transmission Licensee's busbar protection zone at the CATO Transmission Interface Point (see Grid Code ECC 6.2.1.2) complies with the RES/SPTS/SHETS. Copies of these standards are available from The Company's website at:-

<https://www.nationalgrideso.com/uk/electricity/codes/grid-code/electrical-standards-documents-including-specifications-electronic>

The SPTS/SHETS and RES are updated periodically. If the SPTS/SHETS or RES are updated in the period between issuing the CATO Connection Schedule and the CATO completing the connection to the National Transmission System then the PTO will seek agreement with the CATO to use the updated RES and SPTS/SHETS as the standard for plant and apparatus at the Connection Point.

**SCHEDULE 1****TRANSMISSION ASSETS AT THE TRANSMISSION INTERFACE SITE**

This schedule contains a description of the CATO transmission connection assets at the CATO Transmission Interface Site in accordance with STC, Section D, Part One, 2.8

**1.1 HV EQUIPMENT**

<b>LOCATION OF PLANT/APPARATUS</b>	<b>ITEM OF PLANT / APPARATUS**</b>	<b>INSTALLATION YEAR</b>

**1.2 LV EQUIPMENT**

<b>LOCATION OF PLANT/APPARATUS</b>	<b>ITEM OF PLANT / APPARATUS</b>	<b>INSTALLATION YEAR</b>

## **SCHEDULE 2**

### **BOUNDARY INFORMATION**

This schedule contains a description of the High Voltage (HV) boundaries in place at the CATO Transmission Interface Site in accordance with STC, Section D, Part One, 2.9

#### **2.1 HV BOUNDARIES**

##### **2.1.1 DESCRIPTION**

The electrical and ownership boundary between the CATO Transmission System and PTO at the CATO Transmission Interface Site is located at:

\*Insert Location\* :

- a) Main Busbar:-
- b) Reserve Busbar:- \*Details to be provided if relevant\*

##### **2.2.2 HV DIAGRAMS**

Figures 2.1A to 2.1B for the single line diagram and gas zone diagram boundary point between the Onshore Transmission System of the CATO and Onshore Transmission System of the PTO at the CATO Transmission Interface Site.

#### **2.3 LV BOUNDARIES**

To be discussed and agreed between the Lead Parties in the detailed design phase.

**Figure 2.1A Single Line Diagram (HV Boundary Point)**

**Figure 2.1B Gas Zone Diagram (HV Boundary Point)**

### **SCHEDULE 3**

#### **SITE SPECIFIC TECHNICAL CONDITIONS**

This schedule contains a description of the technical, design and operational criteria which the CATO Transmission Interface Site Party has applied to its equipment in planning and developing its Transmission System in accordance with STC, Section D, Part One,



**SCHEDULE 3.1**

**ANCILLARY SERVICES**

PTO:

CATO:

CATO Transmission Interface  
Site:

Not applicable

**SCHEDULE 3.2**

**DEROGATED PLANT**

PTO:

CATO:

CATO Transmission Interface  
Site:

**Derogated Plant**

Not applicable.

**SCHEDULE 3.3****SPECIAL AUTOMATIC FACILITIES**

PTO:

CATO:

CATO Transmission Interface  
Site:**Special Automatic Facilities****1.1 General****Other Facilities**

<u>Requirement</u>	
Automatic Open/Closure Schemes	N/A
System Splitting/Islanding Schemes	N/A

**2 Synchronising**

2.1 Synchronising requirements at the CATO Transmission Interface PointAt each CATO Transmission Interface Site, the CATO and PTO shall agree the installation of appropriate synchronising facilities and related equipment (where necessary), which shall be in accordance with the appropriate electrical standards.

Any additional requirements for the synchronising equipment for example Interfacing arrangements with the National Electricity Transmission System voltage selection scheme shall be discussed and agreed between the CATO and the PTO in the detailed design phase.

## **SCHEDULE 3.4**

### **RELAY SETTINGS & PROTECTION**

PTO:

CATO:

CATO Transmission Interface  
Site:

#### **Relay Settings & Protection**

##### **1.1 Relay Settings at the CATO Transmission Interface Point**

The CATO shall complete the attached protection schedule pro-forma (Schedule 3.4 - Appendix 1) in respect of the CATO Plant and Apparatus at the CATO Transmission Interface Point at <Location>. The CATO has agreed these protection settings with The Company and the PTO. This includes details of the following:

- a. Circuit diagrams of both ac connections and tripping for the purposes of interpreting the schedule;
- b. Protection co-ordination report confirming compliance with the applicable clauses of ECC 6.2 of the Grid Code European Connection Conditions, as provided for in STC Section D, Part 1, clause 2.2.6. The report shall also show how co-ordination with the PTO's existing system backup protection is achieved including proposed back-up protection grading curves; and
- c. Details of the Protection Dependability Index per protected zone which shall be consistent with the requirements defined in ECC 6.2.2.2.2 (d) of the Grid Code.

Any subsequent alterations to the protection settings, shall be agreed between The Company, the PTO and the CATO which shall be consistent with the requirements defined in Grid Code (ECC.6.2.2.5), as provided in the STC Section D Part 1, 2.2.6.

No CATO equipment shall be energised until the protection settings have been finalised. The CATO shall agree with the PTO and The Company and carry out a combined commissioning programme for the protection systems in accordance with STCP 19-4.

In addition, for CATO connections in England and Wales, the CATO shall consider provision of the facility to enable (through local intervention) a dedicated setting group within the IED(s) of their circuit protection(s) to enable a reverse looking distance element that can cover for the CATO's circuit's infeed to a busbar fault during short periods of loss/unavailability of the busbar protection system. This feature is in line with wider Transmission System contingency planning. The settings shall be discussed and agreed with the PTO during detailed design and delivery.

##### **2.1 Protection Arrangements at the CATO Transmission Interface Point**

The fault clearance time (from fault inception to circuit breaker arc extinction) for faults on the CATO Plant and Apparatus directly connected to the PTO System meets the following minimum requirement(s):-

- At 400kV:- within 80ms
- At 275kV:-within 100ms
- At 132kV:-within 120ms

For faults on transformers the clearance time is specified for the HV side (e.g. for a fault on a 400/220kV transformer, the maximum clearance time is 80ms. Where intertripping is required to open circuit breakers, the overall fault clearance time shall not be extended by more than 60ms (total 140ms) to allow such intertripping to operate.

## PROTECTION AND INTERTRIPPING DETAILS AT THE CATO TRANSMISSION INTERFACE POINT

SITE NAME:

CIRCUIT NAME\*:

[illegible]

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CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See OF4 Item 2)	MOST PROBABLE CLEARANCE TIME				FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO VT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		PROT•	CB	INTER TRIP	TOTAL	PHASE- PHASE	PHASE- EARTH		

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[illegible]



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CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See OF4 Item 2)	MOST PROBABLE CLEARANCE TIME				FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO VT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		PROT•	CB	INTER TRIP	TOTAL	PHASE- PHASE	PHASE- EARTH		

Note: \* BU DT Phase Overcurrent protection is able to detect both phase-phase and phase-earth faults under minimum infeed conditions from PTO side and trip in less than 300ms (protection operating time).

**SCHEDULE 3.5****OTHER TECHNICAL REQUIREMENTS**

PTO:

CTO:

Transmission Interface Site:

**Other Technical Requirements**

	<b>Criteria</b>	<b>Code Ref – CATO to comply with:</b>	<b>Obligations</b>
1.	Protection of interconnecting connections at the CATO Transmission Interface Point	ECC 6.2.2.3.1 ECC.6.2.2.2.2	<p>The protection of interconnecting connections at the CATO Transmission Interface Site shall be discussed and agreed between the CATO and the PTO in the detailed design phase, which shall be in accordance with the applicable electrical standards as defined in A1.1.</p> <p>All protection equipment capable of tripping the interconnecting circuit breaker complies with ECC.6.2.2.2.2 of the Grid Code. As provided in STC Section D, Part 1, 2.2.6.</p> <p>In the event that the <u>CATO</u> connects any CATO Plant and Apparatus within the Transmission busbar protection zone which utilises Gas Insulated Switchgear equipment, then the <u>PTO</u> shall provide all necessary alarms and indications with respect to any gas zones across the ownership boundary.</p>
2.	Circuit Breaker Fail Protection at the CATO Transmission Interface Point	ECC.6.2.2.3.2	<p><u>The requirements for circuit breaker fail protection at the CATO Transmission Site including as appropriate the configuration, alarms, status indications and trip commands shall be discussed and agreed between the CATO and PTO in the detailed design phase. Such requirements shall be in accordance with the applicable electrical standards as defined in A1.1.</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
3.	Fault Disconnection Facilities		<u>The CATO:</u> To make provision for tripping of the circuit breakers forming part of the CATO Plant and Apparatus at the CATO Interface Point by PTO's protection systems in accordance with the electrical standards defined in A1.1.
4.	Reactive capability at the CATO Transmission Interface Point		<u>The reactive capability at the CATO Transmission Interface Point shall be specified in accordance with the requirements of the tender.</u>
5.	Restoration		The CATO shall ensure restoration measures are put in place in accordance with the requirements of the STC & STCPs.
6.	Further Resilience Requirements		<u>The CATO:</u> <u>In designing their Plant and Apparatus, the CATO shall avoid introducing any common mode failure which is beyond what is permitted by the security standards or which could potentially affect the CATO's ability to meet their obligations under the Grid Code or the STC.</u>
7.	Voltage Control Requirements at the CATO Transmission Interface Point		<u>The voltage control requirements at the CATO Transmission Interface Point shall be in accordance with the requirements of the tender.</u>
8.	Power Oscillation Damping		To be determined on a case by case basis
9.	Fault Ride Through	ECC.6.3.15	<u>The CATO:</u> To meet the applicable requirements of ECC.6.3.15. The total fault clearance time on the National Electricity Transmission System shall be agreed by the Lead Parties.
10.	Harmonic Performance at the CATO	ECC.6.1.5(a)	<u>The PTO:</u> <u>Shall specify to the CATO by written notice, the harmonic voltage distortion or harmonic current emission limits (as appropriate), in conjunction with harmonic impedance loci and background levels at the transmission interface point by the date agreed between The</u>

	Criteria	Code Ref – CATO to comply with:	Obligations
	Transmission Interface Point		<p><u>Company, the PTO and the CATO. The specification of the above limits shall be prepared in accordance with the procedures specified in Engineering Recommendation (ER) G5/5.</u></p> <p><u>The CATO:</u>  <u>Shall carry out an Assessment to ensure that its CATO Transmission System complies with the applicable standards specified in the Grid Code ECC.6.1.5. Any inter-harmonic component produced by the CATO's equipment shall be determined in accordance with relevant sections in ER G5/5. If the predicted level of inter-harmonic distortion is below 0.1%, no further assessment is required. If the inter-harmonic distortion is above 0.1%, the CATO shall inform the PTO and specify inter-harmonic distortion limits to the CATO. The timeframe for provision of inter-harmonic distortion limits shall be agreed between the PTO and the CATO.</u></p> <p><u>The CATO will provide The PTO with Harmonic Assessment information (as specified in STCP 12-1) and also, in accordance with ER G5/5, submit a report to confirm compliance with limits specified (including inter-harmonic distortion) by the date agreed with the PTO.</u></p>
11.	Power Quality Monitoring at the CATO Transmission Interface Point		<p><u>The CATO:</u>            Shall provide three phase voltage transducers on the CATO Plant and Apparatus of suitable accuracy and performance. These shall be appropriately sited at the CATO Transmission Interface Point to enable continuous power quality voltage monitoring to be undertaken with the CATO's Plant and Apparatus at the CATO Transmission Interface Point energised.</p> <p>Examples of suitable voltage transducers are detailed in TS 3.02.05_RES "Voltage Transformers" (with particular reference to section 1.3) or, alternatively, in TS 3.02.12_RES "Voltage Dividers".</p> <p>Shall provide three phase current transducers of suitable accuracy and performance on the CATO Plant and Apparatus at the Transmission Interface Point to enable continuous power quality current monitoring to be undertaken by The Company.</p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p>Shall provide the CT and VT signals from the transducers (as specified above) to a suitable termination point within the cubicle and shall in agreement with PTO provide a permanent, Class A power quality monitors as defined in IEC 61000-4-30 at the Transmission Interface Point in order the PTO can check compliance against the specified limits and provide cubicle space, power supplies, and ancillary equipment within the Substation which satisfy the requirements detailed in TGN(E) 295.</p> <p><u>In order that the PTO:</u></p> <ol style="list-style-type: none"> <li>1. can undertake a four week period of continuous power quality voltage measurements using the above facilities immediately prior to the energisation of the CATO Plant and Apparatus feeders to establish a baseline for compliance with the Grid Code and</li> <li>2. can carry out continuous power quality monitoring thereon during and after commissioning of the <b>CATO Plant and Apparatus</b> both with and without the connection to the transmission system.</li> </ol>
12.	Voltage Phase Unbalance	ECC.6.1.5(b) ECC.6.1.6	<p><u>The CATO:</u> Shall carry out an unbalance assessment in accordance with Grid Code European Connection Conditions ECC.6.1.5(b) and ECC.6.1.6.</p> <p>The results of this assessment are published as a formal statement of compliance.</p>
13.	Electromagnetic Transients	ECC.6.1.7(a) ECC.6.1.7(b)	<p><u>The CATO:</u> Shall take appropriate measures to minimise the probability and severity of electromagnetic voltage transients which may occur when the CATO Plant and Apparatus (or any material subsystem) is connected to or disconnected from the National Electricity Transmission System.</p> <p>Shall provide to The Company and PTO details of such measures and an assessment of the predicted probability and severity of such transients.</p>

	Criteria	Code Ref – CATO to comply with:	Obligations												
			<p><u>The Company:</u> Shall provide the latest fault level information to enable the assessment detailed above.</p> <p>Note: The CATO may wish to make reference to guidance documents including, but not limited to, IEC 60071-4.</p> <p>In order to limit voltage change at the CATO Interface Point, (for example during energisation), the <u>CATO</u> shall also be required to satisfy the requirements of ECC.6.1.7(a) and ECC.6.1.7(b) of the Grid Code.</p>												
14.	Short Circuit Levels		<p>The CATO must continue to operate satisfactorily and keep fundamental frequency over-voltages to within the limit specified under 'AC System Voltage Variations,' using minimum fault levels as described in the Table 1</p> <table border="1"> <thead> <tr> <th>SQSS Condition</th><th>3-phase Sub-Transient (kA)</th><th>1-phase sub-transient (kA)</th><th>Purpose (It is recommended the relevant fault levels are used for the following purposes)</th></tr> </thead> <tbody> <tr> <td>Minimum fault level</td><td>TBC</td><td>TBC</td><td>           1- Protection settings with additional appropriate safety margins.            2- Electromagnetic transient study in relation to ECC.6.1.7(a) and (b) and TOV (TGN 288). (E&amp;W only)            3- Any study in relation to unbalance.         </td></tr> <tr> <td>Post fault minimum fault level</td><td>TBC</td><td>TBC</td><td>           1- Fault ride through            2- Transient active and reactive power exchange studies            3- For SSTI and control interaction studies the part of network around         </td></tr> </tbody> </table>	SQSS Condition	3-phase Sub-Transient (kA)	1-phase sub-transient (kA)	Purpose (It is recommended the relevant fault levels are used for the following purposes)	Minimum fault level	TBC	TBC	1- Protection settings with additional appropriate safety margins. 2- Electromagnetic transient study in relation to ECC.6.1.7(a) and (b) and TOV (TGN 288). (E&W only) 3- Any study in relation to unbalance.	Post fault minimum fault level	TBC	TBC	1- Fault ride through 2- Transient active and reactive power exchange studies 3- For SSTI and control interaction studies the part of network around
SQSS Condition	3-phase Sub-Transient (kA)	1-phase sub-transient (kA)	Purpose (It is recommended the relevant fault levels are used for the following purposes)												
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	Criteria	Code Ref – CATO to comply with:	Obligations				
			<table border="1"> <tr> <td></td><td></td><td></td><td>the point-of-interest is usually modelled. Post fault minimum fault level, which represent a N-1-D condition on a summer minimum scenario should be included in the study cases.</td></tr> </table> <p><u>Table 1</u></p> <p>Please note that the values in Table 1 are indicative of the predicted landscape at the time of the offer. As the connection date approaches and the surrounding landscape becomes more fixed, more accurate values will be provided on request in accordance with the requirements of STCP 12-1.</p> <p><u>The CATO:</u></p> <p>Must continue to operate satisfactorily and keep fundamental frequency over-voltages to within the limit specified under 'System Voltage Variations at the CATO Transmission Interface Point,' for the extreme minimum short circuit <b>(Steady State)</b> level of [XXXX] kA at the [XXXX]kV busbar.</p>				the point-of-interest is usually modelled. Post fault minimum fault level, which represent a N-1-D condition on a summer minimum scenario should be included in the study cases.
			the point-of-interest is usually modelled. Post fault minimum fault level, which represent a N-1-D condition on a summer minimum scenario should be included in the study cases.				
15.	AC System Voltage Variations at the CATO Transmission Interface Point	ECC.6.1.4	<u>In addition to withstanding the requirements of ECC.6.1.4 of the Grid Code (as required through STC Section D Part One Clause 2.2.6), the CATO's Plant and Apparatus shall be capable of withstanding typical fundamental frequency temporary overvoltages that may occur on the National Electricity Transmission System including at the CATO Transmission Interface Point.</u>				
16.	Changes to Control Schemes and Settings	ECC.6.2.2.6, ECC.6.2.2.7, ECC.6.2.2.8 and ECC.6.2.2.9.10	<p><u>The CATO:</u></p> <p><u>Shall ensure all control schemes (including different control modes) and settings shall be agreed with The Company and PTO as required in ECC.6.2.2.6, ECC.6.2.2.7, ECC.6.2.2.8 and ECC.6.2.2.9.10 (in accordance with STC Section D Part One Clause</u></p>				

	Criteria	Code Ref – CATO to comply with:	Obligations
			<u>2.2.6). Any subsequent changes once commissioned shall not be implemented unless otherwise agreed with The Company and PTO.</u>
17.	Operational Telephony	STCP 04-5	<u>The CATO:</u> To fulfil the obligations defined in STCP 04-5
18.	Operational metering	STCP 04-3	<u>Is required to be installed in accordance with the STC and STCPs, including but not limited to STCP 04-3</u>
19.	Critical Tools & Facilities	ECC.7.10 ECC 7.11	<u>The CATO:</u> As required under Grid Code ECC.7.10 to have critical tools and facilities. In addition, the CATO will also be required to comply with ECC 7.11
20.	Real Time Data Transfer	STCP 04-3	<u>The CATO:</u> Is required to supply real time data as specified in STCP 04-3
21.	Dynamic System Monitoring	STCP 03-1 & STCP 27-1	<p><u>The CATO:</u> <u>Shall provide Dynamic System Monitoring and fault recording facilities on its CATO Plant and Apparatus at the CATO Transmission Interface Point to monitor system dynamic performance and fault recording and provide communication facilities allowing remote access of data to the PTO and The Company.</u></p> <p><u>The Dynamic System Monitoring and Fault Recording requirements are contained in Schedule 3 of this Appendix. In England and Wales these requirements shall be in accordance with TS 3.24.70 RES (Dynamic System Monitoring (DSM) and TS 3.24.71 RES (Fault Recording). In Scotland the requirements shall be in accordance with those specified by the PTO</u></p> <p><u>The CATO Plant and Apparatus shall supply the signals generated by the Dynamic System Monitors and Fault Recorders to the Transmission Interface Point at [XXXX]kV Onshore Substation.</u></p> <p><u>The interfacing and connection arrangements for the Dynamic System Monitoring signals at the CATO Transmission Interface Point at [XXXX]kV Substation shall be agreed with the PTO and The Company as soon as reasonably practicable.</u></p>



	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>There may be a need to change the above requirements depending upon the exact boundary between the PTO and the CATO. When the CATO Interface Point boundary has been defined, The Company and PTO will define the exact requirements for the Dynamic System Monitoring which shall be agreed between the CATO, the PTO and The Company in the detail design phase.</u></p> <p><u>In the event that the CATO dynamic system monitoring equipment fails then the CATO will be required to repair the fault within 5 working days of notification of the fault unless otherwise agreed. The CATO shall advise the PTO and The Company of the nature of the fault, its expected repair time and the time at which it is expected to be returned to service. The Company and/or PTO will advise the CATO of any such measures that may be required to manage the situation when the Dynamic System Monitoring equipment is out of service.</u></p>
22.	Modelling		<u>The CATO is required to supply models and data in accordance with the data exchange mechanism in accordance with STCP 12-1. Any additional requirements for modelling shall be defined in the detailed design phase.</u>
23.	Overall CATO Plant and apparatus protection and control facilities		<p><u>The CATO:</u></p> <p><u>To ensure that no harmful interactions exist between the CATO Plant and Apparatus and the National Electricity Transmission System which may adversely affect either the CATO Plant and Apparatus protection system or the National Electricity Transmission protection systems. The CATO shall ensure that any of its CATO Plant and Apparatus control systems shall be stable in all situations and be self-protected.</u></p> <p><u>Where applicable, the CATO Plant and Apparatus control systems shall co-ordinate with any Dynamic Var Compensation Equipment for the purpose of Reactive Compensation and/or Voltage control. The CATO shall declare the control strategy which shall be discussed and agreed with The Company and PTO as soon as reasonably practicable. In</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<u>any event this shall be no later than 18 months before the Completion Date unless otherwise agreed with The Company and the PTO.</u>
24.	Safety and Operational Interlocking at the Transmission Interface Point		<p><u>The CATO:</u>            Shall provide electrical and mechanical interlocking on the <b>CATO Plant and Apparatus</b> located within the zone covered by the PTO's substation busbar protection at the CATO Transmission Interface Site in accordance with the Electrical Standards.</p>
25.	Earthing Requirements at CATO the Transmission Interface Point		<p>All earth mats on the <u>PTO's</u> site(s) and the CATO's site(s) where these are adjacent may be bonded together. The PTO's site earth mats can be bonded to the CATO's site earth mat.</p> <p><u>The CATO:</u>            Shall carry out an earthing survey of its sites prior to construction of the <b>CATO's Plant and Apparatus</b>. The earthing system is designed to withstand a short circuit current of 63kA for 1 second at 400kV.</p> <p>The CATO shall also ensure that it's Plant and Apparatus is designed and installed such that the rise of earth potential (ROEP) at &lt;insert location&gt; conforms to the touch, step and transfer voltage limits which are defined in ENA TS 41 – 24. Where intertripping (second main protection) is required to open circuit breakers, the overall fault clearance time shall not be more than 140ms.</p> <p>The CATO's earthing system design review shall take the PTO's earthing system design into account and the CATO shall collaborate with the PTO to ensure that compliance has been demonstrated at the CATO Transmission Interface Point and mitigation of 3rd party impact is considered.</p>

	<b>Criteria</b>	<b>Code Ref – CATO to comply with:</b>	<b>Obligations</b>
			<p>It should also be noted that the earthing system at &lt;insert location&gt; shall be designed to comply with ESQCR 2002 and BS EN50522.</p> <p>In the case of a CATO Transmission Interface Point in Scotland, any necessary data or characteristics as requested by the PTO of the CATO Plant and Apparatus shall be provided to allow assessment of the risks arising from transfer of potentials and/or currents from the CATO's Plant and Apparatus earthing system to the PTO's earthing system (either steady state or transient).</p>
26.	CATO Plant and Apparatus Compliance Process	STCP 19-7	<p><u>The CATO:</u> Shall demonstrate compliance with STCP 19-7</p>

### Site Specific Technical Conditions – Harmonic Performance (ECC.6.1.5(a))

**Table 1: Incremental Voltage Emission Limit**[illegible]

- 1.2 The CATO shall ensure that its Plant and Apparatus, at the CATO Interface Point was designed and constructed such that the total harmonic voltage distortion at the CATO Interface Point conform to the limits specified in Table 2.
- 1.3 Table 2 also provides the levels of background harmonic voltage distortion at the CATO Interface Point prior to the connection of the CATO Plant and Apparatus.
- 1.4 The limits specified in Table 1 and Table 2 shall apply for all possible conditions of the CATO Plant and Apparatus. They shall apply for all possible conditions of the Network System (which includes the Transmission Network and relevant Distribution or EU Code User's networks) whose system impedance envelopes at the CATO Interface Point up to 5 kHz (100<sup>th</sup> harmonic) and will be specified by The Company to the CATO, unless otherwise agreed..

**Table 2: Background Harmonic Voltage Distortion and Total Harmonic Voltage Distortion Limits**

[illegible]

Harmon Order 'h'	Background Voltage Distortion at the CATO Interface Point prior to the connection of the CATO Plant and Apparatus and associated Offshore Generation (% of fundamental)	Total Harmonic Voltage Emission Limits (% of fundamental)

- 1.5 The **CATO Plant and Apparatus** conforms to the Total Harmonic Distortion (THD) level, at the CATO Transmission Interface Point as calculated in accordance with Engineering Recommendation G5/5 and IEC 61000-4-30, given in Table 5 below.

**Table 5: Total Harmonic Distortion Limits**

Frequency Range	THD
≥100Hz	



## **2 Voltage Flicker Limits**

2.1 The CATO shall ensure its Plant and Apparatus is designed and constructed to comply with the voltage flicker limits at the Transmission Interface Point.

The CATO is required to follow EREC P28-Issue 2 and provide a report to show – considering time-variation of frequency – that their flicker impact is compliant with Stage 2 assessment criteria of EREC P28-Issue 2. If the Stage 2 assessment criteria cannot be satisfied, then PTO shall issue appropriate limits in accordance with Stage 3 assessment procedure within EREC P28-Issue 2

**Schedule 3.5 – Appendix 2**

## Site Specific Technical Conditions - Communications Plant (ECC.6.5))

Description	Location	Source	Provided By	Comments
Operational Telephony	CATO Plant and Apparatus Control Centre	The Transmission Substation Exchange or as agreed with The Company	PTO provided and installed cross site wiring at the CATO Plant and Apparatus Control Centre	Control Telephony provides secure point to point telephony for routine Control calls, priority Control calls and emergency Control Calls.  The CATO's control point must be immediately and directly contactable by The Company at all times and operators should be able to communicate in clear plain English.
PSTN (or other off-site communications circuits) for Telephony (ECC.6.5.2 to ECC.6.5.5)	CATO Plant and Apparatus Control Centre	Public Telecommunications Operator	Data and speech services required by The Company and the PTO was cabled from the CATO Control Centre to the Public Telecommunications Exchange. The CATO provided their own off-site wiring and communications paths.	

## Schedule 3.5 – Appendix 3

## Site Specific Technical Conditions – Dynamic System Monitoring and Fault Recording. (STCP 27-1)

The CATO is required to provide the dynamic system monitoring facilities on the CATO's circuits and provide communication facilities allowing remote access of data to The Company

Description	Type	Provided by	Notes
3 phase voltage and current at [XXXX]kV substation.	AC Waveforms	The CATO	The functionality, performance, availability, accuracy, dependability, security, configuration, delivery point, protocol and repair times of the equipment generating and supplying the signals (i.e., the inputs, monitors and communication links) shall be agreed with The Company at least 12 months before the Completion Date.
Dynamic System Monitoring and remote communications and interfacing on The CATO's circuits at the PTO's [XXXX]kV substation.	Monitors	The CATO	Connection to enable data to be retrieved from Dynamic System Monitoring equipment. Connection to the PTO with connection, monitoring and security arrangements to be agreed with The Company/the PTO at least 12 months before the Completion Date.
	Communications Channels	The CATO to provide signals and interface at [XXXX]kV substation.	

In the event that any part of the CATO's equipment fails to deliver the information required at [XXXX]kV substation (including the communications routes) then the CATO shall be required to repair the equipment within 5 working days of notification of the fault from The Company unless otherwise agreed. The CATO shall also provide facilities to allow The Company to monitor the health of the Dynamic System Monitoring equipment up to the CATO Transmission Interface Point.

Note:- The specification and performance requirements for Dynamic System Monitoring is detailed in Technical Specification TS 3.24.70-RES (Dynamic System Monitoring (DSM)).

## **Appendix A1ii CATO TRANSMISSION INTERFACE SITE SPECIFICATION-HVDC**

### **\*TEMPLATE\***

**This template (Aii) is only an example, The Company retain the right to change them on a case by case basis.**

**Pre-existing Transmission  
Owner (PTO):**

**Competitively Appointed  
Transmission Owner (CATO):**

**Transmission Interface Site:**

### **CONTENTS**

#### **SCHEDULE 1. TRANSMISSION ASSETS AT THE TRANSMISSION INTERFACE SITE**

- 1.1 HV Equipment
- 1.2 LV Equipment

#### **SCHEDULE 2. BOUNDARY INFORMATION**

- 2.1 Boundaries
  - 2.1.1 Description
  - 2.1.2 Diagrams

#### **SCHEDULE 3. SITE SPECIFIC TECHNICAL CONDITIONS**

- 3.1 Ancillary Services
- 3.2 Derogated Plant
- 3.3 Special Automatic Facilities
- 3.4 Relay Settings & Protection
- 3.5 Other Technical Requirements

### A.1.1 Electrical Standards

These appendices contain references to the Relevant Transmission Licensee's Relevant Electrical Standards (RES) and/or [The Scottish Electrical Standards for Scottish Power Transmission's (SPT)'s Transmission System (SPTS)/ Scottish Electrical Standards for Scottish Hydro Electricity SHET's Transmission's (SHET) transmission sSystem (SHETS)] throughout. The CATO shall ensure that all CATO equipment contained within Relevant Transmission Licensee's busbar protection zone at the CATO Transmission Interface Point (see Grid Code ECC 6.2.1.2) complies with the RES/SPT'sS/SHET'sS. Copies of these standards are available from The Company's website at:-

<https://www.nationalgrideso.com/uk/electricity/codes/grid-code/electrical-standards-documents-including-specifications-electronic>

The SPT's/SHET's and RES are updated periodically. If the SPT's/SHET's or RES are updated in the period between issuing the CATO Connection Schedule and the CATO completing the connection to the National Transmission System then the PTO will seek agreement with the CATO to use the updated RES and SPT,'sS/SHET'sS as the standard for plant and apparatus at the Connection Point.

SCHEDULE 1

TRANSMISSION ASSETS AT THE TRANSMISSION INTERFACE SITE

This schedule contains a description of the CATO Transmission Connection Assets at the CATO Transmission Interface Site in accordance with STC, Section D, Part One, 2.8

1.1 HV EQUIPMENT

LOCATION OF PLANT/APPARATUS	ITEM OF PLANT / APPARATUS**	INSTALLATION YEAR

**1.2 LV EQUIPMENT**

<b>LOCATION OF PLANT/APPARATUS</b>	<b>ITEM OF PLANT / APPARATUS</b>	<b>INSTALLATION YEAR</b>

## **SCHEDULE 2**

### **BOUNDARY INFORMATION**

This schedule contains a description of the High Voltage (HV) boundaries in place at the CATO Transmission Interface Site in accordance with STC, Section D, Part One, 2.9

#### **2.1 HV BOUNDARIES**

##### **2.1.1 DESCRIPTION**

The electrical and ownership boundary between the CATO Transmission System and PTO at the CATO Transmission Interface Site is located at:

\*Insert Location\* :

c) Main Busbar:-

d) Reserve Busbar:- \*Details to be provided if relevant\*

##### **2.2.2 HV DIAGRAMS**

Figures 2.1A to 2.1B for the single line diagram (and gas zone diagram boundary point, if relevant) between the Onshore Transmission System of the CATO and Onshore Transmission System of the PTO at the CATO Transmission Interface Site.

#### **2.3 LV BOUNDARIES**

To be discussed and agreed between the Lead Parties in the detailed design phase.



**Figure 2.1A Single Line Diagram (HV Boundary Point)**

**Figure 2.1B Gas Zone Diagram (HV Boundary Point, if applicable)**

### **SCHEDULE 3**

#### **SITE SPECIFIC TECHNICAL CONDITIONS**

This schedule contains a description of the technical, design and operational criteria which the CATO Transmission Interface Site Party has applied to its equipment in planning and developing its Transmission System in accordance with STC, Section D, Part One.

**SCHEDULE 3.1**

**ANCILLARY SERVICES**

PTO:

CATO:

CATO Transmission Interface  
Site:

Not applicable

**SCHEDULE 3.2**

**DEROGATED PLANT**

PTO:

CATO:

CATO Transmission Interface  
Site:

**Derogated Plant**

Not applicable.

**SCHEDULE 3.3****SPECIAL AUTOMATIC FACILITIES**

PTO:

CATO:

CATO Transmission Interface  
Site:**Special Automatic Facilities****2.2 General****Other Facilities**

<u>Requirement</u>	
Automatic Open/Closure Schemes	N/A
System Splitting/Islanding Schemes	N/A

**3 Synchronising****3.1 Synchronising requirements at the CATO Transmission Interface Point**

At each CATO Transmission Interface Site, the CATO and PTO shall agree the installation of appropriate synchronising facilities and related equipment (where necessary), which shall be in accordance with the appropriate electrical standards.

Any additional requirements for the synchronising equipment, where required, for example interfacing with the National Electricity Transmission System voltage selection scheme, shall be discussed and agreed between the CATO and the PTO in the detailed design phase.

### **SCHEDULE 3.4**

#### **RELAY SETTINGS & PROTECTION**

PTO:

CATO:

CATO Transmission Interface Site:

#### **Relay Settings & Protection**

##### 1.2 Relay Settings at the CATO Transmission Interface Point

The CATO shall complete the attached protection schedule pro-forma (Schedule 3.4 - Appendix 1) in respect of the CATO Plant and Apparatus at the CATO Transmission Interface Point at <Location>. The CATO has agreed these protection settings with The Company and the PTO. This includes details of the following:

- d. Circuit diagrams of both ac connections and tripping for the purposes of interpreting the schedule;
- e. Protection co-ordination report confirming compliance with the applicable clauses of the Grid Code European Connection Conditions, the report shall also show how co-ordination with the PTO's existing system backup protection is achieved including proposed back-up protection grading curves; and
- f. Details of the Protection Dependability Index per protected zone which shall be consistent with the requirements defined in ECC 6.2.2.2.2 (d) of the Grid Code as provided for in accordance with STC Section D Part One 2.2.6.

Any subsequent alterations to the protection settings, shall be agreed between The Company, the PTO and the CATO which shall be consistent with the requirements defined in Grid Code (ECC.6.2.2.5), as provided for in the STC Section D Part 1, 2.2.6.

No CATO equipment shall be energised until the protection settings have been finalised. The CATO shall agree with the PTO and The Company and shall carry out a combined commissioning programme for the protection systems in accordance with STCP 19-4.

In addition, for CATO connections in England and Wales, the CATO shall consider provision of the facility to enable (through local intervention) a dedicated setting group within the IED(s) of their circuit protection(s) to enable a reverse looking distance element that can cover for the CATO's circuit's infeed to a busbar fault during short periods of loss/unavailability of the busbar protection system. This feature is in line with wider Transmission System contingency planning. The settings shall be discussed and agreed with the PTO during detailed design and delivery.

##### 2.2 Protection Arrangements at the CATO Transmission Interface Point

###### Protection Arrangements at the Transmission Interface Point

The fault clearance time (from fault inception to circuit breaker arc extinction) for faults on the CATO Plant and Apparatus directly connected to the PTO System meets the following minimum requirement(s):-

At 400kV:- within 80ms

At 275kV:-within 1020ms

At 132kV:-within 120ms

For faults on transformers the clearance time is specified for the HV side (e.g. for a fault on a 400/220kV transformer the maximum clearance time is 80ms. Where intertripping is required to open

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circuit breakers, the overall fault clearance time shall not be extended by more than 60ms (total 140ms) to allow such intertripping to operate.

CATOs who own and operate an HVDC system should also be aware of the general protection control requirements in the Grid Code ECC 6.2.2.8.



**Schedule 3.4- Appendix 1****PROTECTION AND INTERTRIPPING DETAILS AT THE CATO TRANSMISSION INTERFACE POINT**SITE NAME:CIRCUIT NAME\*:

CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See OF4 Item 2)	MOST PROBABLE CLEARANCE TIME				FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO VT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		PROT•	CB	INTER TRIP	TOTAL	PHASE- PHASE	PHASE- EARTH		

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CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See OF4 Item 2)	MOST PROBABLE CLEARANCE TIME				FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO VT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		PROT•	CB	INTER TRIP	TOTAL	PHASE- PHASE	PHASE- EARTH		

CIRCUIT NAME\*:

59

# STCP 18-5 CATO-TO Connections

Issue 002 – 26/11/2025

CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See OF4 Item 2)	MOST PROBABLE CLEARANCE TIME				FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO VT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		PROT•	CB	INTER TRIP	TOTAL	PHASE- PHASE	PHASE- EARTH		

Note: \* BU DT Phase Overcurrent protection is able to detect both phase-phase and phase-earth faults under minimum infeed conditions from PTO side and trip in less than 300ms (protection operating time).

**SCHEDULE 3.5****OTHER TECHNICAL REQUIREMENTS**

PTO:

CTO:

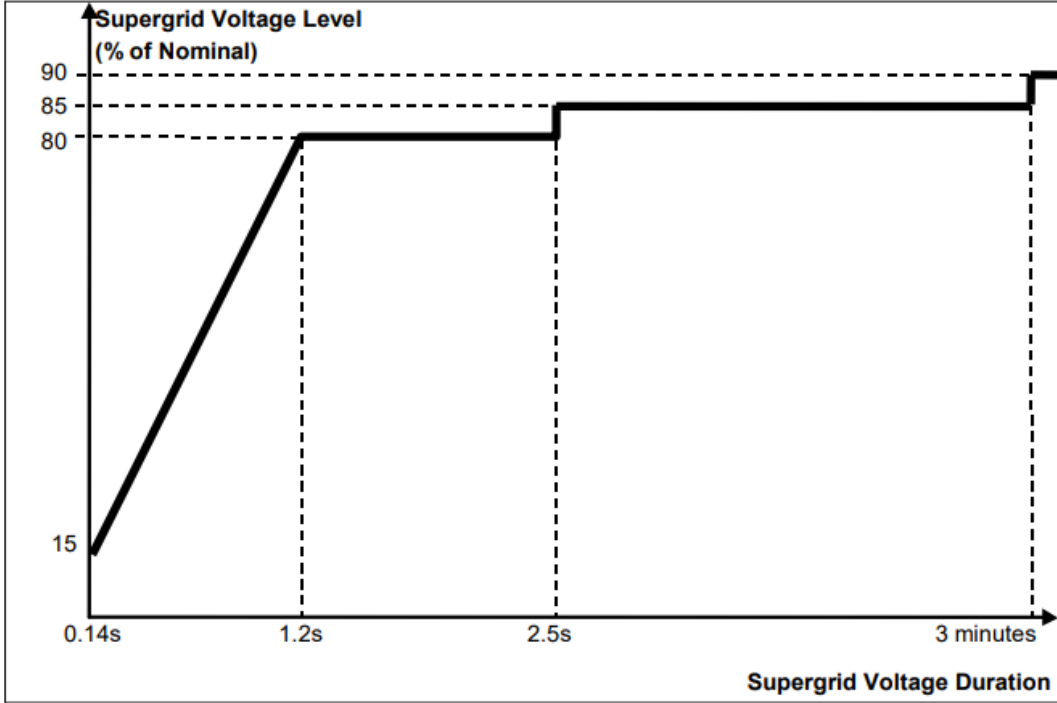
Transmission Interface Site:

**Other Technical Requirements**

	<b>Criteria</b>	<b>Code Ref – CATO to comply with:</b>	<b>Obligations</b>
1.	Protection of interconnecting connections at the CATO Transmission Interface Point	ECC 6.2.2.3.1 ECC.6.2.2.2.2	
2.	Circuit Breaker Fail Protection at the CATO Transmission Interface Point	ECC.6.2.2.3.2.	<u>The requirements for circuit breaker fail protection at the CATO Transmission Site including as appropriate the configuration, alarms, status indications, trip commands shall be discussed and agreed between the CATO and PTO in the detailed design phase. Such requirements shall be accordance with the applicable electrical standards as defined in A1.1.</u> .
3.	Fault Disconnection Facilities		<u>The CATO:</u> To make provision for tripping of the circuit breakers forming part of the CATO Plant and Apparatus at the CATO Interface Point by PTO's protection systems in accordance with the electrical standards defined in A1.1. RES.

	Criteria	Code Ref – CATO to comply with:	Obligations
4.	Reactive capability at the Transmission Interface Point		<u>The CATO:</u> Is required to meet the requirements of ECC.6.3.2.4 of the Grid Code as applicable to HVDC Equipment at the CATO Transmission Interface Point.
5.	Restoration		The CATO is required to put in place measures to ensure its Plant and Apparatus has a restoration capability. The CATO shall ensure restoration measures are put in place in accordance with the requirements of the STC & STCPs.
6.	Further Resilience Requirements		<u>The CATO:</u> <u>In designing their Plant and Apparatus, the CATO shall avoid introducing any common mode failure which is beyond what is permitted by the security standards or which could potentially affect the CATO's ability to meet their obligations under the STC.</u>
7.	Voltage Control Requirements at the CATO Transmission Interface Point	ECC.6.3.8.4 ECC.E7	<u>The CATO's plant and apparatus shall be capable of controlling the voltage at the CATO Transmission Interface Point as defined in ECC 6.3.8.4. The voltage control performance requirements at the CATO Transmission Interface Point are detailed in Appendix E7 of the Grid Code European Connection Conditions.:</u>  To be defined on a case by case basis.
8.	Power Oscillation Damping		To be determined on a case by case basis.
9.	Fault Ride Through, for faults up to 140 ms in duration	ECC.6.3.15	<u>The CATO:</u> To meet the applicable requirements of ECC.6.3.15. The total fault clearance time on the National Electricity Transmission System shall be agreed by the Lead Parties. The CATO:

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p>Is required to ensure that its CATO Plant and Apparatus meets the requirements of ECC.6.3.15 of the Grid Code where applicable. The maximum fault clearance time on the National Electricity Transmission System shall be taken as 140ms.</p> <p>Any additional requirements for Real and Reactive Power injection during and immediately after the fault shall be discussed and agreed between the CATO, the PTO and The Company as soon as reasonably practicable which should be at least 36 months before the Completion Date (Stage 1) unless otherwise agreed with The Company and the PTO.</p>
10.	Fault Ride Through, for faults in excess of 140 ms in duration	ECC.6.3.15	<p><u>The CATO:</u></p> <p><u>Is required to remain transiently stable and connected to the System without tripping of any Plant and Apparatus for balanced Supergrid Voltage dips and associated durations on the Onshore Transmission System (which could be at the CATO Transmission Interface Point) anywhere on or above the heavy black line shown in the figure below:</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			 <p>The graph illustrates the required Supergrid Voltage Level as a percentage of nominal voltage over time. The y-axis represents the voltage level from 15% to 90% in 5% increments. The x-axis represents the duration from 0.14s to 3 minutes. The voltage starts at 15% at 0.14s, rises linearly to 80% at 1.2s, remains constant at 80% until 2.5s, then rises to 85% and remains constant until 3 minutes, where it finally rises to 90%.</p> <p><u>The CATO has to satisfy the requirements of ECC.6.3.16 of the Grid Code for reactive current injection.</u></p> <p><u>In addition, the CATO is required to restore the Active Power Transfer capability following Supergrid Voltage dips within 1s of restoration of the voltage to 0.9pu of the nominal voltage at the CATO Interface Point to at least 90% of the pre-fault power.</u></p>



	Criteria	Code Ref – CATO to comply with:	Obligations
			<u>Once the Active Power Transfer capability has been restored to the required level, Active Power oscillations are acceptable provided the total Active Energy delivered during the period of oscillations is the same as that which would have been delivered and, if the oscillations are adequately damped.</u>
11.	Fast Fault Current Injection	ECC 6.3.16	<u>The CATO is required to fulfil the requirements of ECC 6.3.16 of the Grid Code.</u>
12.	Fast Recovery from DC Fault	ECC.6.1.17.3	<u>The CATO:-</u> <u>Shall be capable of fast recovery from transient faults within the HVDC System. The detailed requirements shall be discussed and agreed between the CATO the PTO and The Company in the detailed design phase which shall take the topology of the HVDC System into account.</u>
13.	Dynamic Performance and Interactions	ECC.6.3.17 ECC.6.1.9 ECC.6.1.10	<u>The CATO:</u>  <u>Is required to satisfy the requirements of ECC.6.1.9, ECC.6.1.10 and ECC.6.3.17 of the Grid Code.</u>  <u>Dynamic Performance Study (DPS) results are required to demonstrate that the expected steady state and dynamic performance of the CATO's Plant and Apparatus has been met.</u>  <u>To ensure its HVDC converters (including controllers) within the HVDC System do not cause negatively or lightly damped resonances or interactions on the National Electricity Transmission System, adequate damping control facilities to be installed if there is a risk of the following phenomena:</u>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p>•<u>Sub-synchronous oscillations due to interactions between the CATO's Plant and Apparatus and the National Electricity Transmission System. For clarity, sub-synchronous torsional oscillations with other CATO's Plant and Apparatus shall be included in the study.</u></p> <p>•<u>Control interaction due to interactions between the CATO's Plant and Apparatus, network and/or any plant directly or indirectly connected to the National Electricity Transmission System. For clarity, Control Interaction with the network and other CATO's Plant and Apparatus shall be studied in the sub-synchronous and super-synchronous frequency ranges where the CATO's Plant and Apparatus is identified to be responsive.</u></p> <p><u>To provide data and results to The Company in consultation with the PTO including full EMT and RMS models (models to be provided 3 years prior to connection, ideally to be included in tender documents) and an updated version of the model to be provided after commissioning. Specification for the models to be agreed with The Company and PTO of all the CATO's Plant and Apparatus to enable the following studies to be undertaken:</u></p> <p>•<u>Transient Analysis studies – electromechanical and electromagnetic.</u></p> <p>•<u>Frequency Domain studies – including eigenvalue analysis and damping torque assessments for all CATO's equipment.</u></p> <p>• _____</p> <p><u>Detailed requirements in relation to the above studies can be agreed with The Company and the PTO at a time convenient to the CATO. The results of these studies must be provided to The Company and the PTO at a date agreed by the Company and PTO.</u></p> <p><u>The CATO shall provide The Company with any relevant information required in the above assessments.</u></p> <p><u>Please note the following:</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>Power Factory RMS model(s):</u></p> <p><u>This includes model(s) and any associated set up script(s) that form part of the model delivery to The Company and should be compliant with STCP 12-1. Any set up scripts should be demonstrated as compatible with the Powerfactory network used by The Company. Also, the RMS model should not require the use of integration time steps less than 10ms due to the time to run a set of simulations on a large network with a large number of models and should not include DLL codes.</u></p> <p><u>Power Factory version:</u></p> <p><u>Model(s) to be delivered in a version of Powerfactory to be agreed with The Company. After the PF model is provided, the model validation report which compares results against simulation results of PF model and FAT results should be submitted.</u></p> <p><u>EMT Model:</u></p> <p><u>After the EMT model is provided, the equipment model validation report which compares results against simulation results of EMT model and equipment Factory Acceptance Test (FAT) results should be submitted. Specification for the model (including time step) should be agreed in advance between The Company in consultation with PTO and the CATO.</u></p> <p><u>Additional Note:</u></p> <p><u>The Company, PTO and the CATO shall endeavour to revise and update as applicable the contents of this clause up to 42 months before the Completion date, unless otherwise agreed, in accordance with the Grid Code as applicable at the time.</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>The Company</u></p> <p><u>To outline the detailed requirements and the extent of the studies to be performed, and the criteria to demonstrate compliance with, depending on the static and dynamic models of the onshore transmission network, other relevant parties and the CATO that are available 42 months before the Completion date. The results of these studies must be provided to The Company and the PTO at a date agreed by all parties.</u></p>
14.	Power Modulation, Power Oscillation Damping and Active Power Dynamic Control for the Provision of Wider Transmission System Stability	ECC.6.3.17	<p><u>The Company (in collaboration with the PTO):</u></p> <p><u>If appropriate The Company may define requirements for design of the damping control by a date agreed with The Company, the PTO and the CATO.</u></p> <p><u>The CATO:</u></p> <p><u>If required, to make provision for installation of the damping controller.</u></p> <p><u>To provide details to The Company and PTO of the proposed control, settings and time constants of this equipment in the Detailed Design Phase (CATO to provide date of data submission) to enable collaborative analysis.</u></p> <p><u>The performance of this controller shall be agreed with The Company and PTO.</u></p>
15	Changes to Control Schemes and Settings	ECC.6.2.2.6, ECC.6.2.2.7, ECC.6.2.2.8 and	<p><u>The CATO:</u></p> <p><u>Shall ensure all control schemes (including different control modes) and settings shall be agreed with The Company and PTO as required in ECC.6.2.2.6, ECC.6.2.2.7, ECC.6.2.2.8</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
		ECC.6.2.2.9.10	<u>and ECC.6.2.2.9.10. Any subsequent changes once commissioned shall not be implemented unless otherwise agreed with The Company and PTO.</u>
16.	Harmonic Performance at the CATO Transmission Interface Point	ECC.6.1.5(a)	<p><u>The PTO):</u></p> <p><u>Shall specify to the CATO by written notice, the harmonic voltage distortion or harmonic current emission limits (as appropriate), in conjunction with harmonic impedance loci and background levels by the date agreed between The Company, the PTO and the CATO. The specification of the above limits shall be prepared in accordance with procedures specified in Engineering Recommendation (ER) G5/5.</u></p> <p><u>The CATO shall comply with the limits specified by the PTO. The CATO shall undertake Harmonic voltage distortion assessments in accordance with Grid Code Conditions ECC.6.1.5(a). Any inter-harmonic component produced by the CATO's equipment shall be determined in accordance with relevant sections in ER G5/5. If the predicted level of inter-harmonic distortion is below 0.1%, no further assessment is required. If the inter-harmonic distortion is above 0.1%, the CATO shall inform the PTO and specify inter-harmonic distortion limits to the CATO. The timeframe for provision of inter-harmonic distortion limits shall be agreed between the PTO and the CATO.</u></p> <p><u>The CATO will provide The PTO with Harmonic Assessment information (as specified in STCP 12-1) and also, in accordance with ER G5/5, submit a report to confirm compliance with limits specified (including inter-harmonic distortion) by the date agreed with the PTO.</u></p>
17.	Power Quality Monitoring at the CATO Transmission Interface Point		<p><u>The CATO:</u></p> <p><u>To provide three phase voltage transducers on the CATO Plant and Apparatus of suitable accuracy and performance. These shall be appropriately sited at the CATO Transmission Interface Point to enable continuous power quality voltage monitoring to be undertaken whether or not the CATO's Plant and Apparatus is energised.</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>Examples of suitable voltage transducers are detailed in TS 3.02.05 RES “Voltage Transformers” (with particular reference to section 1.3) or, alternatively, in TS 3.02.12 RES “Voltage Dividers.”</u></p> <p><u>Also, to provide three phase current transducers of suitable accuracy and performance on the CATO Plant and Apparatus at the CATO Transmission Interface Point to enable continuous power quality current monitoring to be undertaken. The current transducers in the DC Converter feeder shall be sited such that the monitored currents include any contribution from reactive power compensation and/or harmonic mitigation equipment, if any. (A current transducer would be suitable for power quality monitoring if it is also compliant with International Standard IEC 61869-1 and IEC 61869-2). The transducers would be required to meet TS 3.02.04 RES “Current Transformers for Protection and General Use.”</u></p> <p>Shall provide the CT and VT signals from the transducers (as specified above) to a suitable termination point within the cubicle and shall in agreement with the PTO provide permanent, Class A power quality monitors as defined in IEC 61000-4-30 at the Transmission Interface Point in order so the PTO can check compliance against the specified limits and provide cubicle space, power supplies, and ancillary equipment within the Substation which satisfy the requirements detailed in TGN(E) 295.</p> <p><u>In order that the PTO:</u></p> <ul style="list-style-type: none"> <li>○ can undertake a four week period of continuous power quality voltage measurements using the above facilities immediately prior to the energisation of the CATO Plant and Apparatus feeders to establish a baseline for compliance with the Grid Code and</li> </ul>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<ul style="list-style-type: none"> <li>○ can carry out continuous power quality monitoring thereon during and after commissioning of the CATO Plant and Apparatus both with and without the connection to the transmission system.</li> </ul> <p><u>Note:- If it is unclear at the time of the population of the CATO Connection Schedule where the exact CATO Transmission Interface Point Boundary is located, there may be a need to change the above requirements depending upon the exact boundary between the PTO and the CATO. When the CATO Transmission Interface Point boundary has been defined, the PTO will define the exact requirements for Quality of Supply Monitoring which shall be agreed between the CATO in the detailed design phase.</u></p>
18.	Voltage Phase Unbalance	ECC.6.1.5(b) ECC.6.1.6	<p><u>The CATO:</u></p> <p><u>To provide Voltage Unbalance Assessment information as specified in STCP 12-1 which shall be in accordance with PC.4.4.1, PC.4.4.2, PC.4.5, PC.A.4.7 and DRC.6.1.5 Schedule 5, of the Grid Code. The HVDC System shall be designed for a negative phase sequence component of 1.5% of the National Electricity Transmission System voltage for the determination of the HVDC System performance.</u></p> <p><u>The HVDC System shall be designed for continuous operation with a Phase (Voltage) Unbalance of up to 2%, which can prevail on the transmission system.</u></p> <p><u>(Note: The Phase Unbalance is calculated from the ratio of root mean square (rms) of negative phase sequence voltage to rms of positive phase sequence voltage, based on 10-minute average values, in accordance with IEC 61000 4-30).</u></p> <p><u>PTO:</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>Required to carry out an unbalance assessment in accordance with Grid Code Conditions ECC.6.1.5(b) and ECC.6.1.6. Following the assessment, the PTO will specify to the CATO by written notice, the negative phase sequence current limits to which the CATO will comply.</u></p> <p><u>The results of this assessment shall be published as a formal statement of compliance.</u></p>
19.	Electromagnetic Transients	ECC.6.1.7(a) ECC.6.1.7(b)	<p><u>The CATO:</u></p> <p><u>To take appropriate measures to minimise the probability and severity of electromagnetic voltage transients which may occur when the CATO Plant and Apparatus (or any material subsystem) is connected to or disconnected from the National Electricity Transmission System.</u></p> <p><u>To provide the PTO with details of such measures and an assessment of the predicted probability and severity of such transients in the detailed design phase and at least 18 months prior to completion.</u></p> <p><u>The fault levels that should be used for the Electromagnetic Transient studies are described in Table 1 in the section headed 'Short Circuit Levels'.</u></p> <p>The CATO is required to follow EREC P28-Issue 2 and provide a report to show – considering time-variation of frequency – that their flicker impact is compliant with Stage 2 assessment criteria of EREC P28-Issue 2. If the Stage 2 assessment criteria cannot be satisfied, then PTO shall issue appropriate limits in accordance with Stage 3 assessment procedure within EREC P28-Issue 2.</p> <p><u>The PTO:</u></p>



	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>To provide the latest fault level information to enable the assessment detailed above.</u></p> <p><u>Note: The CATO may wish to make reference to guidance documents including, but not limited to, IEC 60071-4.</u></p> <p><u>In the event that the PTO needs to undertake transient overvoltage assessments, the CATO will be required to provide the data required under STCP 12-1 which shall be in accordance with Grid Code PC.A.6.2.1.</u></p> <p><u>In order to limit voltage change at the CATO Transmission Interface Point, (for example during energisation), the CATO shall also be required to satisfy the requirements of ECC.6.1.7(a) and ECC.6.1.7(b) of the Grid Code.</u></p> <p><u>Following the voltage fluctuation assessment, The PTO shall specify to the CATO (by written notice) the flicker limits. The CATO shall ensure that the total repetitive voltage changes (flicker) due to the operation of the CATO's DC Converter Station and any associated equipment, when aggregated with existing flicker levels, do not exceed these values.</u></p>
20.	Short circuit levels at the CATO Transmission Interface Point		<p><u>The CATO:</u></p> <p>The Converter Station must continue to operate satisfactorily and keep fundamental frequency over-voltages to within the limit specified under 'System Voltage Variations at the CATO Transmission Interface Point,' using minimum fault levels as described in the Table 1 below:</p>

	Criteria	Code Ref – CATO to comply with:	Obligations			
			SQSS Condition	3-phase Sub- Transient (kA)	1-phase sub-transient (kA)	<b>Purpose</b> (It is recommended the relevant fault levels are used for the following purposes)

	Criteria	Code Ref – CATO to comply with:	Obligations			
			Minimum fault level	XXXX	XXXX	1- Protection settings with additional appropriate safety margins. 2- Electromagnetic transient study in relation to ECC.6.1.7(a) and (b) and TOV (TGN 288). (E&W only) 3- Any study in relation to unbalance.
			Post fault minimum fault level	XXXX	XXXX	1- Fault ride through 2- Transient active and reactive power exchange studies 3- For SSTI and control interaction studies the part of network around the point-of-interest is usually modelled. Post fault minimum fault level, which represent a N-1-D condition on a summer minimum scenario should be included in the study cases.
<p><u>Table 1</u></p> <p>Please note that the values in Table 1 are indicative of the predicted landscape at the time of the offer. As the connection date approaches and the surrounding landscape becomes more clearly established, more accurate values will be provided on request as defined in PC.A.8 of the Grid Code.</p> <p><u>The CATO:</u></p>						

	Criteria	Code Ref – CATO to comply with:	Obligations
			Must continue to operate satisfactorily and keep fundamental frequency over-voltages to within the limit specified under 'System Voltage Variations at the CATO Transmission Interface Point,' for the extreme minimum short circuit <b>(Steady State)</b> level of [XXXX] kA at the [XXXX]kV busbar.
21	AC System Voltage Variations	ECC.6.1.4	<u>In addition to withstanding the requirements of ECC.6.1.4 of the Grid Code, the CATO's Plant and Apparatus shall be capable of withstanding typical fundamental frequency temporary overvoltages that may occur on the National Electricity Transmission System including at the CATO Transmission Interface Point.</u>
22	Modelling		<u>The CATO is required to supply models and data in accordance with the data exchange mechanism in accordance with STCP 12-1. Any additional requirements for modelling shall defined in the detailed design phase.</u>
23.	Injected/Induced Interference Mitigation		<u>The CATO's HVDC Converter shall not on the AC side generate interference, in the frequency band 70-700kHz, higher than –35dBm as measured at the CATO Transmission Interface Point.</u>
24.	Overall CATO Plant and apparatus protection and control facilities		<p><u>The CATO:</u></p> <p><u>To ensure that no harmful interactions exist between the CATO Plant and Apparatus and the National Electricity Transmission System which may adversely affect either the CATO Plant and Apparatus protection systems or the National Electricity Transmission protection systems. The CATO shall ensure that its CATO Plant and Apparatus control systems shall be stable in all situations and be self-protected.</u></p> <p><u>Where applicable, the CATO Plant and Apparatus control systems shall co-ordinate with the Dynamic VAr Compensation Equipment for the purpose of Reactive Compensation and/or Voltage control. The CATO shall declare the control strategy which shall be discussed and agreed with The Company and PTO as soon as reasonably practicable. In any event this shall be no later than 18 months before the Completion Date unless otherwise agreed with The Company and the PTO.</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<u>In satisfying these requirements, the CATO should be aware of and comply with the applicable sections of TS 3.24.90 RES (Protection and Control for HVDC Systems) or equivalent.</u>
25.	Operational Telephony	STCP 04-5	<u>The CATO:</u> To fulfil the obligations defined in STCP 04-5.
26.	Operational metering	STCP 04-3	<u>Is required to be installed in accordance with the STC and STCPs, including but not limited to STCP 04-3.</u>
27.	Critical Tools & Facilities	ECC.7.10 ECC 7.11	<u>The CATO:</u> As required under Grid Code 7.10 is required to have critical tools and facilities. In addition, the CATO will also be required to comply with ECC 7.11
28.	Real Time Data Transfer	STCP 04-3	<u>The CATO:</u> Is required to supply real time data as specified in STCP 04-3.
29.	Dynamic System Monitoring	ECC.6.6.1	<p><u>The CATO:</u> <u>Shall provide Dynamic System Monitoring and fault recording facilities on its CATO Plant and Apparatus at the CATO Transmission Interface Point to monitor system dynamic performance and fault recording (ECC.6.6) and provide communication facilities allowing remote access of data to the PTO and The Company.</u></p> <p><u>The Dynamic System Monitoring and Fault Recording requirements are contained in Schedule 3 of this Appendix. In England and Wales these requirements shall be in accordance with TS 3.24.70 RES (Dynamic System Monitoring (DSM) and TS 3.24.71 RES (Fault Recording). In Scotland the requirements shall be in accordance with those specified by the PTO.</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			<p><u>The CATO Plant and Apparatus shall supply the signals generated by the Dynamic System Monitors and Fault Recorders to the Transmission Interface Point at [XXXX]kV Onshore Substation.</u></p> <p><u>The interfacing and connection arrangements for the Dynamic System Monitoring signals at the CATO Transmission Interface Point at [XXXX]kV Substation shall be agreed with the PTO and The Company as soon as reasonably practicable.</u></p> <p><u>There may be a need to change the above requirements depending upon the exact boundary between the Onshore Transmission Licensee and the CATO. When the CATO Interface Point boundary has been defined, The Company and PTO will define the exact requirements for the Dynamic System Monitoring which shall be agreed between the CATO, the PTO and The Company in the detailed design phase.</u></p> <p><u>In the event that the CATO dynamic system monitoring equipment fails then the CATO will be required to repair the fault within 5 working days of notification of the fault unless otherwise agreed. The CATO shall advise the PTO and The Company of the nature of the fault, its expected repair time and the time at which it is expected to be returned to service. The Company and/or PTO will advise the CATO of any such measures that may be required to manage the situation when the Dynamic System Monitoring equipment is out of service.</u></p> <p><u>To be installed on a case by case basis, as agreed by the Lead Parties.</u></p>
30.	Safety and Operational Interlocking at the CATO		<p><u>The CATO:</u></p>

	Criteria	Code Ref – CATO to comply with:	Obligations
	Transmission Interface Point		Shall provide electrical and mechanical interlocking on the <b>CATO Plant and Apparatus</b> located within the zone covered by the PTO's substation busbar protection at the CATO Transmission Interface Site in accordance with the Electrical Standards.
31.	Earthing Requirements at the CATO Transmission Interface Point		<p>All earth mats on the <u>PTO's</u> site(s) and the PTO's site(s) where these are adjacent may be bonded together. The PTO's site earth mats can be bonded to the CATO's site earth mat.</p> <p><u>The CATO:</u></p> <p>Shall carry out an earthing survey of its sites prior to construction of the <b>CATO's Plant and Apparatus</b>. The earthing system is designed to withstand a short circuit current of 63kA for 1 second at 400kV.</p> <p>The CATO shall also ensure that it's Plant and Apparatus is designed and installed such that the rise of earth potential (ROEP) at &lt;insert location&gt; conforms to the touch, step and transfer voltage limits which are defined in ENA TS 41 – 24. Where intertripping (second main protection) is required to open circuit breakers, the overall fault clearance time shall not be more than 140ms.</p> <p>The CATO's earthing system design review shall take the PTO's earthing system design into account and the CATO shall collaborate with the PTO to ensure that compliance has been demonstrated at the CATO Transmission Interface Point and mitigation of 3rd party impact is considered.</p> <p>It should also be noted that the earthing system at &lt;insert location&gt; shall be designed to comply with ESQCR 2002 and BS EN50522.</p>

	Criteria	Code Ref – CATO to comply with:	Obligations
			In the case of a CATO Transmission Interface Point in Scotland, any necessary data or characteristics as requested by the PTO of the CATO Plant and Apparatus shall be provided to allow assessment of the risks arising from the transfer of potentials and/or currents from the CATO's Plant and Apparatus earthing system to the PTO's earthing system (either steady state or transient).
32.	Direct Current Injection into the PTO's Earthing System and Corrosion		<p>The CATO:</p> <p>To design the earthing of the CATO HVDC Converter in such a way as to avoid DC stray current flowing through the earthing system during normal operation and to minimise earth current during faulty or unbalanced load conditions. In order to minimise corrosion issues, the requirements for HVDC earthing is specified under BS EN 50162, BS EN 12954 and regarding safe touch voltage threshold for the DC current path, it is defined in IEC/TS 60479-1 which is referenced under BS EN 50522.</p> <p>The entire HVDC system design shall consider the possible maximum level of DC stray currents to which buried or immersed metal structures may be exposed even at a substation distance from the terminal earths of the CATO's DC Converter.</p>
33.	CATO Plant and Apparatus Compliance Process	STCP 19-7	<p><u>The CATO:</u></p> <p>Shall demonstrate compliance with STCP 19-7</p>



### Site Specific Technical Conditions – Harmonic Performance (ECC.6.1.5(a))

**Table 1: Incremental Voltage Emission Limit**[illegible]

2.3 The CATO shall ensure that its Plant and Apparatus, at the CATO Interface Point was designed and constructed such that the total harmonic voltage distortion at the CATO Interface Point conform to the limits specified in Table 2.

2.4 Table 2 also provides the levels of background harmonic voltage distortion at the CATO Interface Point prior to the connection of the CATO Plant and Apparatus.

2.5 The limits specified in Table 1 and Table 2 shall apply for all possible conditions of the CATO Plant and Apparatus. They shall apply for all possible conditions of the Network System (which includes the Transmission Network and relevant Distribution or EU Code User's networks) whose system impedance envelopes at the CATO Interface Point up to 5 kHz (100th harmonic) and will be specified by The Company to the CATO, unless otherwise agreed.

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Harmonic Order 'h'	Background Voltage Distortion at the CATO Interface Point prior to the connection of the CATO Plant and Apparatus and associated Offshore Generation (% of fundamental)	Total Harmonic Voltage Emission Limits (% of fundamental)

- 2.6 The **CATO Plant and Apparatus** conforms to the Total Harmonic Distortion (THD) level, at the CATO Transmission Interface Point as calculated in accordance with Engineering Recommendation G5/5 and IEC 61000-4-30, given in Table 5 below.

**3 Table 5: Total Harmonic Distortion Limits**

Frequency Range	THD
≥100Hz	TBC

#### **4 Voltage Flicker Limits**

- 4.1 The CATO shall ensure its Plant and Apparatus is designed and constructed to comply with the voltage flicker limits at the Transmission Interface Point.

The CATO is required to follow EREC P28-Issue 2 and provide a report to show – considering time-variation of frequency – that their flicker impact is compliant with Stage 2 assessment criteria of EREC P28-Issue 2. If the Stage 2 assessment criteria cannot be satisfied, then PTO shall issue appropriate limits in accordance with Stage 3 assessment procedure within EREC P28-Issue 2.

**Schedule 3.5 – Appendix 2**

Site Specific Technical Conditions - Communications Plant (ECC.6.5))

Description	Location	Source	Provided By	Comments
Operational Telephony	CATO Plant and Apparatus Control Centre	The Transmission Substation Exchange or as agreed with The Company	PTO provided and installed cross site wiring at the CATO Plant and Apparatus Control Centre	Control Telephony provides secure point to point telephony for routine Control calls, priority Control calls and emergency Control Calls.  The CATO's control point must be immediately and directly contactable by The Company at all times and operators should be able to communicate in clear plain English.
PSTN (or other off-site communications circuits) for Telephony (ECC.6.5.2 to ECC.6.5.5)	CATO Plant and Apparatus Control Centre	Public Telecommunications Operator (PTO)	Data and speech services required by The Company and the PTO was cabled from the CATO Control Centre to the Public Telecommunications Exchange. The CATO provided their own off site wiring and communications paths.	

**Schedule 3.5 – Appendix 2****Appendix F5 - Schedule 3**

Site Specific Technical Conditions – Dynamic System Monitoring and Fault Recording. (STCP 27-1)

The CATO is required to provide the dynamic system monitoring facilities on the CATO's circuits and provide communication facilities allowing remote access of data to The Company

Description	Type	Provided by	Notes
3 phase voltage and current at [XXXX]kV substation.	AC Waveforms	The CATO	The functionality, performance, availability, accuracy, dependability, security, configuration, delivery point, protocol and repair times of the equipment generating and supplying the signals (i.e. the inputs, monitors and communication links) shall be agreed with The Company at least 12 months before the Completion Date.
Dynamic System Monitoring and remote communications and interfacing on The CATO's circuits at the PTO's [XXXX]kV substation.	Monitors	The CATO	Connection to enable data to be retrieved from Dynamic System Monitoring equipment. Connection to the PTO with connection, monitoring and security arrangements to be agreed with The Company/the PTO at least 12 months before the Completion Date.
	Communications Channels	The CATO to provide signals and interface at [XXXX]kV substation.	

In the event that any part of the CATO's equipment fails to deliver the information required at [XXXX]kV substation (including the communications routes) then the CATO shall be required to repair the equipment within 5 working days of notification of the fault from The Company unless otherwise agreed. The CATO shall also provide facilities to allow The Company to monitor the health of the Dynamic System Monitoring equipment up to the CATO Transmission Interface Point.

Note:- The specification and performance requirements for Dynamic System Monitoring is detailed in Technical Specification TS 3.24.70-RES (Dynamic System Monitoring (DSM)).





**Appendix A2 : CATO-TO Connection Deliverables Timetable**

Item/process/Agreements	STC/STCP Reference	Drafting Responsibility	First Draft Due by	Final To be Agreed By	To be Agreed By
Transmission interface Agreement	STC Section D, Part Three	Relevant TO	[Date to be agreed 6 months prior to Energisation of TO Assets]	[Date to be agreed prior to Energisation of TO Assets]	Lead Parties
CATO Transmission Interface Site Specification	STC Section D, Part Three	Relevant TO	[Date to be agreed 6 months prior to Energisation of TO Assets]	[Date to be agreed prior to Energisation of TO Assets]	Lead Parties
Completion Report	STCP 18-5 Appendix **	Relevant TO	[Date to be agreed 6 months prior to Energisation of TO Assets]	[Date to be agreed prior to Energisation of TO Assets]	Lead Parties
Provision of Asset Operational Information	STCP04-4	Existing Procedure to be followed			Lead Parties
Communication Arrangements	STCP04-6	Existing Procedure to be followed			Lead Parties
Safety Coordination	STCP09-1	Existing Procedure to be followed			Lead Parties
Outage Planning Information	STCP12-2	Existing Procedure to be followed			Lead Parties
Connection Process	STCP18-5	Existing Procedure to be followed			Lead Parties
Construction Programme	STCP19-7	Existing Procedure to be followed			Lead Parties
Operational Notification Process	STCP19-7	Existing Procedure to be followed			Lead Parties
Commissioning Process	STCP19-4	Existing Procedure to be followed			Lead Parties
Production of Models for NETS Planning	STCP22-1	Existing Procedure to be followed			Lead Parties

GIDFS	STCP 19-7 Appendix **	Existing Procedure to be followed			Lead Parties
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The above Party Entry Process Timetable has been agreed by:

Party:	.....STC Committee Representative .....	Date:.....
Party:	..... STC Committee Representative .....	Date:.....
Party:	..... STC Committee Representative .....	Date: .....

**APPENDIX A3****CATO-TO CONSTRUCTION PROGRAMME**

CATO: \*\*\*\*\*

Connection Site: \*\*\*\*\* Substation

The Construction Programme comprises the following:

<b>CATO Requirements</b>		
1	The date by which the CATO expects to apply for Planning consent	
2	Financial Investment Decision is achieved by the CATO	
3	CATO to confirm to PTO the design of the CATO's substation bays	
4	Data exchange as outlined in the STCP 12-1	
5	The date by when final diagrams are exchanged and agreed between The PTO and CATO	
6	The date by which all CATO's Works are to be completed by	

**Pre-Construction**

<b>Optioneering</b>		
1	The date by which the PTO should review the relevant reinforcement works to deliver a compliant CATO Transmission Interface	
<b>Detailed Engineering</b>		
2	PTO and the CATO jointly carry out site investigations to confirm ground condition to inform tender specifications at CATO Transmission Interface Site by	

**Construction**

<b>Tendering</b>		
1	The latest date by which the PTO will commence the tender process for the transmission reinforcement works at the CATO Transmission Interface Site.	
<b>Contract Award</b>		
2	The latest date by which the PTO will award contracts for the transmission reinforcement works at the CATO Transmission Interface Site.	

<b>Equipment Order</b>		
3	The latest date by which the PTO will place orders for equipment for the transmission reinforcement works at the CATO Transmission Interface Site.	

<b>Construction / Commissioning</b>		
4	The date by which the detailed requirements in relation to the communications links, trip facilities and monitoring facilities have been discussed and agreed between the CATO and PTO	
5	The date by which the detailed requirements in relation to the metering equipment (the meters and communication links) have been discussed and agreed between the CATO and the PTO as defined in the Appendix A STCP 18-5.	
6	First energisation Available from CATO Transmission Interface Site to CATO	
7	The date by which One Off works are to be completed	
8	Completion Date- as agreed in Schedule X	
9	The date by which the PTO Transmission Reinforcement Works are to be completed	

**Notes:**

1. The Construction Programme is based upon the assumption that both parties agree outages.
2. These dates may be amended by agreement of both parties.
3. Changes to the Completion Date must be reported to The Authority and approved.

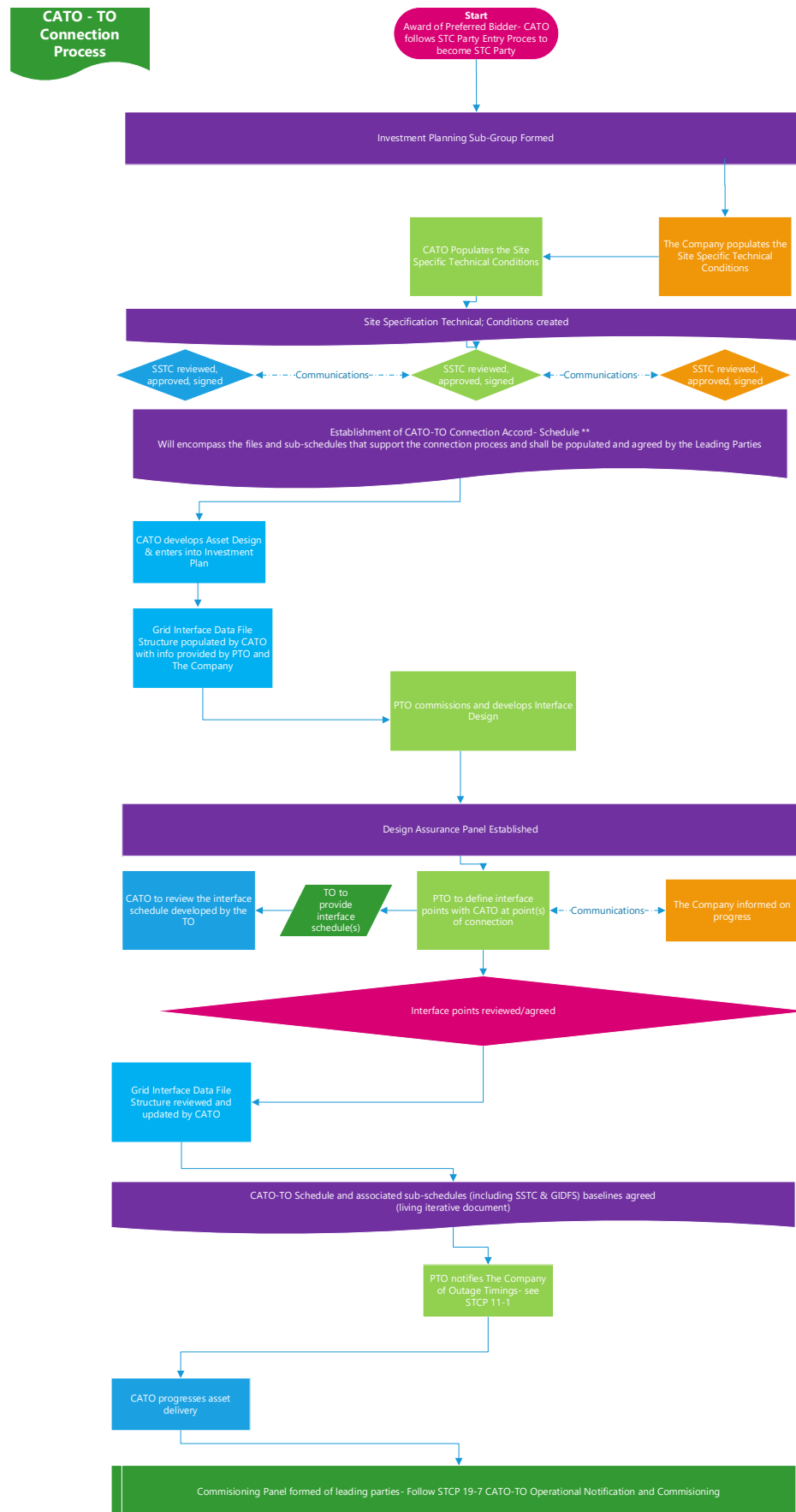
## **APPENDIX A4**

### **MATTERS FOR COMPLETION REPORT**

[List matters to be included which shall contain]

- Confirmation of Compliance Statement; 19-7
- type test results\reports;
- confirmation that the signed Transmission Interface Agreement is in place;
- confirmation that the signed Transmission Interface Site Specification is in place
- confirmation that Safety Rules have been exchanged;
- confirmation that the Site Responsibility Schedule is complete and in place.
- Confirmation of Construction Program

Appendix B: CATO-TO Connections Project Process



## Appendix C- Early Competition Asset Delivery Indicative Timescales.

[illegible]