

**Construction
Design Handbook**

**Guidance on Grid Code Compliance Process for
Design Assurance Engineers
&
Relay Settings Engineers**

DH 12

Issue 1

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GUIDANCE ON GRID CODE COMPLIANCE PROCESS FOR DESIGN ASSURANCE ENGINEERS & SETTINGS ENGINEERS

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1 PURPOSE

The purpose of this Design Handbook is to provide guidance to the Design Assurance Engineer, Settings Engineer and Commissioning Officer in relation their respective roles pertaining to TP130 New Connections Operational Approval.

Responsibilities are defined as follows

TP130 Section 2.2.3 UK Construction – Technical Assurance (Design Assurance Engineer and Settings Engineer)

Key areas include IP2, IP3 and Detailed Design and Delivery with specific focus on clauses contained in the Grid Code, Generator to System protection settings coordination, fulfilment of the requirements of the Technical Appendices contained in the Bilateral agreement. Consideration to any Unlicensed elements of work.

This document does not cover issues associated with DNO connections.

2 REFERENCES

UKBP/TP130	New Connections Operational Approval
UKBP/TP188	Design Management
UKBP/TP106	Equipment Commissioning and De-commissioning
Grid Code	The Grid Code (GC) contains the Connection Conditions (CC)
STC and STCPs	System Operator Transmission Owner Code (STC) and STC Procedures (STCPs)
RES	Relevant Electrical Specifications (see Grid Code)

The GC, CC, STC, STCPs and RES are available from
<http://www.nationalgrid.com/uk/Electricity/Codes>

3 OPERATIONAL NOTIFICATION PROCESS

The UKBP/TP130 New Connections Operational Approval defines the responsibilities of the various business units within National Grid.

The process exists to ensure that the User submits all relevant data (commercial and technical) that is required by the Grid Code and Connection Agreement, and that this data is reviewed and validated by National Grid to ensure compliance with the governance processes.

Where non-conformances are identified, the User and National Grid will work together to eliminate any non conformances.

Where non conformances cannot be rectified mutually, a formal process is then carried out to obtain derogations. Derogations are submitted to OFGEM and this is usually a last resort.

National Grid and the User will meet regularly at Operational Notification Panel Meetings from the signing of the Connection Agreement through to final commissioning to ensure that all requirements relating to the connection project are dealt with.

The process also ensures that National Grid satisfy the requirements as the Transmission Network Operator.

The process is chaired by Commercial – Electricity Customer Team as set out in Section 2.2 of TP130.

3.1 Connection Types

In essence there are two main connection types related to generation.

The conventional onshore connection is applicable to conventional generating stations (Coal, Gas, Hydro) and onshore wind farms.

The offshore connection is applicable mainly to large scale offshore windfarms.

Other connections types related to interconnectors and onshore and offshore HVDC links also exist.

This Design Handbook has used the connection of a conventional generator to illustrate the Operational Notification process. By so doing, the protection arrangements not usually encountered on a regular basis by Design Assurance Engineers have been captured. However, the Operational Notification process also applies to other forms of connection and at the present time wind farms are becoming by far the most common.

The TP130 process outlined above will apply equally to windfarm connections.

For offshore installations, and in accordance with National Grid's role as System Operator for the offshore transmission networks, two sets of technical appendices will be prepared.

The Technical Appendices pertaining to the User at the Offshore Grid Entry Point (ie where the Offshore Generator connects to the Offshore Platform) are defined in the Technical Appendix 'F' of the Connection Agreement.

The Technical Appendices pertaining to the OFTO at the Interface Point (ie where the OFTO connects to the Onshore TO or Onshore DNO System) are defined in Technical Appendix 'OF' of the Connection Agreement.

These technical appendices demand conformance with the various STCPs applicable to such networks.

It is worth noting that some elements of the STCPs carry more stringent requirements than those of the equivalent TS for the National Electricity Transmission System

The ownership boundaries, both Offshore and Onshore should be agreed at the Connection Offer stage and will be some time ahead of OFTO appointment.

The protection arrangements at the 'OF' Interface Point are generally familiar feeder or transformer arrangements applicable at EHV and 132kV with the addition of dynamic system monitoring, quality of supply and scada provisions as demanded by the technical appendices.

Those at the Offshore Grid Entry Point align with typical DNO HV (66kV, 33kV) protection arrangements.

3.2 Unlicensed Works

With reference to Unlicensed Works, irrespective of the User's build arrangement choices further discussed below, the requirements of TP130 apply.

Additionally, the User may opt for National Grid to build the User's assets i.e undertake the Unlicensed Works.

It must be noted that the Design Assurance element is optional work within the unlicensed package.

If the Users choose this option, it is important to recognise that the User, in making this choice, is requesting National Grid to deliver the User's assets (typically at the connection boundary) using the same checks and balances that National Grid would employ in delivering its own assets.

As such, it is important that the project design and delivery team adhere to the processes defined in TP188, and either jointly (as part of the licensed build process) or separately, carry out Design Verification and Design Assurance roles on the unlicensed works and request engagement from and provide feedback to the User.

The User must have full visibility and engagement under these circumstances. This forms a key area of the User's relationship with National Grid.

All technical and project related communications relevant to unlicensed works must be conducted with the knowledge and approval of the Bid Team Manager or Unlicensed Proposals Manager and the Unlicensed Works Project Manager.

3.3 Applicable Standards

In relation to the Unlicensed Works and applicable standards, The Grid Code under CC.6.2.1.2 states that a Standard shall be applied. The Bilateral Agreement states which Standards apply. In all cases the Bilateral Agreement will specify the User shall meet the Requirements of the Relevant Electrical Standards (RES) as referenced under the Grid Code General Conditions – available at:-

http://www.nationalgrid.com/NR/rdonlyres/EDA159FE-E9C9-4686-A16C-3B0390A08432/5528/RES_FinalIssue1090106.pdf

When undertaking an assurance role for unlicensed work, it is important to understand the boundaries of where National Grid Type Registration requirements and the Relevant Electrical Standards in respect of the User's Equipment apply.

It must be noting that the RES does not extend down to 33kV and lower voltages. The Design Engineer must be aware of this when dealing with such equipment.

3.3.1 Standards for Primary Equipment

Examples of how the standards are applied on AIS and GIS systems are given in diagrammatical form in Appendix 1

These diagrams are based on common experiences to date.

However, it must be noted that The Grid Code Review Panel (which is an industry wide panel) is reviewing this area. Hence changes occur may occur in the future. It is advised to confirm the specific arrangements for a User Connection with the National Grid Commercial Electricity Customer Team.

3.3.2 Standards for Secondary Equipment

For User bays which interface to the National Grid system, there is no specific requirement that the User's Protection equipment is Type Registered to National Grid's Technical Specifications.

In this circumstance their equipment must be compliant with the RES.

If existing National Grid common systems are being extended as part of the User's works, then these items must be to National Grid Technical Specifications as this equipment will be owned and operated by National Grid.

For the avoidance of doubt it must be noted that, the Design Responsibility Boundaries are not CDM demarcation boundaries.

4 RESPONSIBILITIES

4.1 Design Assurance Engineer

The following section discusses the roles and responsibilities of the Design Assurance Engineer with regards to the User Connection and the Grid Code Compliance Process. Hence this section must be read as supplemental to the role already carried out Design Assurance Engineers on Licensed Works.

In this regard, a Design Assurance Engineers role(s) typically will cover Lead Design, Protection and Control and Plant but might also cover Civils and Cables.

With reference to Cables and Civils, as a minimum, assurance should be carried out from a 'duty of care' perspective at the interface points.

The P&C design assurance role will typically also encompass the Commissioning Officer role, an important interface between commissioning and Operational Notification processes. The Commissioning Officer role is also referred to in TP130.

Once a Design Assurance Engineer (DA Eng) is allocated to a Connection Project it is important that the DA Eng ensures that the Licensed works associated with the connection project is able to interface with the User's works.

For this to occur, the DA Eng must carry two key parallel activities during the IP2 phase of the project where the CDS and SDS Part 1 are being developed.

These are the User to Licensed Works Interface Design and the Grid Code Compliance Process.

4.1.1 User to Licensed Works Interface Design

The DA Eng must ensure that the Investment Team Leader / Development Engineer at IP2 makes the Technical Appendices of the Generator's Connection Agreement available to the Licensed project design team to ensure that all aspects of primary and secondary equipment interfaces to the Generators systems are catered for in the IP2 design package ie. the Technical Appendices will have been produced as part of the Connection Offer; once the Offer is signed, the requirements need to be incorporated into the full IP2 documentation submission .

This is critical to do at IP2 as it paves the way for the detail to be captured in the Design Intent Document and hence the costs of the interfacing provisions to be developed in time for the IP3 submission and final green light.

Key areas of consideration across the User to National Grid Interface include

- a) Generic
 - National Grid SLD, KLD and Nomenclature
 - Operational Control, Safety Control and Ownership Boundary confirmation
- b) Plant
 - Primary Switchgear Interface Points
 - Earthing System Design and Interconnection to User's System (*refer to TP130 Section 2.2.3 d)*)
 - Mechanical Interlocking and Cross Site Key Exchange requirements
 - Plant Access and Maintenance Philosophies

For GIS build:

- Gas Zone Diagram, Gas Zone Boundaries and Gas Zone Alarm Sharing
- Partial Discharge Monitoring and Alarm Sharing
- Plant capability against specific requirements of the Technical Appendices

c) Protection & Control and Signal Exchange

- Protection Zone Overlap arrangements
- Busbar Protection Design and Equipment Distribution (*refer to TP130 Section 2.2.3 b*)
- Circuit Breaker Fail and Back tripping Interface (*refer to TP130 Section 2.2.3 c*)
- Electrical Interlocking System
- Voltage Selection Scheme

Special Automatic Facilities (Operational Tripping, Auto Close, Load Shedding etc) are in accordance with the requirements of the Technical Appendices of the Bilateral Agreement (*refer to TP130 Section 2.2.3 f*).

Provisions of Dynamic System Monitoring, Ancillary Service Monitoring, Quality of Supply Monitoring, Operational Metering and Indications, Control Telephony, Electronic Data Transfer and Electronic Despatch & Logging facilities are in accordance with the requirements of the Technical Appendices of the Bilateral Agreement.

Note that responsibilities of the User and National Grid are varied across each deliverable. Please refer to the specific Technical Appendices of the Bilateral Agreement of the individual connection scheme.

Control System Boundaries and Alarm sharing.

Cross boundary secondary system interfacing philosophy.

Cross Boundary signal transfer mechanisms. Note that in some instances it may not be possible to achieve hardwired signal exchange due to the distances involved.

d) Telecomms

- Services required from National Grid to User.
- New equipment requirements and their accommodation requirements.

e) Civil

- Foundation Design Principles.
- Primary Plant Layout (Construction may be multi staged).
- Building Design.
- Access requirements.

f) HV Cable

- Cable Route Layouts – Interaction between National Grid circuits and User circuits, thermal ratings impact, crossings (roads, existing fences, and power cables)
- Route proximity to existing assets (tower base clearances etc)
- Cable system design – impacts on existing civil works (undermining proximity, up thrust forces etc)

The items listed above are an aide memoir and are not exhaustive. Each generator connection project will have its own interface issues that will need specific attention from very early on in the project.

4.1.2 User's Design and Associated Grid Code Compliance Process

The Lead DA Eng must commence dialog with the lead National Grid Commercial representative from the Electricity Customer Team to ensure that Design Assurance are involved in the Grid Code Compliance process from an early stage.

Typically this will involve attendance to the Operational Notification Panel meetings to ensure that protection and control aspects of the Grid Code and the specific requirements of the Technical Appendices are being dealt with.

This involvement will continue through the life of the project.

Due to the commercial nature of these activities it is important to note that any dialog with the User must be carried out with the prior knowledge and approval of the responsible commercial manager.

Note this process commences typically at IP2 but interaction on Grid Code Compliance with the User continues throughout the life of the project.

Typically the Licensed build will be ahead of the User build works. It is essential that the License build works interface design is made available to the User to enable their design to develop in cognisance of the Licensed works.

In addition, with reference to Grid Code Compliance the following areas need to be discussed and confirmed with the User.

a) Generic

- User SLD, KLD and Nomenclature
- Operational Control, Safety Control and Ownership Boundary confirmation
- User Interlocking design and interfacing at the interconnection point.
- Site Common Drawings

b) Plant

- Ensure plant capability against specific requirements of the Technical Appendices of the Bilateral Agreement.
- Confirm that the Primary Earthing design is compliant with the Technical Appendices of the Bilateral Agreement (*refer to TP130 Section 2.2.3 d*)
- Confirm Type Registered or conformance with applicable RES is achieved. (*refer to TP130 Section 2.2.3 e*)

c) Protection and Control