



THE GRID CODE OC7.5

INTEGRAL EQUIPMENT TESTS

GUIDANCE NOTES

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The Grid Code OC7.5

INTEGRAL EQUIPMENT TESTS GUIDANCE NOTES

1 INTRODUCTION

These Guidance Notes are those referenced in the **Grid Code OC7.5.3**. Words in bold are defined in the **Grid Code**. The document has been updated to reflect the extended role of National Grid (NG) as **GB System Operator**

They support and supplement, but do not replace, the requirements of the **Grid Code** to ensure that information relating to an **Integral Equipment Test (IET)** is communicated between **Users** and **NG** and to enable **NG** and **Users** adequately to consider the effects of testing.

1.1 Objective

The objective of these Guidance Notes is to provide **Users** with details of suggested procedures, information flows and responsibilities to enable the **Grid Code** provisions to be met. By this, the successful management and implementation of tests such as an **IET** can take place with a minimum effect on other systems.

1.2 What is an IET ?

Any test on equipment, associated with **Plant** and/or **Apparatus** which takes place when the **Plant** or **Apparatus** forms part of a synchronised system and which, in the reasonable judgement of the person wishing to perform the test, may cause an **Operational Effect**.

The **Operational Effects**, which can occur during testing, are primarily MW and/or MVA changes, which may affect system frequency and/or voltage and have consequent effect on other **Users**.

Examples of the type of equipment testing to which these Guidance Notes may apply are given in Appendix A.

It is the responsibility of the **User** wishing to perform a test to consider whether a particular test should be notified as an **IET**. Where there is any doubt, the **User** in the first instance should discuss any proposed testing via the communication and liaison routes described in section 2.

An **IET** will normally be notified as part of the **Operational Planning** process and may at times form part of a formal commissioning or re-commissioning programme.

1.3 The need to notify

An **IET** should not have an adverse effect on the **GB Transmission System** or **User** systems connected to it provided that they are correctly co-ordinated between all interested parties, are correctly managed and that no unforeseen incidents occur during implementation. In order for this to happen it is necessary for **Users**, **NG** and **Transmission Owners** to be able to assess the effects of tests on otherwise normal operation.

Without the proper management and control of these tests there is the possibility that other **Users** of the **GB Transmission System** will be affected by them. In some cases this could give rise to frequency control problems, voltage control and stability problems, generator instability or even system instability.

Typical examples of where inadequate co-ordination and control may cause problems and affect others are given in Appendix B.

1.4 Notice

To allow adequate consideration to be given to the impact of testing it is advisable to provide as much advance notice of tests as possible. Initial notification a minimum of 4 weeks prior to the test date should normally allow for reasonable interchange of information regarding the content and impact of the proposed tests. Unless agreed otherwise details of the tests should be provided in writing to relevant affected parties and the response also made in writing.

At times, following plant failure, it may be necessary to undertake a test at short notice to enable a prompt return to service. The communication process and information exchange outlined in the **Grid Code** must still be followed to minimise the risk of events that could materially affect the system or **Users** of it.

The need for urgent testing as above may result in a proposal for testing being notified outside of normal working hours. In these circumstances it may be necessary to communicate directly with control or operating staff e.g the **NG** Control Room.

Whatever the urgency, notifications, programmes and changes should be communicated in sufficient time for the recipient to assess the implications. There may, otherwise, be a risk that a recipient may be unable to agree the **IET** programme.

Appendix C gives suggested timescales, which should be followed where possible.

Appendix D gives the suggested information content of an **IET** notification.

1.5 Risks

Proposers of an **IET** will need to ensure that they have considered the risks associated with testing and the impact on their equipment and systems.

Recipients will, before agreeing to an **IET**, need to consider the risks imposed on their own equipment and systems.

All reasonable measures to reduce risks should be taken by the proposer and the recipient.

Where a specific test within an **IET** programme does impose a definable and significant risk, the operational parameters that pertain for such a condition will be defined within the **IET** programme and all parties will be fully informed by the **IET** proposer prior to embarking on this particular part of the test.

2 GENERAL COMMUNICATION

An **IET** may be carried out by a **Generator, Network Operator (NO), Non-Embedded Customer (NEC), Transmission Owner (TO)** or **NG** and, dependent on the initiator and type of test, the necessary communications may differ. Appendix E indicates the requirements for liaison for the notification and implementation of tests by the above.

2.1 Generator initiated tests (Appendix E, Table 1)

Power Stations **comprising of Generating Units** can be connected directly to the **GB Transmission System** or be **Embedded** within a **Users** system. **Power Stations** are also further categorized into **Large, Medium** and **Small Power Stations** depending on their **Registered Capacity**. This potentially leads to three categories of generation, each of which may require a different information flow during an **IET**.

For **Transmission** connected **Generating Units** and **Embedded Large Power Stations** it is the responsibility of the **Generator** to liaise with **NG** and where appropriate the relevant **Network Operator**. **NG** will consult with other **NOs, TOs** or **NECs** it reasonably believes may be affected by the proposed **IET**.

The **Network Operator** will liaise with **NG** where it is aware of **Embedded Medium** or **Small Power Stations** intending to perform tests which in the reasonable judgement of the **Network Operator** may cause an **Operational Effect**.

2.2 Network Operator initiated tests (Appendix E, Table 2)

Network Operator initiated tests may affect **Transmission** connected **Generating Units** or **Embedded Power Stations**, the **GB Transmission System** and/or other **Users** equipment. Whenever there is doubt concerning the full effects of the tests, it would be prudent to consult with **NG**. **NG** will consult with the parties connected to the **GB Transmission System** whom it believes may be affected, and **Generators** in respect of the effect on **Embedded Large Power Stations**. Liaison with other parties connected to the **Network Operator** network that could be affected is not part of these Guidance Notes but a matter for the appropriate **Network Operator**.

2.3 NG or Transmission Owner initiated tests (Appendix E, Table 3)

NG or **Transmission Owner** initiated tests may affect **Transmission** connected **Generating Units** or **Embedded Power Stations**, **Network Operators**, or **Non Embedded Customers**. **NG** will be responsible for liaison with those **Users** it judges may be affected as a result of an **NG** or **Transmission Owner** initiated **IET**.

2.4 Tests initiated by Non Embedded Customers (Appendix E, Table 4)

These tests may primarily affect the **GB Transmission System** but may also affect **Transmission** connected or **Embedded Generating Units**, and **Network Operators**.

2.5 Contacts

The **NG** contacts for the planning and implementation of **IETs** are shown in Appendix C. The separate contact details provided for an **IET** proposal for Scotland and for England & Wales reflect only **NG** internal company structure arrangements. The process for progressing the **IET** being the same for Scotland as for England & Wales.

Generators and **Network Operators** should inform **NG** and other **Network Operators** or **Generators** where appropriate of their contact points for notification.

A test co-ordinator, appointed by the company initiating the test, will normally be responsible for the organisation and co-ordination of the test. Communication during the test will be between the respective operations staff.

3 PROCEDURES

3.1 The Notification of an IET

OC7.5.5 defines the basic requirements for the notification of an **IET**. In Appendix D of these Guidance Notes there is a summary of the information which could be expected from a **User** proposing an **IET**.

An **IET** may be notified :

- a) As part of a programme for **Plant** and **Apparatus** commissioning or re-commissioning.
- b) In the case of routine or repeated tests, using standard formats as agreed from time to time between **NG** and **Users**. (e.g. **DAR**, **AVR** tests).

IET notifications should where possible be in writing.

Appendix F shows a flow diagram for the general process of notification and liaison.

3.2 Response to Notification of an IET

- a) An **IET** proposal should normally be accepted when the impact on the system is minimal, not time dependent, or when times specified are precise and unlikely to be varied.
- b) An **IET** proposal may be accepted conditionally subject to minor modifications such as date or time. It may be that a condition may be placed on the proposer that certain tests may only be carried out at particular times, or that, for example, plant test conditions are achieved at a slow and predetermined rate with an analysis of system effects made during this process.
- c) If an **IET** is not agreed, NG should normally be able to suggest amendments which would make the **IET** acceptable. For example it may be that the tests as proposed would result in unacceptable system conditions, but that modifications in terms of times, parameters or test order may make the tests acceptable.

Where the **IET** proposal is acceptable and a programme agreed, the **IET** must then be carried out in accordance with the agreed programme.

3.3 Changes to Test Programme

Once agreed a test programme may only be changed in the following circumstances:

- a) For minor changes such as exact test sequence which can be agreed upon without the need for further test assessment.
- b) When the agreed **IET** operating envelope is likely to be exceeded, a revised **IET** operating envelope should be identified and agreed with **NG**. Depending on the exact circumstances and type of test, adequate time should be allowed for the affected party to assess the impact upon their, or a **Users** system before agreement to revised testing may be possible. Testing may need to be suspended pending agreement to the changes.
- c) When an identifiable risk area is reached during a test programme, for example a dynamic test of the generator under-excitation limit, the test engineer or Control Engineer should inform the recipient of the **IET**.

3.4 Carrying out the IET

Final confirmation from the **User** that the **IET** is still planned to happen will normally be given a day before the planned test date. This provides the opportunity to discuss the final details of the **IET**, including limitations and descriptions of operation of Plant and Apparatus.

However, the **IET** should not commence before normal operational liaison has taken place and final agreement is reached between the appropriate control room staff in receipt of the agreed test programme.

Prior to reaching identifiable risk areas of the test, operating staff should inform the recipient of the **IET**.

3.5 IET forming part of an agreed commissioning programme

An **IET** may form part of an overall testing or commissioning programme where so agreed between **NG** and a **User**. In such cases, a separate **IET** notification is not necessary.

In circumstances where a commissioning programme runs over several weeks or months, or where there are delays to that programme, it is particularly important that the liaison process recurs prior to the eventual implementation of an **IET**.

4 APPENDICES

The following Appendices provide a ready reference to the following :

- Appendix A Examples of IETs
- Appendix B Examples of Problems Arising from Inadequate Test Management and Co-ordination
- Appendix C Timescales and NG Contacts for IETs
- Appendix D IET Notification – Information format
- Appendix E Communication and Liaison
- Appendix F Flow chart for IET Notification and Liaison

EXAMPLES OF IETs

1. **Voltage Control Scheme including Automatic Voltage Regulator (AVR) commissioning / testing**
2. **Power System Stabiliser (PSS) commissioning / testing**
3. **Under Excitation Limiter (UEL) commissioning / testing**
4. **Over Excitation Limiter (OEL) commissioning / testing**
5. **Governor/ Frequency and Load Control systems commissioning / testing**
6. **Transformer Tap Changer commissioning / testing**
7. **Overhead Line Delayed Auto-Reclose (DAR) commissioning / testing**

OTHER TESTS NOTIFIED USING IET PROCEDURES

8. **Unit / Module Load Rejection**
9. **Reactive Capability Tests**

The tests listed above are the types of test which require notification as IETs.

In general **Users** intending to perform a test associated with **Plant** and /or **Apparatus** forming part of a synchronised system need to consider whether a particular test should be notified as an **IET**.

Appendix B

Examples of Problems Arising from Inadequate Test Management and Co-ordination

VAR limiter tests on Generating Units

Particular problems can occur with dynamic testing of excitation limiters with the generator operating with low excitation voltage. If correctly coordinated and carried out, the Generating Unit stability and local voltage control can be properly assessed against system conditions to determine an allowable test operating envelope. If not adequately co-ordinated, at best severe voltage changes may occur, and at worst Generating Unit instability could lead to a system wide disturbance.

DAR testing by a Network Operator

Generation embedded within a Network Operators system may be affected by high numbers of reclosing operations which can take place during this type of testing. If correctly carried out these can be minimised and system conditions co-ordinated so that local Generating Unit operating conditions are at their most favourable. If incorrectly co-ordinated, local Generating Units may experience mechanical shock and possible actual Generating Unit damage may result.

Tap changer testing by NG or Transmission Owner

Problems may occur if excessive voltage variation takes place on the low voltage side of the transformer. If correctly carried out the voltage variation can be minimised by the choice of an appropriate demand and low-voltage network configuration. If incorrectly coordinated significant voltage variations could occur leading to excessive tap changer operations at other voltage levels.

Appendix C

TIMESCALES AND NG CONTACTS FOR IETS

Timescales	Actions	NG Contacts
4 weeks to several days ahead	This period is used to assess the implications of a test, organise resource for possible attendance, notify and seek comment from other Users if appropriate, and agree/disagree to the test in principle.	<u>IET in England & Wales</u> Delivery team (Head – David Reeves) National Grid Control Centre Wokingham Tel: 0118 936 3492 Fax: 0118 936 3266 e-mail : TRANREQ@uk.ngrid.com
Day ahead normal office days and working hours	This should be used to confirm the planned test is progressing at a certain time of day, and at a specific operating point.	<u>IET in Scotland</u> Delivery team (Head – Audrey Ramsay) National Grid Control Centre Wokingham Tel: 0118 936 3633 Fax: 0118 936 3451 e-mail : TRSCOTLAND@uk.ngrid.com
Day ahead - out of normal working hours		National Grid Control Room <u>IET in England & Wales</u> Transmission Despatch South Tel: 0844 892 0371 Transmission Despatch North Tel: 0844 892 0372
On the day	In operational timescales, successful test management is reliant on discussion between NG and other Users ' control staff, working with prior knowledge of an agreed test programme / routine / procedure.	<u>IET in Scotland</u> Transmission Despatch Scotland (South) Tel: 0844 892 0373 Transmission Despatch Scotland (North) Tel: 0844 892 0374
Out of normal working hours	Urgent IETs necessary to enable return to service of plant.	

Appendix D

IET NOTIFICATION : Sample of Information Requirement from **User**

- 1 **Type of Test / Description / Reason for Test**
- 2 **Plant / Circuit on which test will be carried out.**
- 3 **Date**
- 4 **Version No. of IET Notification (if applicable)**
- 5 **Start Time / Finish Time**
- 6 **Name of Test Coordinator and contact details**
- 7 **Programme of Testing and Individual Tests**
 - Power Change or Range** - MW and MVA_r (Normally at the LV terminals)
 - Type of Load Change** - Step or Ramp
- 8 **Comments** including commentary on testing programme and / or other relevant information.

Note : **NG** and **Users** may agree standard formats for the above.

COMMUNICATION and LIAISON

1. Generator Initiated Tests

Type of Generator Connection	Responsibility for Liaison with NG	Responsibility for Liaison with Host NO	Responsibility for Liaison with other NOs, TOs or NECs	Test Sanction
Transmission connected Generating Unit	Generator	N/A	NG	NG
Embedded Large Power Station	Generator	Generator	NG	
Embedded Medium Power Station or Embedded Small Power Station	Excluded from the scope of OC7 if the Network Operator (NO) is aware of testing taking place the NO should liaise with NG if it is judged there may an effect on the GB Transmission System			

2. Network Operator Initiated Tests

Affected Party	Responsibility for Liaison	Test Sanction
NG	Host Network Operator	NG
Embedded Medium Power Station and Embedded Small Power Station		
Transmission connected Generating Unit Embedded Large Power Station Non-Embedded Customer Transmission Owner Other Network Operator	NG	

3. NG / Transmission Owner Initiated Tests

Affected Party	Responsibility for Liaison	Test Sanction
Transmission connected Generating Unit Embedded Large Power Station Non-Embedded Customer	NG	NG
Network Operator		
Embedded Medium Power Station or Embedded Small Power Station	Network Operator	

4. Non-Embedded Customer Initiated Tests

Affected Party	Responsibility for Liaison	Test Sanction
NG	Non Embedded Customer	NG
Transmission connected Generating Unit Embedded Large Power Station Other Non-Embedded Customer Transmission Owner Network Operator	NG	
Embedded Medium Power Station or Embedded Small Power Station	Network Operator	

Flow Chart for IET Notification and Liaison

