

THE GRID CODE OC7.5

INTEGRAL EQUIPMENT TESTS

GUIDANCE NOTES

Issue 9: May 2013

National Grid

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Registered in
England and Wales
No. 2366977

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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 Electricity Transmission (NGET)** as **National Electricity Transmission System Operator (NETSO)**

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 **NGET** and enable **NGET** and **Users** to adequately 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 may cause an **Operational Effect**.

The **Operational Effects**, which can occur during testing, are primarily MW and/or MVAR changes caused by the tests themselves. In addition, testing can introduce an increased risk of **Plant** trip and a corresponding loss of MW and MVAR support. Any MW and/or MVAR changes can affect system frequency and/or voltage and can therefore have a consequential 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. **NGET** would generally consider an **IET** where active power and/or reactive is/are expected to change during the test.

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 **National Electricity 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**, **NGET** 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 **National Electricity 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 otherwise agreed, details of the tests should be provided in writing/email to relevant affected parties and the response also made in writing/email. **NGET** will acknowledge receipt of the **IET** request within two weeks of initial **IET** request. If the test is agreed **NGET**, will create a TOGA booking for the test and advise the requestor two weeks ahead of the test. Any further correspondence regarding the agreed **IET** should quote the relevant TOGA number for ease of reference. During the week of the test to 1 day ahead, **NGET** and the **IET** requestor should confirm that the planned test is progressing at the agreed time of the day. Also see Appendix C.

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 **NGET** 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 **NGET** 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 **National Electricity 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 different information flows during an **IET**.

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

The **Network Operator** will liaise with **NGET** 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 **National Electricity 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 **NGET**. **NGET** will consult with the parties connected to the **National Electricity 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 NGET or Transmission Owner initiated tests (Appendix E, Table 3)

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

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

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

2.5 Contacts

The **NGET** 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 **NGET** internal company structure arrangements. In case of new **generators**, **NGET's** Network Operations will have a designated scheme representative who acts as an additional contact for the commissioning process. The process of **IET** progression is the same for Scotland and England & Wales.

Generators and **Network Operators** should inform **NGET** 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 **NGET** and **Users** e.g DAR, AVR tests.

IET notifications should where possible be in writing/email.

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, **NGET** 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 cases:

- 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 **NGET**. 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 prior to agreement.
- 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 reached between the appropriate control room staff that will be in receipt of the final 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 **NGET** and the **User**. The **User** should submit a Gantt chart through Network Operations' scheme representative to help identify the test sequence and break points. The submitted Gantt chart should be revised if the commissioning programme changes appreciably.

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**.

3.6 Complex/Long IET

In case of a long or complex **IET**, uniquely identified break points should be introduced to allow tests to be discontinued and resume later on the same day or a different day altogether. Each section within the **IET** should be uniquely identifiable to enable ease of test continuation e.g **IET** No. XXXX: Test 1.

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

Appendix A

EXAMPLES OF IETs

1. **Voltage Control System Tests for wind-farms and 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**
10. **Generator Risk Of Trip Due to commissioning/testing**

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 NGET or Transmission Owner

Problems may occur if excessive voltage variation takes place on the low voltage side of the transformer. If correctly carried out, these can be minimised by choosing appropriate demand and low-voltage network configurations. If incorrectly co-ordinated extreme voltage variations could occur leading to excessive tap changer operations at other voltage levels.

Part or Full Load Rejection Tests

Generator part load or full load rejection tests can result in a significant loss of MW almost instantaneously to the **NETSO**. This loss, depending on the size, may have a significant impact on frequency control. For this reason all tests of this nature will require a more thorough coordination between operational staff prior to these tests being undertaken. Before these tests are conducted the User must call National Grids operational staff to check that the prevailing system conditions allow the User to carry out the test.

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 other Users if appropriate, and agree/disagree to the test in principle. During this period NGET will acknowledge receipt of the IET request and advise the requestor the TOGA number and contact person for the agreed IET . NGET may request for further clarification or a change of test date/time.	<p>IET in England & Wales Delivery team (Head – Tim Lovell) National Grid Control Center Wokingham Tel: 0118 936 3471 Fax: 0118 936 3266 e-mail: TRANREQ@NATIONALGRID.COM</p> <p>IET in Scotland Delivery team (Head – Tim Lovell) National Grid Control Center Wokingham Tel: 0118 936 3471 Fax: 0118 936 3266 e-mail : TRSCOTLAND@NATIONALGRID.COM</p>
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. NGET will confirm the planned test quoting the TOGA number for the test.	
Day ahead - out of normal working hours		<p>National Grid Control Room</p> <p>IET in England & Wales Transmission Despatch South Tel: 0844 892 0371 Transmission Despatch North Tel: 0844 892 0372</p> <p>IET in Scotland Transmission Despatch Scotland (South) Tel: 0844 892 0373 Transmission Despatch Scotland (North) Tel: 0844 892 0374</p>
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.	
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 / Witnessed or non Witnessed**
- 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 Co-ordinator and contact details**
- 7 **Programme of Testing and Individual Tests**
 - Power Change or Range** -MW and MVA_r (Normally at the LV terminals)/
duration
 - Type of Load Change** - Step or Ramp/ load curve
- 8 **Risk of Trip**
- 9 **Comments** including commentary on testing programme and / or other relevant information.

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

Appendix E

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	NGET	NGET
Embedded Large Power Station	Generator	Generator	NGET	
Embedded Medium Power Station or Embedded Small Power Station	<p>Excluded from the scope of OC7</p> <p>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 National Electricity Transmission System</p>			

2. Network Operator Initiated Tests

Affected Party	Responsibility for Liaison	Test Sanction
NGET	Host Network Operator	NGET
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	NGET	

3. NGET / Transmission Owner Initiated Tests

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

Flow Chart for IET Notification and Liaison

