

**THE DISTRIBUTION CODE FOR  
THE  
NIGERIA ELECTRICITY DISTRIBUTION SYSTEM**

**Version 02**



# DISTRIBUTION CODE

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## PART 1: GENERAL CONDITIONS (GC)

### SECTION: BACKGROUND

#### 1 TITLE

- 1.1.1. This Code and guidelines shall be called the Distribution Code (otherwise known as “D Code”) for the Distribution Sector of the Nigeria Electricity Supply Industry.

#### 1.2. NEW ARRANGEMENT FOR THE NIGERIAN ELECTRICITY SECTOR

- 1.2.1. The Electric Power Sector Reform Act, 2005 (henceforth referred to as the Act) gave legal backing to the unbundling of the Nigeria Power Sector. The Act stipulates the functional unbundling of the Generation, Transmission and Distribution Sectors.
- 1.2.2. Pursuant to Sections 8, 67 and 68 of the Act, Distribution Companies (Discos) shall be established and licensed to perform the functions of distributing electricity in apportioned Authorised areas on **230V up to 33kV** networks of the Nigerian electricity industry. In addition, Discos shall be responsible for overseeing retail operations to end Users of electrical Energy.

#### 1.3. THE DISTRIBUTION CODE

- 1.3.1. The Distribution Code consist of the following
- (a) Distribution Planning & Connection code: containing Technical & Design criteria, procedures to be followed by the Disco in Planning and development of the distribution system and connection conditions specifying the Technical, Design & Operational criteria to be complied with by any User connected or seeking connection with the Disco.
  - (b) Distribution Operation Code: containing the day-to-day operating procedures and principles governing the development, operation and maintenance of an effective, well co-ordinated and functional Distribution Networks for the Electricity sector in Nigeria.
  - (c) Construction and Maintenance Code: containing guidelines for construction and maintenance of the Distribution System
  - (d) Data Registration Code: containing the schedule and templates for the data to be interchanged among Discos and Users
- 1.3.2. The Code is designed to:
- (a) Facilitate an efficient usage of Electricity for all Users of the Distribution Networks, without any act of undue discrimination between Users or class of Users.
  - (b) Facilitate competition in the generation and supply of Electricity

For complete understanding of the operation of the Nigeria Electricity industry post deregulation, this document has to be read in conjunction with the Market Rules, Grid Code and other documents relating to other operational aspects of the industry.

- 1.3.3. The Distribution Code does not deal with charges and other commercial terms relating to:
- (a) A connection to the System
  - (b) Supplies of electricity
  - (c) The use of the Distribution System for the transport of Electricity

Further details and the calculation of charges for use of the Distribution Network System, together with current prices, are available from the Distribution Companies.

#### 1.4. APPLICATION OF THE DISTRIBUTION CODE

- 1.4.1. The Distribution Code shall apply to all Distribution Companies and Users of the Distribution Networks in the country. The Discos shall be responsible for the development and implementation of the Code. The Discos and Users shall comply with provisions of this Code. Users must provide all the required information and reasonable rights of access, service and facilities necessary for implementation of the Distribution Code.
- (a) If any User has any difficulty in complying with any of the provisions of the Distribution Code, he/she shall immediately, without delay, inform the Nigerian Electricity Regulatory Commission and affected Disco(s), and shall comply within thirty(30) working days.
  - (b) Consistent failure in compliance with the Distribution Code may lead to disconnection of the User's plant, Equipment or Apparatus.
  - (c) The operation of the Distribution Code shall be reviewed regularly by the Distribution Code Review Panel in accordance with the provisions of the relevant industry Rules and Regulations.

#### 1.5. ROLE OF THE DISTRIBUTION COMPANIES

- 1.5.1. Subject to and **in** accordance **with** the Conditions of Licence, the roles of the Distribution Companies are:
- (a) Provide connection and deliver electric Energy to the Users in accordance with applicable Laws, its licence and the Distribution Code in accordance with the technical and safety parameters specified in this Code and other industry regulations, at a level of service quality consistent with the applicable Standards of Performance Code
  - (b) procure Ancillary Services on behalf of the Transmission and System Operator and recover the costs of procuring Ancillary Services;
  - (c) handle Network Emergencies and restore the Network back to its normal conditions in a safe and functional manner;
  - (d) perform Demand forecasting;
  - (e) evaluate and accept Users connections;
  - (f) ensure proper metering at all Connection Points to their network;
  - (g) supervise compliance with, and enforce, the Distribution Code and other Health and Safety Regulations for the Network;
  - (h) develop, monitor and enforce procedures for conducting system tests pertaining to the network to ensure Health and Safety of personnel and Equipment;
  - (i) obtain necessary information from Users of the Distribution Network to enable it perform adequate planning operations and development of the network;

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- (j) test and monitor Users Equipment / Apparatus connected to the network to ensure their compliance with the Distribution Code and other relevant regulations;
  - (k) report on scheduled and planned actions and unexpected occurrences such as faults, outages, network upgrading; to network Users, Connectors and the Regulator;
  - (l) comply with the Transmission Grid Code and protect the integrity of the Transmission Network.

## 2. SECTION: PURPOSE AND SCOPE

### 2.1. OBJECTIVE

- 2.1.1. The objective of these **General Conditions** are,
- (a) To establish the conditions applicable to all the **Distribution Code** and , to the extent possible, ensure that the various parts and sections of the **Distribution Code** work together for the benefit of the **Disco** and all **Users**, and apply consistently to all **Users**;
  - (b) To provide the principles and procedures for the development and application of the **Distribution Code**.

### 2.2. UNFORESEEN CIRCUMSTANCES

- 2.2.1. The Distribution Code contains procedures for the management of day to day technical situations on the Distribution Networks, taking into account a wide range of operational conditions likely to be encountered under both normal and abnormal conditions.
- 2.2.2. The Distribution Code cannot foresee all the possible operating conditions on the Distribution Networks. Users must therefore understand and accept that Distribution Companies, in such unforeseen circumstances, may be required to act decisively to discharge their obligations under their License condition(s), within the following general principles and priorities:
- (a) As first priority, preserve or restore the integrity of the **Distribution System** and/or the **Transmission System**, including the avoidance of breakdown, separation or collapse (total or partial).
  - (b) Compliance by the **Disco** with the Electric Power Sector Reform Act, conditions in its **Distribution Licence or Concession**, as applicable, and the Grid Code.
  - (c) Preserve the safety of equipment, to prevent damage to **Plant** and/or **Apparatus**, and public safety to prevent personal injury.
  - (d) The achievement of objectives specifically identified in the **Distribution Code**.

Users shall provide such reasonable cooperation and assistance as Distribution Companies may require in such circumstances.

- 2.2.3. If circumstances not envisaged by the provisions of the Distribution Code should arise, the **Disco** shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith with the Panel or all affected Users in an effort to reach agreement as to what should be done. If agreement between the **Disco** and the Panel or affected Users cannot be reached in the time available, the **Disco** shall determine what shall be done in accordance to this Distribution Code. The **Disco** shall promptly refer any unforeseen circumstance identified, together with the determinations and interpretations made, to the Distribution Code Review Panel for consideration.
- 2.2.4. If an agreement could not be reached, the matter should be referred to the Distribution Code Review Panel in accordance with the provisions of this Distribution Code.
- 2.2.5. Each User shall comply with all instructions given to it by the Disco following a determination for an unforeseen circumstance or a difference in interpretation, provided that such instructions are consistent with the technical characteristics of the User's System and the principles established in

the Distribution Code, and do not endanger the safety of its equipment or staff.

- 2.2.6. Users should note that the provisions of the Distribution Code may be suspended in whole or in part during a Security Period, or in accordance with a Civil Emergency Direction as may be initiated by the Regulator or other competent Nigeria Government Authority.

### 2.3. APPLICABILITY

- 2.3.1. This **Distribution Code** must be applied and used together with the **Grid Code** and the Standards of **Performance Code**.
- 2.3.2. This Code applies to Distribution Companies and Users of the Distribution Networks. Users are:
- (a) Directly Connected Generators.
  - (b) Directly Connected Power Customers.
  - (c) Inter-connected Distribution Network Operators.
  - (d) Energy Retailers or Marketers.

### 2.4. ENFORCEMENT

- 2.4.1. The Electric Power Sector Reform Act of 2005 assigns to the Nigeria Electricity Regulatory Commission (NERC) the authority to establish the appropriate technical codes and manuals that may be required for the safe, reliable and efficient operation of the system. Within such powers, the NERC has the authority to establish the initial Distribution Code and to approve amendments from time to time, as reviewed by the Distribution Code Review Panel.
- 2.4.2. The provisions of this Code shall be implemented by the Disco in accordance with guidelines from the Nigerian Electricity Regulatory Commission, Connection Agreement and relevant industry Rules and Regulation.

### 3. SECTION: INTERPRETATION

#### 3.1. DEFINITIONS

3.1.1. Capitalised words and expressions used in this Code, unless the context otherwise requires, shall have the meaning assigned to them in Appendix 1.

#### 3.2. INTERPRETATION

3.2.1. In this Code, unless the context otherwise requires:

- (a) a reference to a particular Section, Condition, or Appendix is to a section or Condition of, or Appendix to, this Code;
- (b) a reference in a particular Condition or Appendix to a paragraph is to a paragraph of that Condition or Appendix;
- (c) the table of contents and Section and Condition headings are for convenience only and shall be ignored in construing this Code;
- (d) references to the masculine include the feminine and references in the singular include references in the plural;
- (e) “Disco” means a Distribution Company and all its legally permitted operating functions;
- (f) “N” means Naira;
- (g) the word “include” shall be construed without limitation;
- (h) a reference to a “person” includes any individual, partnership, firm, company, corporation (statutory or otherwise), joint venture, trust, association, organisation or other entity, in each case whether or not having separate legal personality;
- (i) a reference to applicable law shall be construed, at the particular time, as including a reference to any modification, extension, re-enactment or replacement thereof then in force;
- (j) a derivative term of any defined or interpreted term or expression shall be construed in accordance with the relevant definition or interpretation;
- (k) a reference to another agreement or any deed or other instrument shall be construed as a reference to that other agreement, deed or other instrument, as the same may have been, or may from time to time be, modified; and
- (l) “In writing” means typewriting, printing, lithography, electronic mail, facsimile and other modes of reproducing words in a legible and non-transitory form.

#### 3.3. LAYOUT OF SECTIONS

3.3.1. From Part 2 onwards each Section starts with an objective and a general paragraph.

- (a) Objective: This paragraph states the objective(es) that the relevant section tries to achieve.

- (b) General: This paragraph provides background information and gives some understanding of the technical topic at hand. No specific obligations are specified in the general paragraph, but this information could be used for clarification purposes in the event of an uncertainty.

### 3.4. HIERARCHY

- 3.4.1. In the event of any inconsistency between this **Distribution Code** and the **2005** Electric Power Sector Reform Act or the license of a **Disco** or a Licensee that is a User, the **2005** Electric Power Sector Reform Act or the license respectively shall prevail to the extent of such inconsistency.
- 3.4.2. In the event of any inconsistency between this **Distribution Code** and the **Grid Code**, the latter shall prevail to the extent of such inconsistency unless the contrary intention is explicit in this **Distribution Code**.
- 3.4.3. Nothing in this **Distribution Code** is intended to or shall derogate from a **Distributor** or a Licensee any license or concession obligation.
- 3.4.4. If any provision of this **Distribution Code** should be found to be unlawful or wholly or partially invalid for any reason, the validity of all remaining provisions of this **Distribution Code** shall not be affected.
- 3.4.5. If part of a provision of this **Distribution Code** is found to be unlawful or invalid but the rest of such provision would remain valid if part of the wording were deleted, the provision shall apply with such minimum modification as may be:
- (a) necessary to make it valid and effective; and
  - (b) most closely achieves the result of the original wording but without affecting the meaning or validity of any other provision of this Distribution Code.
- 3.4.6. In the event of any conflict between the provisions of this Distribution Code and any contract, agreement or arrangement between the Disco and a User, the provisions of this Distribution Code shall prevail unless this Distribution Code expressly provides otherwise, provided that in the case of Connection Agreements with Consumers or Users signed prior to the approval of this Distribution Code, the conditions in such agreement shall prevail unless
- (a) the parties agree an amendment: or
  - (b) the User registers a non-compliance situation that negatively affects the security of the Distribution System, in which case the User must accept the necessary amendments to ensure full compliance with this Distribution Code, except for any derogation.

### 3.5. DEROGATIONS

- 3.5.1. If a User finds that it is, or will be, unable to comply with any provision of this **Distribution Code**, then the User shall, without delay, report such non-compliance to its **Disco** (to whose Distribution Network the User is connected) and shall make such reasonable efforts as are required to remedy such non-compliance within thirty (30) days.
- 3.5.2. When the non compliance described in the previous Condition arises upon the issuance of this **Distribution Code**, or a revision to this **Distribution Code** or the **Grid Code** relating to

Equipment already connected to the Electric System or Equipment approved to be connected to the Distribution System where the User has commenced the procurement or works prior to the issuance of this **Distribution Code** or the revision to this **Distribution Code**, and the User believes either that it would be unreasonable (including on the grounds of cost and technical considerations) to remedy such non-compliance or that it should be granted an extended period to remedy such non-compliance, the User shall promptly submit to the **Disco** a request for derogation from such provision in accordance with this Section. The burden of proof shall rest with the User to show good reason why it cannot comply.

- 3.5.3. If a **Disco** finds that it is, or will be, unable to comply with any provision of this **Distribution Code**, then it shall, without delay, report such non-compliance to the **Commission** and shall take such steps as are required to remedy such non-compliance within thirty (30) days or as may be directed by the Commission.
- 3.5.4. When the non compliance described in the previous Conditions arises upon the issuance of this **Distribution Code**, or a revision to this **Distribution Code** or the **Grid Code** relating to Equipment already connected to the Electric System or Equipment approved to be connected to the Distribution System where the **Disco** has commenced the procurement or works prior to the issuance of this **Distribution Code** or the revision to this **Distribution Code**, and the **Disco** believes either that it would be unreasonable (including on the grounds of cost and technical considerations) to remedy such non-compliance or that it should be granted an extended period to remedy such non-compliance, the **Disco** shall promptly submit to the **Commission** a request for derogation from such provision in accordance with this Section. The burden of proof shall rest with the **Disco** to show good reason why it cannot comply. FOR FURTHER REVIEW. This is in order. It identifies the need for derogation as a result of amendment to the Distribution or Grid Code.
- 3.5.5. A request for derogation from any provision of this **Distribution Code** shall contain:
- (a) the detail of the Equipment and Connection Point in respect of which derogation is sought and if relevant, the nature and extent of non-compliance;
  - (b) the provision of this **Distribution Code** with which the **Disco** or User that requests the derogation is, or will be, unable to comply;
  - (c) the reason for the non-compliance; and
  - (d) the remedial actions and the date by which compliance could be achieved (if remedy of the non-compliance is possible).
- 3.5.6. Every six months, the **Disco** shall report to the **Commission**:
- (a) the list of derogations requested during the last quarter, including requests by the **Disco**, and the status of each request;
  - (b) the list of approved derogations during the last six months indicating type of derogation and party; and
  - (c) for each approved derogation, the progress of remedial actions in achieving compliance.
- 3.5.7. On receipt of any request for derogation, the **Disco** or the Commission, as applicable, shall promptly consider such a request provided that the **Disco** or the **Commission** considers that the grounds for the derogation are reasonable. In its consideration of a derogation request, the **Disco** or the **Commission** as applicable may contact the relevant **Disco** or User to obtain clarifications of



the request or request additional information or to discuss changes to the request, and review possible remedial actions to achieve compliance as soon as reasonably practicable.

- 3.5.8. The Disco shall:
- (a) keep a register of all derogations which have been granted, identifying the name of the User in respect of whom the derogation has been granted, the relevant provision of this **Distribution Code** and the period of the derogation; and
  - (b) on request from the **Commission** or any User, provide a copy of such register of derogations.
- 3.5.9. The **Commission** shall keep a register of all derogations that have been granted to Discos, identifying the name of the **Disco** in respect of whom the derogation has been granted, the relevant provision of this **Distribution Code** and the period of the derogation.
- 3.5.10. The **Commission** may initiate at its own initiative or at the request of a **Disco**, or in view of a User complaint, a review of any existing derogations, and any derogations under consideration where a relevant and material change in circumstance has occurred.

### 3.6. DATA AND NOTICES

- 3.6.1. Submission of data under this **Distribution Code** shall be in electronic format or any suitable unified format applicable to all Discos.
- 3.6.2. Submission of notice(s) under this **Distribution Code** shall be by hand delivery, registered first-class mail, telex or facsimile transfer or e-mail. Exceptions to this requirement may be made with the agreement of the party with the **Disco** or the **Commission**.
- 3.6.3. Any notice required to be given by this **Distribution Code** shall be deemed to have been given or received:
- (a) if sent by hand, at the time of delivery;
  - (b) if sent by post, from and to any address within Nigeria, [four (4) Business Days] after posting unless otherwise proven; or
  - (c) if sent by facsimile, subject to confirmation of uninterrupted transmission report, or by e-mail, [one hour] after being sent.
- 3.6.4. Any transmission sent after [17:00 hours] on any day shall be deemed to have been received at [08:00 hours] on the following Business Day unless the contrary is shown to be the case.
- 3.6.5. For the purposes of this Code, “Business Day” means a day other than:
- (a) a Saturday or a Sunday; or
  - (b) a public holiday in Nigeria;
- 3.6.6. References to times of the day in these Rules are to official time in Nigeria.

### 3.7. CONFIDENTIALITY

- 3.7.1. The **Disco** shall not, except in pursuance of specific requirements of the Distribution Code or other applicable codes approved by the Commission or conditions in its licence or concession, disclose such information for other uses than those provided in this Distribution Code to any other User or other person without the prior written consent of the provider of the information, provided that this inhibition shall not apply to information required by the Commission.

## 4. SECTION: REVIEW PROCESS AND CODE DISPUTES

### 4.1. DISTRIBUTION CODE REVIEW PANEL

- 4.1.1. The Distribution Companies shall establish and maintain a Distribution Code Review Panel (“the Panel”) under the administration of the Nigerian Electricity Regulatory Commission (NERC). The Panel shall be responsible for improving and developing the Code through regular review, consultation, research and other methodologies found appropriate from time to time. The funding and maintenance of the Panel shall be the responsibility of the Distribution Companies **through their appointed agent**. The secretariat of the Panel shall be located in a place agreed to by majority of the Distribution companies.
- 4.1.2. The Panel shall be a standing body to carry out the functions referred to in paragraph 4.1.3.
- 4.1.3. The Distribution Code Review Panel shall:
- (a) Maintain and ensure publication of the current version of the **Distribution Code**;
  - (b) Keep the Distribution Code and its working under review;
  - (c) Review all suggestions for amendments to the Distribution Code which NERC or any User or Distribution companies may wish to submit for consideration by the Panel from time to time;
  - (d) Publish recommendations as to amendments to the Distribution Code that any of the Distribution Companies or the Panel feels are necessary or desirable and the reasons for the recommendations;
  - (e) Submit to the Commission recommendations to each proposal for amendment to the **Distribution Code** and the reasons for the recommendations;
  - (f) Issue guidance in relation to the Distribution Code and its implementation, performance and interpretation when asked to do so by any User;
  - (g) Consider what changes are necessary to the Distribution Code arising out of any unforeseen circumstances referred to it by Users of the Distribution Networks, Distribution Companies or NERC;
  - (h) Consider and identify changes to the Distribution Code to remove unnecessary section(s) or clause(s) that are irrelevant to the effective operation of the Nigeria Distribution Networks
  - (i) Establish and maintain joint coordination arrangements with the Grid Code Review Panel to coordinate changes to and consistent development of the Grid Code and the Distribution Code
- 4.1.4. The Panel shall consist of:
- (a) a Chairman and up to 4 members appointed by the Distribution Companies;
  - (b) 2 persons representing Generating Companies one of which must represent hydro power stations;
  - (c) 2 persons representing TCN (one from the TSP and other from the System Operator);
  - (d) 2 persons representing the Rural Electrification Agency;

- (e) 3 persons representing Consumers in the following categories - domestic, commercial and industrial.; and
- (f) a person appointed by the Nigerian Electricity Regulatory Commission (with no voting rights)

Each of the Panel member shall be appointed by their respective industry sector pursuant to the rules issued by the Panel in 4.1.5.

- 4.1.5. The Panel shall establish and comply at all times with its own rules and procedures relating to the conduct of its business, which shall be approved by NERC. Meetings of the Panel shall be held at regular intervals and at least **once every quarter except for emergencies** at such **time** and place as the Panel shall decide.

## 4.2. DISTRIBUTION CODE AMENDMENTS

- 4.2.1. All revisions to the Distribution Code must be first reviewed by the Distribution Code Review Panel prior to submission to the Commission for approval. All proposed revisions from Users, the Commission, a Disco or the System Operator shall be sent to the Chairman of the Distribution Code Review Panel for consideration by the Panel. The Chairman will advise the Panel of all proposed revisions to the Distribution Code with notice of no less than [20 Business Days] in advance of the next scheduled meeting of the Distribution Code Review Panel.
- 4.2.2. The Panel shall consult in writing all Industry Stakeholders and Operators which are liable to be affected in relation to all proposed amendments to the Distribution Code and shall review and discuss all proposed amendments and comments to the Distribution Code prior to coming up with recommendations to amending the Distribution Code.
- 4.2.3. The Panel through any of the Distribution Companies shall establish (and, where appropriate, revise from time to time) joint working arrangements with industry stakeholders or Operators to facilitate the identification, coordination, making and implementation of changes to their operations consequent on an amendment to the Distribution Code in a full and timely manner. These working arrangements shall be such as to enable development and evaluation of proposed amendments to the Distribution Code, how Operators will proceed in a full and timely manner to changes to their operations consequent to an amendment to the Distribution Code to be made.
- 4.2.4. Following the review of a proposed revision by the Distribution Code Review Panel, the Commission shall review the Panel recommendation. The Commission shall consider the proposed revision, other views, and any further representations and shall determine whether the proposed revision should be made and, if so, whether in the form proposed or in an amended form.
- 4.2.5. If the Commission decides that the revision shall be made, the Chairman shall notify each Disco, in a manner approved by the Commission, of the revision at least [10 Business Days] prior to the revision taking effect. The revision shall take effect with this Distribution Code deemed to be amended accordingly from [and including] the date specified in such notification. The representatives of the Discos in the Panel shall have the responsibility of drafting the amended Conditions. The Distribution Code Review Panel shall publish the amended conditions.
- 4.2.6. After any amendment to the Distribution Code, each Disco shall publish the revised version.

### 4.3. DISTRIBUTION CODE DISPUTES

- 4.3.1. If any Dispute arises relating to, arising out of, or in connection with this Code between: (a) User(s) of the Distribution Network and Disco; (b) Person who applies to be a User and Disco; and Between Users, the parties in dispute shall use their best endeavors to resolve the dispute amicably between themselves
- 4.3.2. In case the dispute can not be resolved amicably, it shall be resolved by the Distribution Code Review Panel in accordance with the provisions contained in Rules set up by the Distribution Code Review Panel and other relevant Market Rules for the industry as approved by NERC.
- 4.3.3. The decision of the Distribution Code Review Panel is binding on the parties in dispute in all cases where there is no award of costs.
- 4.4.4. Any of the parties in dispute may appeal to NERC where it feels that the decision of the Distribution Code Review Panel is unfair.

## **5. SECTION: EFFECTIVENESS AND CONDITIONS PRECEDENT**

### **5.1. EFFECTIVENESS**

- 5.1.1. The provisions of this Code came into effect empowered by Order No. NERC /GL023as declared by the Commission.

### **5.2. CONDITIONS PRECEDENT**

- 5.2.1. The Conditions Precedent are already in place and are:
- (a) enactment into law of the Electric Power Sector Reform Act;
  - (b) the incorporation of Discos as some of the successor Companies to Power Holding Company of Nigeria.

## PART 2: DISTRIBUTION, PLANNING AND CONNECTION CODE (DPCC)

### 1. SECTION: PURPOSE AND SCOPE

#### 1.1. INTRODUCTION

- 1.1.1. The Distribution Planning and Connection Code (**DPCC**) specifies the technical and design criteria and the procedures to be complied with by the **Disco** in the planning and Development of the **Distribution System**. It also applies to **Users** in the planning and development of their installations in so far as they affect the **Distribution System**
- 1.1.2. The **User's** requirement may necessitate the reinforcement of, or extension to the **Distribution System** and in some cases may require the **Disco** to seek the reinforcement or extension to the capacity of the relevant point of interconnection, between the **Distribution System** and the **Transmission System**. This may arise for a number of reasons including but not limited to:
- (a) A development on a **User's System** already connected to the **Distribution System**;
  - (b) Introduction of a new **Connection Point** between the **User's System** and the **Disco's System**;
  - (c) Increase the **System** capacity, remove operating constraints and maintain standards of security to accommodate a general increase in electricity **Demand**.
- 1.1.3. Accordingly the reinforcement or extension of the **Distribution System** may involve work at the following locations:
- (a) At a **Connection Point** between a **User's System** and the **Distribution System**;
  - (b) On the **Distribution System** or other facilities which join a **Connection Point** to the remainder of the **Distribution System**;
  - (c) At or between points on the **Distribution System** remote from the **Connection Points**.
- 1.1.4. The time required for the planning and development of the **Distribution System** and any consequential development of the **Transmission System** will depend on the type and extent of the necessary reinforcement and / or extension work, and the degree of complexity of the new work, while maintaining satisfactory security and quality of supply. Development of the **Distribution System** shall be planned with sufficient lead time to allow for any foreseeable delay in the obtaining of any necessary statutory consents or wayleaves (Right of Way) including any associated hearing if required.
- 1.1.5. An offer by a **Disco** to a **User** for connection to or use of the **Distribution System** may be conditional upon the grant of consents or other external factors. In such circumstances, the **Disco** shall do all that is reasonably practicable to progress the matter expeditiously. **Grant of consents by a third party as an example of what constitutes an external factor is sufficient to help identify such cases.**
- 1.1.6. Reference is made in the **DPCC** to the **Disco** supplying information or advice to **Users**. For avoidance of doubt, unless the context otherwise requires, such information or advice shall be

provided by the **Disco** within five (5) Business Days following a request by the **User** (Whether during the application for connection process or otherwise).

## 1.2. PURPOSE

1.2.1. The purpose of the Distribution Planning and Connection Code is:

- (a) to ensure that there is no undue discrimination in the application of the **Distribution Code** between **Users**, classes of **User** or other **Discos**;
- (b) to enable the planning, design and construction of the Distribution System for a safe and economical operation with the specified degree of Reliability as stated in the Standards of Performance Code;
- (c) to facilitate the use of the Distribution System by any User connected to or seeking connection with it;
- (d) to define the requirements for a **User** seeking connection and/or for a modification of the current connection, and to define the procedures for the exchange of **System** planning data between the **Disco** and **Users**;
- (e) to provide the required information to the Users for connection, planning and development of their own systems and make them compatible with the Distribution System;
- (f) to formulate the technical conditions to be followed by the respective Distribution & Retail Supply Licensees and Users in meeting the standards for an efficient operation of the common electrical interface;
- (g) to specify the information to be provided and procedure for exchange of information by Users of the Distribution System to Discos to enable the Discos to comply with its obligations under the relevant Distribution and Grid Codes; and
- (h) to enable the **Disco** to develop, maintain and operate the **Distribution System** in a coordinated and economic manner in compliance with the **Disco's** licence.

## 1.3. SCOPE

1.3.1. The Distribution Planning and Connection Code (**DPCC**) applies to the following:

- (a) The Distribution Licensees (**Discos**)
- (b) **Users** connected or seeking connection to the **Distribution System**.



## 2. SECTION: DISTRIBUTION PLANNING PROCEDURES

### 2.1. DISTRIBUTION PLANNING RESPONSIBILITY

- 2.1.1. The **Disco** shall be responsible for Distribution Planning, including:
- (a) Forecasting the future **Demand** on its distribution area
  - (b) Analysing the impact of the connection of new facilities such as Generation connected to the **Distribution System**, loads, distribution lines, or substations.
  - (c) Planning the expansion of the **Distribution System** to ensure its adequacy to meet forecast **Demand** and the connection of new Generation, Loads ; and
  - (d) Identifying and correcting problems on Quality of Supply, Power Quality and **System Losses** in the **Distribution System**
- 2.1.2. The **Users** of the **Distribution System**, including **Generation connected to the Distribution System**, shall cooperate with the **Discos** in maintaining the Distribution Planning data.
- 2.1.3. In order to fulfil the obligations stated in Condition 17 of the Distribution Licence, the **Disco** shall develop yearly a [5 Year] Distribution Plan. The Distribution Plan shall include:
- (a) **Energy** and **Demand** Forecasts;
  - (b) Distribution feeder routing and sizing;
  - (c) Distribution **Reactive Power** compensation plan;
  - (d) Distribution Losses reduction plan;
  - (e) Other Distribution reinforcement plans; and
  - (f) A summary of the technical and economic analysis performed to justify the [5 Year] Distribution Plan.

The [5 Year] Distribution Plan shall be submitted to the Commission for approval. The Commission will review the proposed [5 Year] Distribution Plan and may request clarifications or modifications prior to approval. Once approved, the Commission shall have the right to monitor and audit its effective execution.

### 2.2. SUBMISSION, CONSOLIDATION AND MAINTENANCE OF PLANNING DATA

- 2.2.1. Any **User** applying for connection or a modification of an existing connection to the **Distribution System** shall submit to the **Disco** the relevant **Standard Planning Data** and the Detailed Planning Data, in accordance with the requirements prescribed in Section 3 of this Distribution Planning and Connection Code.
- 2.2.2. When requested, **Users** shall submit to the **Disco** the relevant historical planning data for the previous year and/or the forecast planning data for the [five (5)] succeeding years. These shall include the updated **Standard Planning Data** and the Detailed Planning Data.
- 2.2.3. The required **Standard Planning Data** shall consist of information necessary for the **Disco** to evaluate the impact of any **User** Development on the **Distribution System**.

The Disco shall inform the User what shall be covered in the Standard Planning Data.

- 2.2.4. The Detailed Planning Data shall include additional information necessary for the conduct of a more accurate Distribution Planning study. This shall cover circuit parameters, switchgear, and Protection arrangements of Equipment directly connected to or affecting the **Distribution System**. The data shall be adequate to enable the **Disco** to assess any implication associated with the **Connection Points**.
- 2.2.5. The **Standard Planning Data** and Detailed Planning Data shall be submitted by the **User** to the **Disco**. The **Disco** shall consolidate and maintain the Distribution planning data according to the following categories:
- (a) Forecast Data;
  - (b) Estimated Equipment Data; and
  - (c) Registered Equipment Data.
- The Forecast Data shall contain the **User's** best estimate of the data, including **Energy** and Power, being projected for the [five (5)] succeeding years.
- The Estimated Equipment Data shall contain the **User's** best estimate of the values of parameters and information pertaining to its Equipment.
- The Registered Equipment Data shall contain validated actual values of parameters and information about the **User's** Equipment, usually required at the time of connection.
- 2.2.6. If there is any change to its planning data, the **User** shall notify the **Disco** of the change within ten (10) Business Days. The notification shall contain the time and date when the change took effect, or is expected to take effect, as the case may be. If the change is temporary, the time and date when the data is expected to revert to its previous registered value shall also be indicated in the notification.
- 2.2.7. The **User** shall give notice to the Disco in the event that the connection is no longer required subject to the provisions of Part 1 Section 3.6 (Data and Notices).

### 2.3. LOAD FORECAST

- 2.3.1. The **Disco** shall forecast the **Demand** for **Power** and **Energy** within the licensed area annually. The **Disco** shall formulate its long term **Load** Forecast taking the previous year ending December 31st as the Base Year and projecting the **Demand** over the succeeding five years.
- 2.3.2. The **Disco** shall forecast **Demand** using **Prudent Industry Practice**. In conducting this **Load** Forecast the **Disco** shall consider:
- (a) **energy** sales per customer category, adopting a suitable methodology to assess its trend, taking into account degree of electrification, electricity prices, the growth in population, trends on the national economy, or any other parameter the **Disco** considers suitable to forecast it.
  - (b) the effects if any, due to **Demand** side management and loss reduction.
  - (c) specific projects, either Government or private sponsored that will imply the appearance of new loads in the **Disco's** licence or concession area.

- (d) conservation programmes, **Demand** side management or off-peak usage programmes which the **Disco** may be sponsoring, which are intended to reduce the **User's** future **Energy** and peak **Demand**.
  - (e) significant public Events;
  - (f) expected schedules for Generators connected to Distribution;
  - (g) interconnection with adjacent **Discos**, if *existing*; and
  - (h) any other information under the **Disco's** knowledge that could have some influence in the **Load** Forecast.
- 2.3.3. The **Disco** shall create a data base of loads for each **User** category and for each distribution substation connected to its **Distribution System** and update it on an annual basis.
- 2.3.4. All **Users** with **Large Connections** shall provide yearly to the **Disco** with their **Energy** and **Demand** Forecasts at each **Connection Point** for the 5 succeeding years. The Forecast Data for the first year shall include monthly **Energy** and Power Forecasts, while the remaining four years shall include only the annual **Energy** and Power Forecasts. **Users** with **Medium Connections** shall provide the same type of data if so instructed by the **Disco**.
- 2.3.5. In the case of **Users** having Generation connected to the **Distribution System**, they shall provide the net values of **Energy** and Power Forecast after any deductions to reflect the output of the **Generating Plant**. Such deductions shall be stated separately in the Forecast Data, including the projected **Energy** and **Demand** to be generated by each **Generating Unit or Power Park Module** in the **Generating Plant**.
- 2.3.6. The **Disco** shall develop a load research programme with the objective of obtaining **User** load profile data that describes the usage characteristics of specific appliances, **Users** and group of **Users**. The load research will facilitate obtaining the following information:
- (a) **Demand** according to end use at the hour of **System** peak, daily, monthly, seasonally or annually.
  - (b) Hourly end use **Demand** for the day of the **System** peak, monthly, seasonally or Hourly end use **Demand** for the average day of the **System** peak, monthly, seasonal or annually.
  - (c) Category wise diversity or coincidence factors and load factors.
  - (d) Total **Energy** consumption for each category by day, month, season or year.
  - (e) Category wise non-coincident peak **Demands**.
  - (f) Hourly **Demand** for end use appliances
- 2.3.7. The **Disco** shall compute the aggregate **Energy** requirement at each of the **Connection Points** with the **Transmission System** after accounting for **System** losses. Based on the metering data at each **Connection Point** with the **Transmission System**, the Licensee shall develop load curves for the area fed by the concerned **HV/MV** substation. By compiling data from each **HV/MV** substation feeding its **Distribution System**, the Licensee shall develop a **System** load curve for its area of supply by applying a suitable diversity factor. By reconciling actual **Energy** sales figures with the metering data at each substation, approximate losses in the **System** may be computed for any period. This data shall be furnished to the **Commission** as required.

- 2.3.8. If a **User** believes that the cohesive forecast prepared by the **Disco** does not accurately reflect its assumptions on the planning data, it shall promptly notify the **Disco** of its concern. The **Disco** and the **User** shall promptly meet to address the concern of the **User**. If an agreement could not be reached, the matter shall be referred to the Distribution Code Review Panel in accordance with the Distribution Code, Part 1 Section 4.3.

## 2.4. DISTRIBUTION PLANNING

- 2.4.1. The **Disco** shall conduct Distribution Planning studies and evaluations to ensure the safety and reliability of the **Distribution System** in order to:
- evaluate the requirement of **Distribution System** reinforcement projects;
  - assure the requirement stated under the Technical Requirements section of this Code, and the **Standards of Performance Code** are met for all the **Users** in the **Distribution System**; and
  - evaluate any proposed **User** development, which is submitted (or is expected to be submitted) in accordance with the applications and procedures stated in the Connection Code.
- 2.4.2. The Distribution Planning studies shall be conducted to assess the impact on the **Distribution System** or to any **User System**, of the **Load** Forecast or any proposed **Equipment** change in the **Distribution System** or the **User System**, and to identify corrective measures to eliminate the deficiencies in the **Distribution System** or the **User System**.
- 2.4.3. The **Disco** shall conduct distribution planning analysis which shall include:
- the determination of optimum patterns for feeder development; **taking** into account existing or future substations proposed by the Transmission Licensee;
  - the development of optimum **Reactive Power** compensation programs;
  - the development of an optimum feeder configuration and switching controls for distribution feeders; and
  - The cost effectiveness of loss reduction measures without compromising the security standards.

The relevant technical studies and the required planning data specified in following sections shall be used as a guide in the conduct of the Distribution Planning studies.

- 2.4.4. In addition to catering for **Active Power Demand**, **Reactive** components of power requirement should be studied and adequate measures should be taken by installing **Reactive** compensation equipment at different voltage levels in a phased manner to improve power factor and cause reduction of losses.

## 2.5. SYSTEM STUDIES

- 2.5.1. The following **System** studies are expected to be carried out by the **Disco** in order to develop the [5 Year] Distribution Plan:
- Voltage Drop Studies: Voltage drop studies shall be performed to determine that the expected voltages at the **User's connection Points** comply with the requirements stated

on the Technical Requirements section and in the **Performance Standards Code**.

It shall take into account the connection of new Generation connected to the **Distribution System**, the Forecasted **Load**, and any planned expansion, reinforcement, or development in the **Distribution System**.

- (b) Short Circuit Studies: Short circuit studies shall be performed to evaluate the effect on the **Distribution System Equipment** of the connection of new Generation connected to the **Distribution System** and other facilities that will result in increased fault duties for the **Distribution System Equipment**. These studies shall identify the **Equipment** that could be damaged when current exceeds the design limit of the **Equipment**. The studies shall also identify the Circuit Breakers and fuses, which may fail when interrupting possible short circuit currents.
- (c) Three-phase short-circuit studies shall be performed for the most demanding scenario (either maximum or minimum generation) and for different **System** circuit configurations. Single line-to-ground fault studies shall also be performed for critical **Distribution System** nodes. These studies shall identify the most severe conditions that the **Distribution System Equipment** may be exposed to, and to determine possible constraints in fulfilling the **Power Quality** standards set out in the **Performance Standards Code**. Alternative **Distribution System** circuit configurations may be studied to reduce the short circuit current within the limits of existing **Equipment**. The results shall be considered satisfactory when the short-circuit currents are within the design limits of **Equipment** and the proposed **Distribution System** configurations are suitable for flexible and safe operation.
- (d) **System Losses** Studies: **System Losses** studies shall be performed to identify, classify, and quantify the losses in the **Distribution System**, and to propose measures for gradually reducing them if technically and economically feasible. **System** Loss studies shall be performed to determine the effects of any **User** Development and any development in the **Distribution System** on the efficiency of the **Distribution System**.
- (e) Distribution Reliability Studies: Distribution Reliability studies shall be performed to determine the frequency and duration of **User Interruptions** in the **Distribution System**, in order to assure the requirements stated in the **Performance Standards Code** are met. The historical Reliability performance of the **Distribution System** shall be determined from the **Interruptions** data of the **Distribution System**.

The above list is not exhaustive, and is presented in this Code solely as a guide. The Disco will be responsible to determine the actual studies to be conducted in order to fulfil the obligations indicated in 2.4. Any study carried out shall be made available on request to the User or the Commission.

### 3. SECTION: PROCEDURES FOR CONNECTION OR MODIFICATION

#### 3.1. APPLICATION FOR CONNECTION

- 3.1.1. Any **User** seeking a new or modified connection to the **Distribution System** will submit to the **Disco** a connection application. Suitable forms shall be made available by the **Disco to the User**, depending on the required Connection Capacity and the nature of the User's Equipment to be connected.
- 3.1.2. When requested by the **User** seeking a new or modified connection, the **Disco** shall furnish relevant **System** data. Detailed data relating to the interface between the **Distribution System** and that of the **User**, covering circuit parameters, switchgear and Protection arrangements of equipment directly connected to or affecting the **Distribution System** to enable the **Disco** to assess any implications associated with these points of connection.
- 3.1.3. **Users** shall contact the **Disco** in advance if it is proposed to make any significant change to the connection, electric lines or electrical **Equipment**, install or operate any generating equipment or do anything else that could affect the **Distribution System** or require alterations to the connection.
- 3.1.4. **Users** seeking for a new or modified connection shall provide the **Disco** with any information requested about the nature/use by the **User**, of electrical equipment on the **User's** premises.
- 3.1.5. A list of the information usually required by the **Disco** is indicated in Annex 3.1. Should a preliminary examination of this data indicate that more detailed information is required then it shall be provided to the **Disco** on request. The **Disco** will only ask for information that is needed by it in relation to its Distribution License or the **Distribution Code**.

#### 3.2. PROCESSING OF APPLICATIONS

- 3.2.1. The **Disco** shall establish procedures for the processing of applications for connection or Modification of an existing connection to the **Distribution System**. The **Disco** shall process the application for connection or Modification to an existing connection within the time frames indicated in the **Performance Standards Code**.
- 3.2.2. Any **User** applying for connection or a Modification of an existing connection to the **Distribution System** shall take all necessary measures to ensure that its proposed connection or Modification fulfils all the requirements stated on the "Technical Conditions at the **Connection Point**" Section of this Code, and shall not result in the Degradation of the **Distribution System**.
- 3.2.3. Based on the data supplied by the **User**, the **Disco** shall conduct all the required Distribution Impact Studies it considers appropriate, to evaluate the impact of the proposed connection or modification to an existing connection on the **Distribution System**. The evaluation should include:
  - (a) impact of short circuit in-feed to the Distribution **Equipment**; and
  - (b) impact of **User** Development on **Power Quality**.

- 3.2.4. Upon request of the **User**, the **Disco** shall provide to the **User** adequate and sufficient information regarding the **Distribution System**, to enable the **User** conduct Impact Studies on the **User's** system, and/or the **Distribution System** it considers appropriate.
- 3.2.5. During the application for connection process, based on the results of the Impact Studies, the **Disco** will propose and agree with the **User** the voltage level and point in the **Distribution System** to which a **User** will be connected in accordance with its normal practice for the type of load to be supplied. The **Disco** may on occasion specify a different **Connection Point** or connection voltage from normal in order to avoid potential disturbance caused by the **User's Equipment** to other **Users** of the Network or for other technical reasons or may agree alternative methods for minimizing the effects of System disturbance. The **Disco** may disapprove an application for connection or a Modification of an existing connection to the **Distribution System** if it is determined through the Distribution Impact Studies that the proposed connection or Modification will not fulfil the technical requirements or result in the Degradation of the **Distribution System**.
- 3.2.6. If the application of the **User** is not acceptable, the **Disco** shall notify the **User** as to why its application is not acceptable. The **Disco** shall include in its notification details of the amendments required to make the **User's** application acceptable to the **Disco**. The **Disco** shall report this situation to the NERC.
- 3.2.7. The **User** shall accept the proposal of the **Disco** within [30 days] or a longer period specified in the **Disco** proposal, after which period the proposal will lapse.

### 3.3. CONNECTION AGREEMENTS

- 3.3.1. The acceptance by the **User** of the **Disco** proposal shall lead to the signing of a **Connection Agreement** or an amended **Connection Agreement**. If the **Disco** and the **User** cannot reach agreement on the proposed connection, Modification to an existing connection, the **Disco** or the **User** shall have the right to bring the matter before the **Commission** for resolution. The **Commission** shall have the reasonable right of access to any information that it deems fit in order to resolve such disagreement.
- 3.3.2. Before entering into a **Connection Agreement** and before connecting a **User's System** at a **Connection Point**, it will be necessary for the **Disco** to be reasonably satisfied that the **User's System** at the boundary with the **Distribution System** will comply with all appropriate requirements of this **Distribution Code**.
- 3.3.3. The **Connection Agreement** shall include, and shall not be limited to, provisions for the submission of information and reports, **Safety Rules**, Test and Commissioning programs, **Electrical Diagrams**, statement of readiness to connect, certificate of approval to connect, and other requirements agreed between the parties. If required by the **Disco**, .
- 3.3.4. Any **User** seeking to modify an existing connection to the **Distribution System** shall request an amended **Connection Agreement** with the **Disco** prior to any modification to the **User's System**. The amended **Connection Agreement** shall include provisions for the submission of additional information required by the **Disco**.

- 3.3.5. **Submissions** Prior to the Commissioning Date: The following information shall be submitted by the **User** prior to the Commissioning date, pursuant to the terms and conditions and schedules specified in the **Connection Agreement**:
- (a) Specifications of major Equipment not included in the **Standard Planning Data** and Detailed Planning Data;
  - (b) Details of the Protection arrangements and settings referred to in **Section ”Technical Conditions at the Connection Point“** of this Code.
  - (c) **Electrical Diagrams** of the **User’s** Equipment at the **Connection Point** as described in Annex 3.1
  - (d) Information that will enable the **Disco** to prepare the **Connection Point Drawings**;
  - (e) Copies of all **Safety Rules** and Local Safety Instructions applicable to the **User’s Equipment** and a list of Safety Coordinators, pursuant to the requirements of **DOC Section 6**.
  - (f) A list of the names and telephone numbers of authorised representatives, including the confirmation that they are fully authorised to make binding decisions on behalf of the **User**, for Significant Incidents;
  - (g) Proposed Maintenance Programme; and
  - (h) Test and Commissioning procedure for the **Connection Point** and the **User** Development (if required).

### 3.4. COMMISSIONING OF EQUIPMENT AND PHYSICAL CONNECTION TO THE DISTRIBUTION SYSTEM.

- 3.4.1. Upon completion of the User Development, including work at the Connection Point, the Equipment at the Connection Point and the User Development may be subjected to the Test and Commissioning procedure specified in the Connection Agreement. The User shall then submit to the **Disco** a statement of readiness to connect, which shall include a certified Test and Commissioning report, if applicable. The **Disco** shall be entitled to witness the tests. The **Disco** may withhold agreement to energize the User's Equipment where test results do not demonstrate compliance with the Distribution Planning and Connection Code.
- 3.4.2. Upon acceptance of the **User’s** statement of readiness to connect, the **Disco** shall, issue a certificate of approval to connect. The physical connection to the Distribution System shall be made by the Disco only after the certificate of approval to connect has been issued by the **Disco** to the User and within the timeframes specified in the Performance Standards Code.

### 3.5. OWNERSHIP BOUNDARIES

- 3.5.1. The point or points at which supply is given or taken between the Distribution System and Users will be agreed between the **Disco** and the User as required. For MV connections, including connections between the **Disco** and User, and where necessary bus bar connected supplies at LV, the Connection Points will be subject to specific agreement between the parties in each case.



- 3.5.2. The respective ownership of Plant or Apparatus will be recorded in the Connection Agreement. In the absence of specific provision in the contrary, construction, commissioning, control, operation and maintenance responsibilities follow ownership.
- 3.5.3. For supplies to **Generators** Connected to Distribution that operate in parallel with the Distribution System and all supplies at MV the **Disco** will prepare, with the User's agreement, a **Site Responsibility Schedule and Operation Diagrams** showing the agreed Ownership Boundary, which will be **included in the Connection Agreement**. The **Site Responsibility Schedule** shall detail the demarcation of responsibility for safety of persons carrying out work or testing at sites having a Connection Point to the Distribution System and/or circuits which cross an Ownership Boundary at any point. Changes in the boundary arrangements proposed by either party must be agreed in advance and will be recorded on the **Connection Agreement**.

## 4. SECTION: TECHNICAL REQUIREMENTS AT THE CONNECTION POINT

### 4.1. SUPPLY QUALITY STANDARDS

- 4.1.1. The **Disco** shall plan and operate its **System** to ensure that at any **User's Connection Point**, the Supply Quality standards specified in the Standards of **Performance Code** are complied with. **Users** seeking connection to the **Distribution System** or Modification of an existing connection shall ensure that their Equipment does not suffer damage as a result of unscheduled outages, which can occur on the **Distribution System** from time to time.

### 4.2. FREQUENCY VARIATIONS

- 4.2.1. The System frequency variations are as specified in the Grid Code.
- 4.2.2. **Users** shall ensure that their Equipment can operate reliably and safely within the specified limits during Normal Operation, and can withstand the limits specified under **System** Stress and extreme System fault conditions.

### 4.3. VOLTAGE LEVELS

- 4.3.1. Nominal and Operational Voltages on the **Distribution System** are shown in the following Table.

Nominal Voltage	Operational Voltages	
	Minimum kV (pu)	Maximum k V (pu)
33 kV	31 (0.94)	34.98 (1.06)
16 kV	15.2 (0.95)	16.8 (1.05)
11 kV	10.45 (0.95)	11.55 (1.05)
400 V	376 V (0.94)	424 V (1.06)
230 V	216.2 V (0.94)	243.8 V (1.06)

- 4.3.2. Under fault and circuit switching conditions the rated frequency component of voltage may fall or rise transiently. The fall or rise in voltage will be affected by the method of earthing of the neutral point of the Distribution System and voltage may fall transiently to zero at the point of fault.
- 4.3.3. The **Distribution System** and the **User System** shall be designed and operated to include devices that will mitigate the effects of transient over voltages on the **Distribution System** and the **User System**. The **Disco** and the **User** shall take into account the effect of electrical transients when specifying the insulation of their electrical Equipment.

#### 4.4. VOLTAGE UNBALANCE

- 4.4.1. The maximum Voltage Unbalance at the **Connection Point** of any **User**, excluding the Voltage Unbalance passed on from the Transmission System shall not exceed the limits set by the affected **Disco**.
- 4.4.2. The **User** shall ensure that its **System** shall not cause the Voltage Unbalance in the **Distribution System** to exceed the limits specified in this Section.

#### 4.5. HARMONICS AND FLICKER

- 4.5.1. **Discos** shall ensure that the Individual Harmonic Content and the Total Harmonic Distortion of the voltage at any **Connection Point**, shall not exceed the limits prescribed in the table below.
- 4.5.2. Distortion of the System voltage waveform, caused by certain types of Equipment, may result in annoyance to Users or damage to connected Apparatus. In order to limit these effects Users' Equipment connected to the Distribution System shall comply with the emission limits indicated in IEC 61000-3 Standards.
- 4.5.3. The level of harmonics generated by total **User's** connected Equipment at the **Connection Point**, shall not exceed the limits prescribed in the following table:

Limits of Harmonic Current Distortion

Harmonic Order (n)	Low Voltage Contracted Power less than 10 kW	Low Voltage Contracted Power greater than 10 kW	Medium Voltage
	A	%	%
(odds no multiples or 3)			
5	2,28	12	12
7	1,54	8.5	8.5
11	0,66	4.3	4.3
13	0,42	3,0	3,0
17	0,26	2.7	2.7
19	0,24	1.9	1.9
23	0,20	1.6	1.6
25	0,18	1.6	1.6
> 25	4,5/n	0.8 + 0.8*25/n	0.8 + 0.8*25/n
(odds multiples or 3)			
3	4,6	16.6	16.6
9	0,8	2.2	2.2
15	0,3	0.6	0.6
21	0,21	0.4	0.4
> 21	4,5/n	0.3	0.3
(even)			

2	2,16	10.0	10.0
4	0,86	2.5	2.5
6	0,60	1.0	1.0
8	0,46	0.8	0.8
10	0,37	0.8	0.8
12	0,31	0.4	0.4
> 12	3,68/n	0.3	0.3
Total	240 V Users: 5 A 400 V Users: 14 A	20.0%	20.0%

Under certain circumstances the **Disco** may agree to other limits or levels.

- 4.5.4. Measurements may be taken by the **Disco** at the **User's Connection Point**. Measurements shall be taken in accordance with methodologies of IEC 61000-4-7 lasting for at least 24 hours taken at 10 minute intervals.
- 4.5.5. The Flicker Severity at the Connection Point of any User, shall not be above the maximum values stated in IEC 61000-3 Standard for more than 3 % of the measured period.
- 4.5.6. The maximum emission limits produced by any User shall be below the maximum values stated in IEC 61000-3 Standard.
- 4.5.7. In the event that the User's Equipment operates outside the above specified limits causing annoyance or other injurious effects either to another User, or to the Distribution System, the Disco shall give reasonable notice to the User to remedy the defect and the User shall remedy the defect at its own expense. In determining the period of notice, the Disco shall have regard to the nature and degree of non compliance, the nature and degree of annoyance or other injurious effects as well as the prescriptions stated in the Distribution Performance Standards. The Disco shall have the right to disconnect the User's Equipment in the event that the User does not comply with such notice.

#### 4.6. PROTECTION OF THE DISTRIBUTION SYSTEM

- 4.6.1. The **Distribution System** shall be designed and operated with sufficient Protection to ensure safety and to limit the frequency and duration of Interruptions to **Users**.
- 4.6.2. No item of electrical equipment shall be allowed to remain connected to the system unless it is covered by the appropriate protection materials that ensure Reliability, selectivity, speed and sensitivity. The Disco and TSP shall cooperate to ensure correct and appropriate settings of protection to achieve effective, discriminatory isolation of faulty line/equipment within the target time clearance specified by TSP.
- 4.6.3. 33 kV lines: -These lines shall have two over current and one earth fault non-directional protection. It shall also have instantaneous over current element.
- 4.6.4. Distribution System: -For Power Transformers of HV class in the Distribution System, differential protection shall be provided for 5 MVA and above along with backup time lag over current and earth fault protection with directional feature for parallel operation. Transformers of 1.6 MVA and above but less than 5 MVA shall be protected **on the primary side by appropriately rated dropped out fuses and CT operated Ring Main Unit (RMU) on the secondary side**. In

addition, all power transformers **rated 5MVA and above** shall be provided with gas operated relays, winding and oil temperature alarm and protection.

- 4.6.5. Distribution lines: - All the 33 kV and 11 kV lines at connection points shall be provided with a minimum of over current and earth fault relays as follows:
- (a) plain radial feeders: Non-directional time lag over current and earth fault relays with suitable settings to obtain discrimination between adjacent relay settings.
  - (b) parallel/ring feeders: Directional time lag over current and earth fault relay.
  - (c) long feeders/transformer feeders: These feeders shall incorporate a high set instantaneous element.

#### 4.7. PROTECTION OF THE USERS INTERFACE

- 4.7.1. The requirements for the Protection **System** at the **Connection Point** shall be agreed upon by the **Disco** and the **User** during the application for connection or Modification of an existing connection and shall be reviewed from time to time by the **Disco**, with the concurrence of the **User**.
- 4.7.2. The **User System** shall be designed and operated and tested to achieve the desired level of speed, sensitivity, and selectivity in fault clearing in order to minimise the impact of faults on the **Distribution System** and in accordance with the requirements of the **Disco**. Unless the **Disco** advises otherwise, the **User** shall not use current limiting protective devices to limit the fault current in feed to the **Distribution System**.
- 4.7.3. The **Disco** shall provide the **User** with the details of any Auto-reclosing or sequential switching features in the **Distribution System that could have some impact in the User's System**. The **User** should take this information into account in the design of its Protection **System**.
- 4.7.4. The **User** shall consider in the design of its Protection **System** the possible disconnection of only one phase or two phases during fault conditions on the Distribution System. For example, three phase motors shall be designed to withstand single phasing either by design or by suitable protection.

#### 4.8. GROUNDING REQUIREMENTS

- 4.8.1. The method of Grounding at the **User System** shall comply with the Grounding standards and specifications of the **Disco**. The Disco shall supply the User with these standards when applying for connection.
- 4.8.2. The specification of associated Equipment shall meet the voltages which will be imposed on the Equipment as a result of the method of grounding
- 4.8.3. Where there are multiple sources of power, the **User** shall ensure that the effects of circulating currents with respect to the grounded neutral are either prevented or mitigated.

#### 4.9. EQUIPMENT SHORT CIRCUIT RATING

- 4.9.1. The **Disco** shall inform the **User** of the design maximum Short Circuits Levels of the **Distribution System** at the **Connection Point**. The **User** shall consider the design maximum Short Circuits Levels at the **Connection Point** in the design and Operation of the **User System**.

#### 4.10. MONITORING AND CONTROL EQUIPMENT REQUIREMENTS

- 4.10.1. The **Disco** and the **User** shall agree on the mode of monitoring and control. If the Disco requires telemetry, the **Disco** shall provide, install, and maintain a telemetry outstation and all associated Equipment needed to monitor the **User System**. If the **User** agrees that the **Disco** shall control the switchgear in the **User System**, the **Disco** shall install the necessary control outstation, The User shall provide the necessary control interface for its switchgear which is to be controlled by the Disco.

#### 4.11. EQUIPMENT AND MAINTENANCE STANDARDS

- 4.11.1. All Equipment at the **Connection Point** shall comply with the requirements of the IEC Standards or their equivalent national standards.
- 4.11.2. All Equipment at the **Connection Point** shall be operated and maintained in accordance with Prudent Industry Practice and in a manner that shall not pose a threat to the safety of any personnel or cause damage to the Equipment of the **Disco** or the **User**.
- 4.11.3. The **Disco** shall maintain an appropriate log containing the test results and maintenance records relating to its Equipment at the **Connection Point** and shall make this log available when requested by the **User** or NERC
- 4.11.4. The **User** shall maintain a log containing the test results and maintenance records relating to its Equipment at the **Connection Point** and shall make this log available when requested by the **Disco**.

#### 4.12. POWER FACTOR

- 4.12.1. All MV **Users** (or other **Users** as may be determined by the Commission from time to time) of the **Distribution System** shall maintain a Power Factor not less than 0.85 lagging at the **Connection Point**, unless a different value have been agreed in the **Connection Agreement**.

#### 4.13. UNDER FREQUENCY RELAYS FOR AUTOMATIC LOAD SHEDDING

- 4.13.1. The **Connection Agreement** or amended **Connection Agreement** shall specify the manner in which **Demand**, subject to Automatic Load Dropping, will be split into discrete MW blocks to be actuated by Under Frequency Relays.

#### 4.14. REQUIREMENTS FOR GENERATORS

- 4.14.1. **Generators connected to Distribution** shall be connected to the **Distribution System** at the voltage level agreed to by the **Disco**, based on the Distribution Impact Studies.

- 4.14.2. The **Connection Point** shall be controlled by a Circuit Breaker that is capable of interrupting the maximum short circuit current at the point of connection. Means shall also be provided for Circuit Breaker isolation for maintenance purposes.
- 4.14.3. The **Generator connected to Distribution** shall be capable of continuously supplying its **Active Power** output, as specified in the **Generator's** declared data, within the **System** Frequency range specified in the Grid Code. Any decrease of power output occurring in the Frequency range of 48.75 to 51.25 Hz shall not be more than the required proportionate value of the **System** Frequency decay.
- 4.14.4. If the **System** frequency momentarily rises up to the value of 51.5 Hz or falls up to the value to 47.5 Hz, **Generators connected to Distribution** shall remain in synchronism with the **Distribution System, unless something different has been agreed** in the Connection Agreement.
- 4.14.5. The **User** shall be responsible for protecting its **Generator connected to Distribution** against damage for frequency excursions outside the range of 51.5 Hz and 47.5 Hz. The **User** shall decide whether or not to disconnect its Generation Unit from the **Distribution System**.
- 4.14.6. The **Generators connected to Distribution** shall be capable of supplying its **Reactive Power** outputs, as specified in the **Generator's** declared data, within the Voltage Variation specified in this Code, during Normal Conditions.
- 4.14.7. The **Generators connected to Distribution** shall meet the requirements for Voltage Unbalance as specified in this **Distribution Code**. The **Generators connected to Distribution** shall also be required to withstand without tripping, the unbalance loading during clearance by the Backup Protection of a close-up phase-to-phase fault on the **Distribution System**.
- 4.14.8. The Protection of **Generators connected to Distribution**, associated Equipment and the connection to the **Distribution System** shall be designed, coordinated, and tested to achieve the desired level of speed, sensitivity, and selectivity in fault clearing and to minimise the impact of faults on the **Distribution System**. The **Disco** and the **Generator connected to Distribution** shall be solely responsible for the Protection **System** of the electrical Equipment and facilities at their respective sides of the **Connection Point**. The owner shall provide suitable protection at the interface to protect his system from any damage due to normal and abnormal conditions in the Distribution System
- 4.14.9. If designed to support islanding operation, the **Generator connected to Distribution** could operate in an islanding mode even over its own Auxiliaries, of supplying other **User's** load or Equipment. If this kind of operation is allowed, the **User** shall be responsible for:
- adequately designing the protection and control schemes of the Generator, both for islanding and connected to the grid modes;
  - assure the protection schemes of the **Generator** and the rest of the **User System** are able to detect and trip internal faults, under the islanding situation (probably reduced short circuit power); and
  - assure adequate grounding when islanding operation.

- 4.14.10. A fault or maintenance Outage, could result in the disconnection of the Generation Connected to Distribution together with an associated section of the **Distribution System**, from the remainder of the Total System. Unless explicitly arranged with the **Disco**, and clearly stated on the **Connection Agreement** or amended **Connection Agreement**, the **Generator** connected to **Distribution** should never supply load and/or maintain voltage in any part of the **Distribution System** if this part is isolated from the Transmission System. If the **Generator** is capable of maintaining this voltage because it is equipped with synchronous or self excited asynchronous **Generators**, the **User** should install adequate protection devices (that could include inter-tripping schemes) to assure the disconnection either of the **Generator** or the whole **User's** facilities at the **Connection Point**.
- 4.14.11. In case the **User** facilities are connected to a feeder of the **Disco** equipped with auto-reclosing, the protection **System** and switching arrangements should be designed to separate the **Generator** (or the **Generator** and other **User's** facilities below the **Connection Point**) following the first **Disco's** Main Breaker, Recloser or Sectionalizer opening, and to remain disconnected until the **System** has completely restored.
- 4.14.12. The **Generators connected to the Distribution System** providing Ancillary Services for **Reactive Power** supply shall be capable of contributing to Voltage Control by continuous regulation of the **Reactive Power** supplied to the **Distribution System**. The **Generators connected to the Distribution System** providing Ancillary Services for **Reactive Power** supply shall be fitted with a continuously acting automatic excitation control **System** to control the terminal voltage without instability over the entire operating range of the **Generators connected to the Distribution System**. The performance requirements for excitation control facilities, including power **System** stabilizers, where necessary for **System** operations shall be specified in the Distribution **Connection Agreement** or Amended **Connection Agreement**.
- 4.14.13. The Generator connected to the Distribution System shall specify in its Application for a Connection or an Application for Modification if it has a Black Start capability. In the case the Generator connected to Distribution System wishes to provide Ancillary Services for Black Start to the System Operator, it shall develop and sign the necessary agreements with it, and comply with the Grid Code.
- 4.14.14. In case the Generating Unit is an Induction Generator, the owner shall install separate metering for the Reactive Load generated, in addition to his active power metering.
- 4.14.15. In addition to the above provisions applicable to the Generating Units, in case of Units above 5 MW, the Generating Company shall comply with the provisions of the Grid Code.
- 4.15.16 In addition to the provisions in this Distribution Code, Power Park Modules with a Registered Capacity of 1MW or above shall comply with the relevant provisions of the Grid Code section 12.6 (and corresponding referenced sections), unless otherwise agreed with the relevant Disco, with the following modifications applied:
- a) In Grid Code section 12.6.7 c) the default K value shall be 0
  - b) In Grid Code section 12.6.9 f) the Voltage control function is not required. For the avoidance of doubt the remaining provisions of 12.6.9 still apply
- 4.15.17 In addition to the provisions in this Distribution Code, Power Park Modules with a Registered Capacity of less than 1MW shall comply with the following provisions:
- a) Unity power factor (0 MVar exchange) will be maintained at the Connection Point



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(within a tolerance of +/- 5% equivalent in MVA<sub>r</sub> of the Rated Capacity in MW) for all Active Power outputs of the Power Park Module

- b) During network disturbances there should be no fault current supplied to the network from the Power Park Module (equivalent to a K factor of 0 as per 4.14.16 a)

## ANNEX 3.1

### PLANNING DATA

#### Small Connections (Limited Standard Planning Data)

For new or modified **Small Connections**, it is possible in most cases to assess whether a proposed connection is acceptable, and to determine the necessary supply arrangements, from analysis of the following limited **Standard Planning Data** provided by the **User**:

- (a) The requested **Connection Capacity** in **kVA**;
- (b) Type and electrical loading of **Equipment** to be connected, e.g. number and size of motors, cookers, showers, space and water electrical heating arrangements, including (if applicable) details of equipment that is subject to switching by the **Disco**; and
- (c) Date when the new or modified connection is required.

#### Medium Connections

For new or modified **Medium Connections** the required **Standard Planning Data** provided by the **User** will include, in addition to indicated previously:

- (a) Rated voltage, frequency and number of phases at which supply is required:
- (b) Expected Point of Connection to the **Distribution System** (geographical and electrical). Location of load with a location map drawn to scale,
- (c) Single line diagrams of existing and proposed arrangements of main **Plant** and **Apparatus** showing equipment rating and operating parameters.
- (d) For all types of load:
  - (i) Requested **Connection Capacity (kVA)**.
  - (ii) Maximum **Active Power Demand (kW)**.
  - (iii) Maximum **Reactive Power** requirements (**kVAr**).
- (e) For Fluctuating Loads:
  - (i) The rate of change of the **Demand**;
  - (ii) The switching interval; and
  - (iii) The magnitude of the largest step change.
- (f) Type and electrical loading of equipment to be connected, e.g. number and size of motors, electrical heating arrangements, etc.
- (g) Description of equipment:
  - (i) Motors: (State the purpose and number of installations, voltage and kW/MW rating, method of starting, starting current and duration, type of motors, types of drives and control Equipment etc.)
  - (ii) Heating: (Type and kW rating)
  - (iii) Furnace: (Type, Furnace Transformer capacity and voltage ratio)

- (iv) Electrolysis: (Purpose and kVA capacity)
- (v) Lighting: kW Demand.
- (vi) Any other loads with particulars:
- (h) Sensitivity of Demand to fluctuations in voltage and frequency of supply at the time of peak load: (Give details).
- (i) Phase unbalance imposed on the System:
  - (i) Maximum:
  - (ii) Average:
- (j) Maximum harmonic content imposed on the System (Furnish details of devices proposed for the suppression of harmonics).
- (k) Details of the loads likely to cause demand fluctuations greater than 1 MW at the point of connection including voltage dips (percentage) lasting for 5 seconds or more.
- (l) Details of any Load Management scheme to be applied by the **User** on the **User System**.
- (m) Three phase short circuit infeed from all sources within the **User's System**, based on Generation Set sub-transient reactance and the minimum zero phase sequence impedance of the **User's System**.
- (n) **Reactive Power** switching arrangements:
  - (i) Rated Capacity (MVAR);
  - (ii) Rated Voltage (**kV**);
  - (iii) Type (*e.g.*, shunt inductor, shunt capacitor, static var compensator); and
  - (iv) Operation and control details (*e.g.* fixed or variable, automatic, or manual).
- (o) Grounding arrangements
- (p) Standard load profiles
- (q) In the cases the **User** is connected to the **Distribution System** through a step up transformer:
  - (i) Rated MVA;
  - (ii) Rated voltages (**kV**);
  - (iii) Winding arrangement;
  - (iv) Positive and zero sequence resistance and reactance
  - (v) Tap changer range, step size and type (on-Load or off-Load); and
  - (vi) Basic Lightning Impulse Insulation Level (**kV**).

### **Large Connections (Detailed Planning Data)**

For new or modified **Large Connections** the **Planning Data** supplied by the **User** will include, in addition to that required for Medium Connections:

- (a) **Load** data

- (i) Type of load and control arrangements (e.g. controlled rectifier or large motor drives and type of starter employed).
  - (ii) Maximum load on each phase at the time of **Peak Demand**
  - (iii) **Demand** profiles (48 x half hour average estimates) for **Active** and **Reactive Power Demand** for the day of **Distribution System Peak Demand** and for the day of the **Transmission System Peak Demand**.
  - (iv) In relation to **Fluctuating Loads**
    - The rates of change of **Demand (Active Power and Reactive Power)** both increasing and decreasing.
    - The shortest repetitive time interval between fluctuations in **Demand (Active Power and Reactive Power)**.
    - The magnitude of the largest step changes in **Active Power and Reactive Power**, both increasing and decreasing
    - Sensitivity of **Demand** to fluctuations in voltage and frequency of supply at the time of **Peak Demand**: Voltage sensitivity (**kW/kV** and **kVAr/kV**) and Frequency sensitivity (**kW/Hz** and **kVAr/Hz**).
- (b) Equipment data
- (i) Circuit parameters (positive and zero sequence resistance and reactance; positive and zero sequence shunt susceptance) of the overhead lines and/or underground cables from the **User's** substation to the **Connection Point** in the **Distribution System** (if they are different)
  - (ii) for the switchgear, including circuit breakers, **Load** break switches, and disconnect switches at the **Connection Point** and at the substation of the **User** (if they are different):
    - Rated voltage (**kV**);
    - Rated current (A);
    - Rated symmetrical **RMS** short-circuit current (**kA**); and
    - Basic Lightning Impulse Insulation Level (**kV**).

### **Generators (Detailed Planning Data)**

**Users** seeking connection to the **Distribution System** for Generation Connected to the **Distribution System** greater than 50 kW shall provide the following additional information of each Generation Unit:

- (a) Rated Capacity (MW) on a monthly basis if applicable;
- (b) Minimum Stable Loading (MW);
- (c) Reactive Power capability;
- (d) Stator armature resistance;
- (e) Direct axis synchronous, transient, and subtransient reactances;

- (f) Quadrature axis synchronous, transient, and subtransient reactance's;
- (g) Direct axis transient and subtransient time constants;
- (h) Quadrature axis transient and subtransient time constants;
- (i) Turbine and **Generating Unit** inertia constant (MWsec/MVA);
- (j) Rated field current (amps) at rated MW and MVAR output and at rated Terminal voltage; and
- (k) Short circuit and open circuit characteristic curves.
- (l) Information on Step-up Transformers:
  - (i) Rated MVA;
  - (ii) Rated voltage (**kV**);
  - (iii) Voltage ratio;
  - (iv) Positive sequence resistance and reactance (maximum, minimum, and nominal tap);
  - (v) Zero sequence resistance and reactance;
  - (vi) Tap changer range;
  - (vii) Tap changer step size; and
  - (viii) Tap changer type: on **Load** or off circuit.

In addition with the data specified previously, the following data could be required by the **Disco** for all **Generating Units** with Rated Capacity greater than 5 MW:

- (a) Parameters for the excitation control **System**:
  - (i) DC gain of Excitation Loop;
  - (ii) Rated field voltage;
  - (iii) Maximum field voltage;
  - (iv) Minimum field voltage;
  - (v) Maximum rate of change of field voltage (rising);
  - (vi) Maximum rate of change of field voltage (falling);
  - (vii) Details of Excitation Loop described in diagram form showing transfer functions of individual elements;
  - (viii) Dynamic characteristics of over excitation limiter; and
  - (ix) Dynamic characteristics of under excitation limiter.
- (b) Parameters for the speed-governing control **system**:
  - (i) Governor average gain;
  - (ii) Speeder motor setting range;
  - (iii) Speed droop characteristic curve;
  - (iv) Time constant of steam or fuel governor valve or water column inertia;
  - (v) Governor valve opening limits;

- (vi) Governor valve rate limits; and
- (vii) Time constant of turbine.
- (viii) A governor block diagram showing the transfer functions of individual elements.
- (c) Auxiliaries data:
  - (i) Normal unit-supplied auxiliary **Load** for each **Generating Unit** at rated MW output; and
  - (ii) Each Generation Unit auxiliary **Load** other than (a) above and where the station auxiliary **Load** is supplied from the **Distribution System**.

The following **Plant** flexibility performance data for each **Generating Plant** shall be submitted:

- (a) Existence of Black Start Capability
- (b) Rate of Loading following Shutdown
- (c) Rate of **Load** Reduction from normal rated MW; and
- (d) Regulating range

## PART 3: DISTRIBUTION OPERATING CODE (DOC)

### 1. SECTION: PURPOSE AND SCOPE

#### 1.1. INTRODUCTION

- 1.1.1. In order for the Disco to operate the Distribution System efficiently and to ensure maximum System security and safety, there is a need for some Users to provide loading and generation output information to the Disco. This Demand and generation forecasting information is required to enable the Disco to plan and maintain the integrity of the Distribution System.
- 1.1.2. It is also required to normalize the procedures and practices to be followed under normal operation and on emergencies, as well as the procedures to be followed for a safe and efficient operation of the Distribution System by the Disco and by the Users.
- 1.1.3. The objectives of this Distribution Operating Code are to:
  - (a) Set out the Demand forecast and Generating Plant Output information required to be provided by Users to the Disco
  - (b) set out the Operational Planning procedures and a typical timetable for the co-ordination of outage requirements of Directly Connected Generators to enable the Disco to adequately operate the Distribution System.
  - (c) establish procedures to enable the Disco, following an instruction of the System Operator or otherwise, to achieve reduction in Demand.
  - (d) provide for the exchange of information so that the implications of the Operation and/or Event can be considered and the possible risks arising from it can be assessed and appropriate action taken by the relevant party.
  - (e) enable co-ordination between all Users with a common approach to give uniformity of priorities to restart or to operate the system in normal and abnormal situations.
  - (f) facilitate the provision of more detailed information in writing and, where agreed between the Disco and the Users involved, joint investigation of those Significant Incidents.
  - (g) ensure that at any site where there is an Ownership Boundary every item of Apparatus has numbering and/or nomenclature that has been mutually agreed and notified between the owners concerned to ensure the safe and effective Operation of the Systems involved and to reduce the risk of error.
  - (h) Ensure that the procedures for arranging and carrying out of System Test do not threaten the safety of either personnel or the general public and cause minimum threat to the security of supplies.
  - (i) Set out procedures to be followed for establishing and reporting System Test.

#### 1.2. SCOPE

- 1.2.1. For safe operation of the networks, Discos may request for additional information from Users from time to time. Users of the Distribution System, which this Operating code applies, are:
  - (a) Customers with a Demand greater than 1MW

- (b) Directly Connected Generators whose output is greater than 100kW where the Discos consider it appropriate.
- (c) Retailers / Marketers acting on behalf of their Customers
- (d) Inter connected Network of other Discos
- (e) Other customers connected to the Distribution Network which the Discos consider their operation(s) has major impact on the network



## 2. SECTION: OPERATIONAL PLANNING

### 2.1. OBJECTIVE

- 2.1.1. The objectives of this Operational Planning Section are:
- (a) to set out the information required by Discos from Users about their Forecasted Demand or generation that are required to operate their Distribution System. Such information (e.g. expected load consumption, power output in case of Directly Connected Generation etc.) provided by Users will enable the Discos operate their network in a safe and reliable manner, while complying with their obligations under their respective Licenses and the Distribution and Grid Codes.
  - (b) To set out the Discos Operational Planning procedure and typical timetable for the co-ordination of outage requirements of Users equipment, plant and apparatus to enable the Discos to operate the Distribution System in a safe and reliable manner.
  - (c) To specify the information to be provided and procedure for exchange of information by Users of the Distribution System to Discos to enable the Discos to comply with its obligations under the relevant Distribution and Grid Codes.

### 2.2. GENERAL

- 2.2.1. Operational Planning within the terms of the Distribution Code comprises the co-ordination through various timescales, of planned outages of Plants, Equipment and Apparatus which affect the Operation of the Distribution System.
- 2.2.2. Operational Planning also enables a Distribution Company to meet its Distribution License obligation to provide certain information specified in the relevant Grid Code and establishes procedures to enable the collection of such data from Users to enable the Discos maintain the safe integrity of the Distribution System, Users are required to provide their Forecast Demand and its profile at different time scales and in case of Directly Connected Generation their expected output level at different time scale. In compliance with the Grid Code, when required, Discos on behalf of the System Operator will collect relevant information about their Demand Forecast and pass it on to the System Operator.
- 2.2.3. To ensure compliance with relevant sections of the Distribution and Grid Codes, the Discos will use this information to plan for the expected network loading in the operational phase and future expansion of their network. This information shall be in writing as specified in Annex 3.1.

Where Demand data is required from the User, this means the MW Demand of Electricity at the Connection Point between the Disco and User. The Disco may, in certain cases, specify that the Demand data shall include the MVA<sub>r</sub> Demand. .

- 2.2.4. The information provided by Users of the Distribution System and the System Operator will form the basis of Operational Planning, in order for the Discos to fulfill the requirements of the Distribution Code.

### 2.3. USERS REQUIRED INFORMATION TO DISCOS

- 2.3.1. Operational Planning and Demand Forecast apply to the following Users of the Distribution System which are connected at HV level of the network

- (a) HV Customers where the Discos consider it appropriate.
- (b) Customers with own Generation where the Discos reasonably considers it appropriate.
- (c) Directly Connected Generating Plant in the Discos Distribution System whose Registered Capacity is greater than 100kW, or where the Discos reasonably consider it appropriate.
- (d) Other network(s) connected to the Disco's Distribution System.

#### 2.3.2. Other Plant and Apparatus

Information relating to all Plant and Apparatus connected to the Distribution System, or that which may affect its Operation, shall be co-coordinated with the Discos.

## 2.4. TIMESCALES AND DATA

- 2.4.1. Implementation of data gathering and timescales will be agreed between the Discos and each User. Due recognition will be given by the Discos to voltage levels and capacities of Plant and Apparatus when assessing information requirements.
- 2.4.2. All information shall be provided on a Weekly basis as a minimum, where Week 1 commences in the first week of January as published from time to time.
- 2.4.3. In this Section Year 0 means the current calendar year at any time, Year 1 means the next calendar year, Year 2 means the calendar year after Year 1, etc. Where Week 52 is specific read Week 53 in the appropriate years.
- 2.4.4. The rolling timescales involved in this Section are as follows:
  - (a) Operational Planning Phase
    - (i) Long Term - Calendar years 1 and 2 ahead
    - (ii) Short Term - The current calendar year 52 weeks ahead down to 9 weeks ahead
  - (b) Programming Phase
    - (i) 24 hours to 8 weeks ahead inclusive
  - (c) Control Phase
    - (i) 0 to 24 hours ahead

## 2.5. DEMAND FORECAST

#### 2.5.1. Demand Forecast Information

The Discos will collect Demand forecast information for each Grid Supply Point on their network, to meet the requirements of the relevant Distribution and Grid Codes. The Discos will aggregate forecast information provided by Users, where appropriate, and provide forecast information for their planning periods and to the System Operator where the Demand, or change in Demand, is greater than 1 MW at any Disco Connection Point.

- 2.5.2. Users shall supply Forecasted Demand information as specified below and as set out in the relevant Schedules of the Data Registration Requirements in Appendix 2:
  - (a) Long Term Planning Phase (next 2 years ahead)

Users' information required by Discos is shown below. This information shall reach the Discos by Calendar week 30 of each year:

- (i) Active and Reactive Power, plus Power Factor at peak periods for the specified timescale at the associated Grid Supply Points and at the specified times required by the System Operator.
- (ii) Active and Reactive Power, plus Power Factor of Directly Connected Generators. In addition, where the generation output may have a particular impact on the security or stability of the System then the Disco may request the following information:
  - a.ii.1) Weekly peak: Active and Reactive generation output at the time specified by the System Operator.
  - a.ii.2) Planned outage programme.
- (b) Programming Phase (24 hours to 10 weeks)

Users information with regular updates required by Discos are shown below. This information shall reach the Discos by 16:00hrs of Friday of every Calendar week.

- (i) Users demand greater than 1MW and periods of the day for this demand.
- (ii) Users demand control programme greater than 1MW and periods for this programme.
- (iii) Forecasted availability for Directly Connected Generator(s) and their output.
- (iv) Any other information required by the Discos.
- (c) Control Phase – 0 to 24 hrs ahead

Users shall provide the following information to the Discos at reasonable times to be specified by the Disco for the un-expired period covered in the Control Phase.

- (i) Details from Users connected to the Distribution System of any change in aggregated Demand at the point of supply greater than 1MW of the Demand.
- (ii) Details from difference amount and duration of their proposed use of Demand Control programme aggregated to 1MW or more (averaged over any half- hour period).
- (iii) Details of any differences greater than 1MW from the schedules of operation of any Directly Connected Generator on a half hourly basis.

### **Forecast Factors**

- 2.5.3. Discos and Users shall take the following factors into account when conducting Demand forecasts in the Operational Planning Phase.
- (a) Historic Demand data and trends
  - (b) Weather forecasts (responsibility for weather correction of User's Demand rests with the User).
  - (c) Incidence of major events or activities.

- (d) Directly Connected Generation Set Schedules
- (e) Interconnection with adjacent Discos.
- (f) Users operated Demand Control.
- (g) Any other factor reasonably considered necessary.

### **Energy Audit**

- 2.5.4. The Disco shall have centres for Energy audit in its Authorised Area. Cities and towns with population of 20,000 and above, plus Grid Supply sub stations shall qualify for such centres and be accountable for the Energy sales and calculation of distribution losses. Load survey meters with a memory retaining capacity of at least 45 days shall be installed for all the incoming/outgoing feeders in the area identified for each centre.
- 2.5.5. The Disco shall carry out Energy audit of his total system compiling the data and analysis carried out in each centre. The Energy received from each substation shall be measured at the 11kV terminal switchgear of all the outgoing feeders installed with appropriate Energy meters such that the Energy supplied to the each division is accurately available. It shall be compared with the corresponding figures of monthly Energy sales and the distribution loss for each division shall be worked out.

## **2.6. MAINTENANCE PLANS**

- 2.6.1. Long Term Programme (2 Calendar years ahead)
- (a) Each year, the Discos will prepare a Long Term Programme covering 2 years ahead which will include Distribution System outages and directly connected Generating Plant outages, where the Disco reasonably considers it appropriate, which may affect the performance of the total System.
- 2.6.2. Users and Directly Connected Generators where the Discos reasonably consider it appropriate will provide the Disco with information in accordance with Appendix 2. . Users and Directly Connected Generators shall also provide to the Disco information regarding their provisional Maintenance Plan for the following years. The following information shall be included in the User's provisional Maintenance Program for its System or Equipment.
- (a) identification of the Equipment and the MW capacity involved;
  - (b) reasons for the maintenance;
  - (c) expected duration of the maintenance work;
  - (d) preferred start date for the maintenance work and the date by which the work shall have been completed; and
  - (e) if there is flexibility in dates, the earliest start date and the latest completion date.
- 2.6.3. The Long Term Program shall be developed taking into account the following:
- (a) the forecasted Demand;
  - (b) the Maintenance Plan actually implemented;
  - (c) the requests by Users for changes in their maintenance schedules;
  - (d) the requirements for the maintenance of the Grid;

- (e) the need to minimise the total cost of the required maintenance; and
- (f) any other relevant factor.

2.6.4. If a User is not satisfied with the Maintenance Schedule allocated to its Equipment, the User may notify the Disco to explain its concern and request changes in the Long Term Program. The Disco shall endeavour to accommodate the User's request in preparing the Long Term Program.

2.6.5. The Disco shall advise Users or Directly Connected Generators who may be significantly affected by particular outages of Distribution Plant or Apparatus, of the dates and duration of the outages. If there are objections from Users, the Disco shall attempt to resolve the problem. The Disco shall make all reasonable attempts to revise the Long Term Program to accommodate the User's concerns. If no reasonable alternative exists, then the Disco may take the outage despite that User's or Generator's concerns. If no reasonable alternative exists, the parties concerned will refer the matter to the NERC.

2.6.6. Short Term Programme (Current year 52 weeks ahead down to 9 weeks ahead)

The previous Medium Term Programme will be updated to form the basis of the Short Term Programme. The Discos will continually review this Programme as necessary and periodically discuss it with the relevant parties as appropriate.

It will take account of such review and discussions and any additional outages and the following further details of each outage proposed will be notified at this stage by the appropriate party:-

- (a) Return to service times of circuits (if different from programme).
- (b) Specific Plant and Apparatus to be worked upon
- (c) Any other information that may be reasonably specified by the Discos from time to time.

At any time and from time to time during the current calendar year up to the Programming Phase (8 weeks ahead), Users may notify reasonable changes and additions to the outages previously notified during the Medium Term Planning process. The Discos will consider whether the changes will adversely affect System security, stability or other parties, and will discuss with the party in question. Whether the change is so discussed the Discos will inform the other affected Users

2.6.7. Programming Phase (24 hours to 8 weeks ahead inclusive)

The Short Term in the Planning Phase will form the basis of the Programming Phase and a rolling suggested programme for the following week and subsequent 10 week period respectively will be prepared weekly by the Disco.

The Disco will update the programme each week and take account of any additional or varied outages. Any decision to depart from the outages and actions determined during this phase will immediately be notified to the Disco, who will inform other affected parties.

Generation Scheduling Information (Programming Phase 24 hours to 8 weeks ahead inclusive). The Disco will obtain Scheduling information from Directly Connected Generators for Generating Plant.

The Scheduling information will specify the following on an individual Generation Unit basis:

- (a) The period the set is required
- (b) The planned half hourly output
- (c) Any other information the Disco reasonably considers necessary

2.6.8. Control Phase (0 to 24 hours ahead)

During the real time Operation any changes to the outage programmes for the day shall be at the discretion of the Disco.

## 2.7. PLANNING PHASE – TIME SCALE

2.7.1. Planning Phase – The requirements for applying Directly Connected Generating Units or Power Park Modules to the Disco's Distribution System. Each Calendar Year by:

- (a) WEEK 2 - Directly Connected Generators provide the Disco with a provisional Generating Plant outage programme for up to 2 Year ahead specifying the Generation Set and MW concerned, the preferred date for each proposed outage, and where there is a possibility of flexibility, the earliest start date and latest finishing date where applicable.
- (b) WEEK 4 - Disco will inform Directly Connected Generators of Output Usable requirements for weeks 9-52.
- (c) WEEK 10 - Directly Connected Generators will provide the Disco with estimates of each Generating Plant Output Usable for weeks 18-52
- (d) WEEK 12 - The Disco will after discussion with the Directly Connected Generator provide the appropriate Directly Connected Generator with details of Disco's Distribution System constraints and potential Disco's Distribution System requirements during each week of Years 1 and 2 for an outage together with any suggested changes to its proposed Generation Set outage programme. The Disco will notify each Directly Connected Generator of Output Usable requirements for Years 1 and 2 (weeks 1 to 52).
- (e) WEEK 25 - Directly Connected Generators will provide the Disco with estimates of each Generating Plant Output Usable for weeks 28-52.
- (f) WEEK 28- Users within the Disco's distribution services area will provide the Disco with details of outages due to take place during the Years 1 and 2 which may affect the performance of the Disco's Distribution System. This will comprise updating the programme for Years 3 ahead where appropriate and including any subsequent requests.

In addition to outage proposals, the programme shall include Trip Testing, Risks of Trip, and other information where known which may affect the security and stability of the Disco's Distribution System.

- (g) WEEK 42-The Disco after discussions with the Directly Connected Generator(s) will notify each Directly Connected Generator with details of any suggested revisions necessary to maintain Disco System security to the updated provisional Generating Plant outage programme previously supplied.
- (h) WEEK 43- Following consultation with Users, the Disco will include these outage proposals in the Planning Programme.

### 3. SYSTEM OPERATION

#### 3.1. GENERAL

- 3.1.1. This Section specifies the procedures and practices to be followed for a safe and efficient operation of the Distribution System by the Disco and by the Users of the Distribution System of their Equipment / Apparatus and lines which are connected to the Distribution System. This shall also apply to any electrical interface between two Discos for a safe and efficient operation of the interface.
- 3.1.2. The following aspects of operation are covered in this Section:
- (a) Demand Estimation,
  - (b) Outage Planning,
  - (c) Contingency Planning,
  - (d) Demand Management and Load Shedding,
  - (e) Interface with Directly Connected Generating Unit or Power Park Module
  - (f) Metering and Protection,
  - (g) Communication,
  - (h) Monitoring and control of Voltage, Frequency and Power Factor,
  - (i) Major Incident and Accident reporting,
  - (j) Maintenance and Testing,
  - (k) Tools and Spares,
  - (l) Training.

#### 3.2. DEMAND ESTIMATION

- 3.2.1. In pursuant of Section 2 of this Code, the Disco shall estimate its hourly and daily Demands at each point of interconnection on the basis of relevant Load Curves drawn on day-ahead basis subject to modifications depending upon the communications received from any specific User or caused by any contingency.
- 3.2.2. For this purpose, the concerned Users identified by the Disco shall furnish the required data pertaining to their Demands of their installations to it.

#### 3.3. OUTAGE PLANNING

- 3.3.1. Pursuant to Part 2 Section 2 of this Code, the Disco shall furnish his proposed outage programs to the System Operator on a month-ahead basis.
- 3.3.2. The outage program shall contain identification of Lines and Equipment of the Distribution System proposed to be taken out of service, date of start of outage, duration of outage, quantum of load restricted at any interconnection point during outage.
- 3.3.3. The outage plan proposed by the Disco shall come into effect only after the System Operator releases the finally agreed Transmission outage plan.

- 3.3.4. Notwithstanding any approved outage plan,, the Disco shall not take any circuit/equipment out of service before intimating and obtaining the consent of the designated officer of the System Operator. This shall however, not apply under the following circumstances:
- (a) in cases where the estimated power input and output at interconnection points is not affected;
  - (b) emergency situations to save plant and machinery;
  - (c) in such unforeseen emergency situations requiring isolation of Lines or Equipment to save human life;
  - (d) disconnection to be effected on any User installation due to violation of Connection Agreement. In this case the Nigerian Electricity Regulatory Commission shall be informed wherever the load to the extent of 1 MW or more is affected.
- 3.3.5. Maintenance of the Distribution System may require outages that interrupt the supply to a User or group of Users. In such cases, the Disco shall:
- (a) Notify the affected Users at least [72 hours] in advance. Longer notice periods may be agreed between a User and a Disco. This notification could be made by advertising the interruption in at least two newspapers of major distribution. The notification should contain, as a minimum, a clear indication of the zone affected by the interruption, the interruption starting date, the expected duration, and the reason of the interruption, including the Plant or Equipment to be maintained.
  - (b) Notify, utilising the procedures indicated in Part 3 Section 3.7 of this Code, to large Users, Directly Connected Generators and Users with essential Loads.

### 3.4. CONTINGENCY PLANNING

- 3.4.1. A contingency situation may arise in the event of a Total or Partial Blackout in the Transmission System. A contingency may also arise on a part of the Distribution System due to local breakdowns in the Distribution System itself or a breakdown in the Equipment /Apparatus of Users of the Distribution System or TSP at the point of interconnection.
- 3.4.2. These Contingencies are classified as:
- (a) **System** Blackout (Total or Partial).
  - (b) Distribution System failure.
  - (c) Failure of Equipment of the **T**ransmission Licensee
- 3.4.3. System Blackout:
- (a) In case of a total or partial blackout at any point of interconnection, the Disco shall follow the black start procedures framed by the System Operator as required in the Grid Code.
  - (b) The Disco shall sectionalise the Distribution System into discrete, unconnected blocks of demand. It shall advise the System Operator of the amount of MW load likely to be picked up on switching each demand block.
  - (c) The Disco shall prepare a schedule of Essential and non-essential Loads in order of priority at each interconnection to be picked up during the restoration process. The



schedule is to be approved by the **System Operator** and forwarded to the **Commission**. Such schedule shall be updated continually. The schedule shall conform to provisions of the **Grid Code**.

- (d) The Disco shall ensure and maintain the load generation balance under the direction of the System Operator.
- (e) The Disco shall maintain direct communication links with the System Operator until the System is restored to Normal Conditions.
- (f) To co-ordinate activities, **Users** and the **Disco** will ensure that there are suitable communication paths available and that where appropriate senior members of staff are appointed to manage these abnormal situations. The Disco shall furnish the names and designations of the person(s) along with their telephone numbers and location, authorized to deal with contingency operations, to the System Operator. This list shall always be kept up to date.

#### 3.4.4. Distribution System Failure:

- (a) Interruptions to power supply in any part of the Distribution System lasting for more than two hours due to breakdown in any part of the Distribution System may be termed as a Distribution System Failure.
- (b) The Discos shall evolve a restoration process for such a Distribution System Failure.
- (c) If a part of the **Distribution System** to which a Directly Connected **Generator** is connected becomes isolated from the **Distribution System**, the **Disco** shall decide if it is desirable for the Directly Connected **Generator** to continue operating.
- (d) If no facilities exist for the subsequent resynchronization with the rest of the **Distribution System**, the **Disco** shall issue an instruction to the Directly Connected **Generator** to disconnect its **Generating Unit or Power Park Module** to enable the Island Grid to be reconnected to the rest of the **Distribution System**.

#### 3.4.5. Failure of the Apparatus on the Transmission System

- (a) The Disco shall immediately contact the System Operator or the authorized person at the substation of the TSP, and assess the probable period of restoration and the probable restriction on load from the affected substation.
- (b) The Disco may implement the Demand Side Management plan according to Agreement with Users of its network, as necessary.

### 3.5. DEMAND MANAGEMENT AND LOAD SHEDDING

3.5.1. Demand Management may be resorted to, for maintaining the Load Generation balance as instructed by the System Operator. This may also be necessary due to loss of circuit or equipment or any other operational contingency.

3.5.2. The term “Demand Management” is used to describe any or all of these methods of achieving a Demand Reduction:

- (a) Voluntary User Demand Management initiated by the Disco;
- (b) Automatic under frequency load shedding;

- (c) **User Demand** reduction including Voltage Reduction.
- (d) Emergency manual **User Demand** reduction.
- 3.5.3. Where instructed by the **System Operator**, temporary load shedding shall be carried out to maintain the load generation balance. This may also be necessary due to lack of generation, loss of any circuit, equipment or any other operational contingency.
- 3.5.4. **User Demand** may be disconnected automatically at selected location in accordance with the requirements of the **Grid Code**, in the event of a sudden fall in frequency. Such an arrangement shall be carefully co-ordinated as part of an overall scheme and may take into account any operational requirements or Essential Load.
- 3.5.5. Deliberate reduction in **System** frequency may also be used to achieve a temporary reduction in load **Demand** in accordance with the **Grid Code**. Emergency manual load shedding may be also carried out on the **Distribution System** if so instructed by the **System Operator**.
- 3.5.6. The Disco shall estimate Loads that may be shed in discrete blocks at each Grid Supply Point in consultation with the Users supplied through such point as required. Such Users shall cooperate with the Disco in this regard.
- 3.5.7. The Disco shall work out the sequence of Load Shedding operations and the detailed procedure shall be furnished to the person(s) in-charge of substations concerned where such Load Shedding has to be carried out. In case of automatic load Shedding through under frequency relays, the circuits and the amount of Load to be interrupted with corresponding relay settings shall be intimated to the **System Operator** and person(s) in charge of the substations of the Disco Network.
- 3.5.8. Where Demand Management is exercised by the **Disco** on instruction or request from the **System Operator** in order to safeguard the **System Security**, then the **Disco** is required to respond to these requests promptly but shall liaise with and inform other Users so far as is reasonably practicable.
- 3.5.9. Once an automatic or manual disconnection, either due to low frequency or voltage problems, has taken place, it shall not be reconnected until the **Disco** is instructed by the **System Operator** to do so in accordance with this Code. Each **Disco** shall abide by the instructions of the **System Operator** with regard to reconnection without delay.
- 3.5.10. If the duration of Load Management to any part of the **Distribution System** exceeds [3 hours], the public should be intimated promptly through the media. The Consumers with Demand of 1 MW and above and the essential services such as Hospital, Public Water Works etc. shall be intimated over the telephone or any other means of communication possible.
- 3.5.11. In the event of a sustained period of shortfall, due to any constraint in the **Transmission System** and/or **Distribution System**, then planned rotational load shedding may be used to share the available power among affected Users.
- 3.5.12. In the event of load shedding under the **Disco's** planned load shedding rotas, the public shall be promptly notified of such **Disco's** arrangements through the media or on a web site. Users with contract Demands of [1 MW] and above and Essential Load such as hospital, public water works etc. shall be notified also by telephone or any other means of communication possible.

- 3.5.13. In addition, Directly Connected Generators may wish to disconnect, automatically or manually, their Plant from the System to which it is connected at certain frequency levels. Any such disconnection will be agreed with the Disco or the System Operator, as required, in accordance with the Distribution Planning and Connection Code.
- 3.5.14. All the Standards and Procedures related with the Load Shedding, including automatic load shedding, load shedding exemption policies, rotational load shedding and User's communications should be contained and documented in a Distribution Load Shedding Plan. Discos shall permanently maintain and update this document, which should be submitted to the Commission for revision and approval, if instructed to do so.

### 3.6. METERING AND PROTECTION

#### 3.6.1. Operational metering:

The minimum requirement of Operational metering at the Distribution System substations shall be as follows:

(a) 33 kV/11 kV substations:

- (i) 33 kV Bus Voltage
- (ii) 11 kV Bus Voltage
- (iii) 33 kV incoming/outgoing current in each phase and each circuit
- (iv) Power Transformer Primary and Secondary Currents in each phase of every Transformer
- (v) 11 kV outgoing feeder currents in each phase for each feeder
- (vi) Power Factor in each 11 kV feeder
- (vii) Load survey meters having memory duration of at least 45 days for all the incoming and outgoing feeders (both 33 and 11 kV)

(b) User's system with Demand of 1 MW and above:

- (i) Voltage
- (ii) Current
- (iii) Load
- (iv) Power Factor

#### 3.6.2. Tariff and Commercial Metering:

- (a) Tariff metering shall be provided at each point of connection between the Distribution and Transmission Systems in accordance with the Grid Code, the Metering Code and the Transmission Connection Agreement.
- (b) Commercial metering shall be provided at the connection points between the User's System and the Distribution System and shall be governed by the provisions in the Metering Code and Distribution Connection Agreement.

#### 3.6.3. Measurement of energy import/export

- (a) The Disco shall install the following meters for all of their lines connecting the Generating Stations, and substations for the measurement of Energy import/export from each line, Energy generated in generating units or Power Park Modules and Energy consumed in Power Stations and substations:
  - (i) Active Energy import.
  - (ii) Active Energy export.
  - (iii) Reactive Energy import.
  - (iv) Reactive Energy export.
- (b) All metering equipment shall comply with the provisions in the Metering Code.

#### 3.6.4. Protection System:

- (a) Protection settings shall not be altered, or protection bypassed and/or disconnected without consultation and agreement of all the affected parties. In case the protection has been bypassed and/or disconnected by agreement due to any cause, the same should be rectified and protection restored to normal condition as quickly as possible. If Agreement has not been reached, the electrical Equipment shall be isolated forthwith.
- (b) The settings of protective relays for 33 kV and 11 kV lines shall be that a fault in any section does not affect the section between Directly Connected Generating Units or Power Park Modules and the faulty section under all conditions. Discos shall notify the initial settings and any subsequent changes to Directly Connected Generating Units or Power Park Modules from time to time.
- (c) Routine checks on the performance of the protective relays shall be conducted and any malfunction shall be noted and corrected as soon as possible. Short circuit studies required for deciding the relay settings shall be conducted by the Disco with the data collected from Directly Connected Generating Units or Power Park Modules and other Users of the Distribution Network. Representatives of the Directly Connected Generating Units or Power Park Modules, Discos, TSP and other Users shall meet periodically to discuss such malfunctions, changes in the system configuration, if any, and possible revised settings of relays.
- (d) The TSP shall be responsible for arranging periodical meetings between the Generating Companies and the Discos to discuss coordination of protection. The TSP shall investigate any malfunction of protection or other unsatisfactory protection issues. The concerned parties shall take prompt action to correct any protection malfunction or other unsatisfactory protection issue as discussed and agreed to in these periodical meetings.

## 3.7. COMMUNICATIONS

- 3.7.1. Reliable communication links shall be established for exchange of data, information and operating instructions between the Disco, Users and TSP. Only for this chapter, User means:
  - (a) Consumers with Demand of 1 MW and above
  - (b) Consumers connected to the AV network AV FOR VERIFICATION
  - (c) Directly Connected Generating Units or Power Park Modules
- 3.7.2. Data communication channels shall be provided to support the metering, operations and protection systems. Automated channel monitoring and failure alarms shall be provided for protection of communication infrastructures and channels if such failure can cause undesired

protection operation. The Reliability and Availability of the communication system(s) shall be of acceptable quality levels and in accordance with the prevailing telecommunication standards.

### 3.7.3. Communication facilities

All communication equipment **deployed** by the Discos and Users of the Distribution System shall comply with the applicable International Telecommunications Union (ITU) and International Electrotechnical Commission (IEC) standards. This shall apply to Remote Terminal Units (RTU), Supervisory Control and Data Acquisition (SCADA), Relays, Telephone, Telegraph, and other relevant communications equipment and shall meet such standards as stipulated by the Nigeria Communication Commission (NCC) and the Standards Organisation of Nigeria (SON) and the working requirements of the Discos for their design or procurement and shall be provided at the reasonable cost to the Discos and Users of the Distribution System.

3.7.4. The **Disco** and each **User** connected to its **Distribution System** will nominate officers and agree communication channels to make effective the exchange of information. Communication should, as far as practicable, be direct between the **User** and the operator of the **Distribution System** to which that **User** is connected. However, this does not preclude communication with the **User's** nominated representative.

3.7.5. If the **Disco** decides that a back up or alternative route of communication and/or emergency communication is necessary for the safe operation of the **Distribution System**, the additional means of communication shall be agreed between the **Disco** and the **User**.

3.7.6. A list of duly authorized personnel and their telephone numbers shall be exchanged between the **Disco** and the **User** so that control activities can be efficiently coordinated. The **Disco** and the **User** shall maintain 24-hour availability for these duly authorized personnel when necessary.

3.7.7. In the case of an **Operation** on the **System** of a **User** connected to the **Distribution System**, which will have or may have an **Operational Effect** on the **Distribution System**, the **User** will notify the **Disco** in accordance with the procedures established in this **Code**.

- (a) In the case of an **Operation** on the **Distribution System** or on receipt of notification of an **Operation** on the **Transmission System**, which will have or may, in the opinion of the **Disco**, have an **Operational Effect** on the **System** of a **User** connected to the **Distribution System**, the **Disco** will notify the **User**.
- (b) An **Operation** may be caused by another **Operation** or an **Incident** on another's **System** and in that situation the information to be notified is different from that where the **Operation** arose independently of any other **Operation** or **Incident**. Whilst in no way limiting the general requirement to notify in advance, the following are examples of situations where, in as much as they may have or have had an effect on the **Operation** of the **Distribution System** or another **System**, notification will be required of:
  - (i) the implementation of a **Schedule Outage** of lines and/or **Equipment** which has been arranged pursuant to Part 3 Section 3.3 (Outage Planning);
  - (ii) the **Operation** of any Circuit Breaker or Isolator or any sequence or combination of the two, including any temporary over-stressing, **System** parallels, or **Generating Unit** or Power Park Module synchronizing; and

- (iii) voltage control.
- 3.7.8. In the case of an Incident on the **System** of a **User** connected to the **Distribution System**, which has had or may have had an Operational Effect on the **Distribution System** or on the **Transmission System**, the **User** will notify the **Disco** as soon as practicable.
- 3.7.9. The following are examples of situations where notification will be required if they have an Operational Effect:
- (a) The actuation of any alarm or indication of any abnormal operating condition;
  - (b) Adverse weather conditions being experienced;
  - (c) Breakdown of, or faults on, or temporary changes in the capabilities of, **Plant** and/or **Equipment** including Protection; and
  - (d) Increased risk of inadvertent Protection **Operation**.
- 3.7.10. The notification (other than in relation to the information which the **Disco** is merely passing on from a **User**) will be of sufficient detail to enable the recipient of the notification reasonably to consider and assess the implications and consequences arising from the **Operation** on the **Distribution System** and will include the name of the individual reporting the **Operation** on behalf of the **Distributor**. The recipient may ask questions to clarify the notification.
- 3.7.11. A notification under this **Section** will be given as far in advance as practicable and in any Incident shall be given in sufficient time as will reasonably allow the recipient to consider and assess the implications and risks arising. The notification will be dictated to the recipient who shall record it and on completion shall repeat the notification in full to the sender and check that it has been accurately recorded.
- 3.7.12. Except in an emergency situation the notification will be dictated to the recipient who shall record it and on completion shall repeat the notification in full to the sender and check that it has been accurately recorded.

### 3.8. SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

- 3.8.1. SCADA facilities shall be required in the Disco's Control Centre for the transmission and collection of signals plus indications to and from Remote Terminal Units. The signals and indications, which must be provided by Discos Equipment and if necessary Users equipment for transmission and collection by SCADA Equipment to the Disco's Control Centre shall be the signals and indications required for effective monitoring of the Distribution Network and may from time to time be upgraded to meet related operational requirements.
- 3.8.2. Remote Terminal Units (RTU) with their communication facilities shall be installed in the bulk load supply points of the Discos area and also on major Users load centres to collect real time operational data to be transmitted to the Disco's Control Centre. Provision and maintenance of wiring and signaling from these (RTU) to the Discos Control Centre shall be the responsibility of the Discos.
- 3.8.3. Each Disco shall be responsible for the provision, maintenance, reliability, integrity and security of their monitoring, communication and data gathering Equipment.
- 3.8.4. Access and Security

All SCADA, metering Equipment, computer and communications Equipment in use by the Discos and the information carried by it must be secured against unauthorised access. Procedures governing security and access shall be developed by the Distribution Code Review Panel, and adopted by the Discos, but shall allow for adequate access to the Equipment and information by the Discos and their authorised agent for the purposes of maintenance, repair, testing and the taking of readings.

### 3.9. VOLTAGE, FREQUENCY AND POWER FACTOR MONITORING AND CONTROL

- 3.9.1. The Disco shall monitor the Voltage, Frequency and Power Factors on the Distribution System at different points at peak and off-peak hours and take reasonable measures for improvement of the same in co-ordination with Directly Connected Generating Units or Power Park Modules, Users with Demand of 1 MW and above, and the System Operator.
- 3.9.2. Voltage monitoring and control
- (a) The Voltage monitoring at each substation feeding 11 kV Distribution Systems shall be carried out by data logging.
  - (b) The Voltage monitoring on the Low Voltage side of the Distribution transformers shall be carried out at least once a week during peak load hours to cover at least two transformers in each 11 kV feeder as follows:
    - (i) One Transformer at the beginning of the feeder.
    - (ii) One Transformer at the tail end of the feeder.
  - (c) Improvement to voltage conditions shall be achieved by operating On-Load Tap Changing Transformer (OLTC) wherever available in 33 /11 kV substations and by contacting over telephone the operators of Transmission Licensee at the point of interconnection, to correct Voltage at the sending end whenever required.
- 3.9.3. The Disco shall take Power Factor improvement measures at strategic points in the Distribution System by carrying out System Studies and installing the required Reactive Compensation Equipment.
- 3.9.4. Load monitoring

Station Log Sheets and Registers for Sub Station operations duly recording the hourly readings of the meters such as current, load, voltage etc., and the station operations shall be maintained at each station. A separate register for the daily energy meter readings for both the Energy received and Energy sent out shall be maintained along with the above.

- 3.9.5. Data Logging
- (a) All-important data such as Voltage, Current, Power factor, kW, Transformer data such as tap position, oil/winding temperature, etc shall be logged on hourly basis in all substations feeding distribution lines.
  - (b) The following records among others shall be maintained at each station:
    - (i) Operation and maintenance manuals for the Equipment and the entire station consisting of the details of operation of the station and maintenance of Equipment,
    - (ii) Maintenance registers for the Equipment and station batteries,

- (iii) Interruption Registers,
  - (iv) Line Clearance Register,
  - (v) Equipment registers.
- (c) A detailed analysis of the above data shall be made to assess the performance of the Equipment, overloading conditions and the necessity for major maintenance.

#### 3.9.6. Load balancing

- (a) The unbalanced load on the Low Voltage side of the Distribution transformers shall not exceed 10% of the peak load.
- (b) The secondary currents and voltages of the Distribution transformers shall be recorded at least once a month during expected peak load hours on all the phases.

### 3.10. SAFETY CO-ORDINATION

- 3.10.1. The Disco and the Users shall prepare safety manuals incorporating all the safety precautions to be taken for each component of the Distribution System based on the "Safety Standard for Distribution System" issued separately. All the safety rules and precautions shall be observed when work is to be carried out on any line, Equipment or Apparatus, switchgear or circuits in any part of the Distribution System or in any part of the User System. The safety manuals thus prepared shall be issued to all the Safety Control Persons and Users for compliance.

### 3.11. SIGNIFICANT INCIDENT AND ACCIDENT REPORTING

#### 3.11.1. Significant Incident

Every case where either or combination of the following happens:

- (a) malfunctioning of Equipment, Apparatus connected to the Distribution Network;
- (b) a person, or animal receives an electric shock, whether mild or serious or suffers an injury or burn, directly or indirectly due to electrical causes.

shall be treated as a Significant Incident. The Disco personnel in charge of the concerned Equipment, Apparatus or area shall report the incident immediately to the highest responsible officer of the Disco in charge within 12 hours. A designated officer from the affected Disco should reach the spot within 24 hours and assess the situation and probable cause of the accident, losses to consumers, and damage to Equipment, Apparatus of the Disco and or the User(s).

- 3.11.2. Whenever an accident occurs resulting in or likely to have resulted in loss of life or injury to human beings or animals, the above report should be followed by a detailed report within 48 hours. The Disco shall take all other statutorily required actions, such as reporting to the Police, Ministry of Energy and the NERC etc.
- 3.11.3. The Disco shall send a preliminary report to the Nigerian Electricity Regulatory Commission of all Significant Incidents in the Disco Area of Supply which results in interruption to service, substantial damage to Equipment, loss of life, injury to human beings and or animals within 36 hours of its occurrence followed by a detailed report within two weeks.



- 3.11.4. For every Significant Incident, NERC shall order an enquiry of the event. It should be completed with the least possible delay, in any case, not exceeding twenty days. It should be a searching probe that may or not involve members of the security forces to uncover the root causes of the accident, which sometimes are quite difficult to ascertain. The enquiry should not only fix responsibility for the accident, but it is more important, to spell out steps to be taken to prevent such accidents in future.
- 3.11.5. The Disco and the affected person or their agent shall establish a format and procedure for exchange of information for any Significant Incident event.
- 3.11.6. Users or their agent shall furnish information to the Disco regarding any major incident occurring on their Systems promptly.

### 3.12. INCIDENT REPORTING PROCEDURE

- 3.12.1. All reportable incidents occurring on the lines and Equipment of 11 **kV** and above at the 33 kV substations shall be promptly reported orally by the Disco whose Equipment has experienced the incident, to Users identified by the Disco and to the System Operator within one hour. The reporting Disco should submit a written report to the **NERC** within 24 hours of such oral report, if necessary such report should be sent to affected Users. If the reporting incident is of major nature, the written report shall be submitted within two hours duly followed by a comprehensive report within 48 hours of the submission of the initial written report. In other cases, the reporting Disco shall submit a report within five working days to the **NERC**

Where the incident impacts negatively on TCM network, the company should be duly informed as above.

- 3.12.2. The **NERC** shall call for a report from any Disco on any reportable incident affecting other Users and in case such User whose Equipment might have been a source of the reportable incident does not report the same. However this shall not relieve any User from the obligation to report Events in accordance with Incident Reporting Rules agreed with the Disco. The format for such a report shall be as per the approval of the Distribution Code Review Panel and shall typically contain the following:
  - (a) Location of the incident
  - (b) Date and time of the incident
  - (c) Plant or Equipment involved
  - (d) Ownership of the faulted Plant or Equipment
  - (e) Supplies / generation interrupted and the duration wherever applicable
  - (f) Amount of Generation lost, wherever applicable
  - (g) System Parameters before and after the incident: Voltage, Frequency, Load, Generation, etc.
  - (h) Network configuration before the incident
  - (i) Relay indications and performance of protection
  - (j) Brief description of the incident
  - (k) Estimated Demand Control relief undertaken

- (l) Estimated Demand shed Automatic/Manual
  - (m) Estimated time of return to service
  - (n) Any other relevant information
  - (o) Recommendations for future improvement
  - (p) Name and designation of the reporting person.
- 3.12.3. The report shall contain sufficient detail information to describe the Event to enable the recipient to assess the implications and risks arising out of the same. The recipient may ask for clarifications wherever necessary and it is obligatory that the reporting User shall put his best efforts and provide all the necessary and reasonable information.
- 3.12.4. In case of a request by either party, the oral report shall be written down by the sender and dictated by way of a telephone message or sent by Fax/e-mail to the recipient. In case of an emergency the report can be given only orally and followed by written confirmation.
- 3.12.5. Reporting of accidents shall be in accordance with the Incident Reporting Rules. If an accident occurs in the Distribution System resulting in or likely to have resulted in loss or injury to human or animal life, the Disco shall send a report to the Nigerian Electricity Regulatory Commission within 24 hours of the knowledge of such occurrence. This shall be followed by a written report in the form set out in the Incident Reporting Rules on the aspect of occurrence of fatal and all other accidents.

### **3.13. JOINT INVESTIGATION OF SIGNIFICANT INCIDENTS**

- 3.13.1. Where a Significant Incident has been declared and a report submitted under Part 3 Section 5.11 and 5.12 either party or parties may request in writing that a joint investigation be carried out.
- 3.13.2. The composition of such an investigation panel will be appropriate to the incident to be investigated, and agreed by all parties involved.
- 3.13.3. Where there has been a series of Significant Incidents (that is to say, where a Significant Incident has caused or exacerbated another Significant Incident) the parties involved may agree that the joint investigation should include some or all of those Significant Incidents.
- 3.13.4. A joint investigation will only take place where all affected parties agree to it. The form and rules of the procedure for, and all matters (including, if thought appropriate, provisions for costs and for a party to withdraw from the joint investigations once it has begun) relating to the joint investigation will be agreed as the time of a joint investigation and in the absence of agreement the joint investigation will not take place.
- 3.13.5. Any joint investigation under this section of the code is separate from any inquiry which may be carried out under the Electricity Power Sector Reform Act of 2005 (as amended from time to time) or other Industry Rules and Regulations.

### **3.14. MAINTENANCE AND TESTING**

- 3.14.1. The Disco shall prepare maintenance schedules for lines and Equipment to meet the level of maintenance as required by best industry practice and meet Safety Standard for Distribution System as contained in its Licence conditions.

- 3.14.2. Regular testing of all the Equipment, such as Transformers, Switchgear, Protective Relays etc., should be carried out as recommended by the manufacturers and the appropriate industry code of practices operating at the time. The test shall be carried out at the prescribed intervals and the test results shall be recorded in the maintenance registers. Wherever the test results indicate a decline in the insulation resistance and/or deterioration of the Equipment, preventive maintenance shall be carried out to ensure serviceability, safety and efficiency.
- 3.14.3. The Disco shall maintain well trained hot-line personnel, and all the required tools in good condition, and conduct the maintenance work by using hot-line technique, wherever possible, to reduce the period of interruption.
- 3.14.4. The Users shall maintain their Apparatus and Power Lines at all times conforming to manufacturers and the appropriate industry code of practices operating at the time and shall be suitable for being connected to the Distribution System in a safe and reliable manner.

### 3.15. TOOLS AND SPARES

- 3.15.1. The Disco shall ensure availability of proper tools and tackles at all work places for carrying out the maintenance. The tools and tackles shall be checked from time to time and their serviceability shall be ensured.
- 3.15.2. The Disco shall maintain an inventory of spares required for maintenance and replacement purposes at suitable locations according to a clear policy to be agreed with the Nigerian Electricity Regulatory Commission.

### 3.16. TRAINING

- 3.16.1. The Disco shall make appropriate arrangements for imparting training in both cold line and hot-line work to his workmen and supervisory staff, incorporating up-to-date health and safety techniques of Distribution System design, construction and maintenance. He shall frame a suitable training programme for this purpose.

### 3.17. MONITORING

- 3.17.1. Monitoring of the Distribution Networks shall be carried out at all times by the Discos. Monitoring shall be carried out by visual inspection (where possible), data collection, recording and analysis.
- 3.17.2. Data Collection, Recording and analysis system

Where a data collection, recording and analysis system is used, the Discos shall maintain to the highest integrity the quality of the data at all times and be prepared upon request to make available to Users and the System Operator information in respect of the data collected relating to their Equipment and Apparatus.

## 4. SECTION: RELIABILITY ANALYSIS

- 4.1.1. The planning of the extension and improvement to a Distribution System shall also take into consideration the improvement in Reliability of power supply to customers. The Reliability indices of power supply in the area fed by the Distribution System before and after the implementation of the extension and improvement program shall be estimated. At the initial stage of deregulation the information for the analysis of the Reliability limits under which the Distribution System is being operated is not available due to inadequate data. The planning of the Distribution System shall also take into consideration the improvement in Reliability and efforts should be made to collect the data in this regard.
- 4.1.2. The Reliability and Quality of Service indicators that will be computed and reported as part of the Annual Regulatory Accounting Report are detailed in the Standards of Performance Code.
- 4.1.3. The following Factors, which affect Reliability indices, shall also be considered subject to availability of data:
- (a) Momentary incoming supply failures
  - (b) Momentary interruptions on 33 and 11 kV feeders
  - (c) Breakdown on LT feeders
  - (d) Prearranged shutdowns on lines and feeders
  - (e) Blowing out of Distribution Transformer fuses
  - (f) Individual fuse off calls
  - (g) Accidents / vandalism of Distribution System Infrastructure.

## 5. SECTION: SYSTEM TESTS

### 5.1. OBJECTIVES

- 5.1.1. The objectives of this Section of the Code are to:
- (a) Ensure that the procedures for arranging and carrying out of System Test do not, so far as practicable, threaten the safety of either personnel or the general public and cause minimum threat to the security of supplies, the integrity of Plant and/or Apparatus and cause minimum detriment to the Disco and Users.
  - (b) Set out procedures to be followed for establishing and reporting System Test

### 5.2. GENERAL

- 5.2.1. This Section sets out the responsibilities and procedures for arranging and carrying out System Test, which have or may have an effect on the Systems of the Disco or Users. System Test are those tests which involve either simulating conditions or the controlled application of irregular, unusual or extreme conditions on the total Distribution System or any part of the System, but do not include commissioning or re-commissioning tests or any other tests of a minor nature.
- 5.2.2. System Test which has a minimal effect on the Distribution System of others will not be subject to this procedure, minimal effect will be taken to mean variations in voltage, frequency and waveform distortion of a value not greater than those figures which are defined in Distribution Planning and Connection Code.
- 5.2.3. If the System Test proposed by the Disco or User connected to the Disco's Distribution System will or may have an effect on the Transmission System then the provisions of the relevant Grid Code shall apply.
- 5.2.4. Conditions of this section apply to the Discos and to Users, which are:
- (a) Medium Voltage (MV) Customers
  - (b) Directly Connected Generators, connected to the Disco's Distribution System at MV
  - (c) Other Authorised Distributors connected to the Disco's Distribution System at MV

### 5.3. PROPOSAL NOTICE

- 5.3.1. When the Disco or a User intends to undertake a System Test which will have or may have an effect on the System of others normally six months notice, or as otherwise agreed with the Disco, of the proposed System Test will be given by the person proposing the System Test (the "Test Proposer") to the Disco and to those Users who may be affected by such a System Test.
- 5.3.2. The proposal shall be in writing (the "Proposal Notice") and shall contain details of the nature and purpose of the proposed System Test and will indicate the extent and situation of the Plant or Apparatus involved.
- 5.3.3. If in view of the recipients the information set out in the Proposal Notice is considered insufficient by the recipients they shall as soon as is reasonably practicable contact the Test Proposer with a request in writing for further information which shall be supplied as soon as reasonably practicable.

The Disco shall not be required to do anything under this aspect of the Code until it is satisfied with the details supplied in the Proposal Notice or pursuant to a request for further information.

- 5.3.4. If the Disco wish to undertake a System Test and duly inform User(s) and does not receives a response from Users after the agreed time elapses, the User(s) shall be deemed to have accepted a proposal of that System Test.

#### 5.4. PRELIMINARY NOTICE AND ESTABLISHMENT OF TEST PANEL

- 5.4.1. The Disco shall have overall co-ordination of the System Test. Using the information supplied to it under 5.3, the Disco shall determine in its reasonable estimation, which Users other than the Test Proposer may be affected by the proposed System Test.
- 5.4.2. The Disco shall, with the agreement of the Users which it has identified may be affected, appoint a Test Coordinator as soon as reasonably practicable after it has received a Proposal Notice and in any event prior to the distribution of the Preliminary Notice referred to below.
- (a) Where the Disco **determined** that its Distribution System will or may be significantly affected by the proposed System Test, then the Test Coordinator shall be a suitably qualified person nominated by the Disco.
- (b) Where the Disco **determined** that its Distribution System will not be significantly affected by the proposed System Test, then the Test Coordinator shall be a suitably qualified person nominated by the Proposer of the System Test, in consultation with the Disco.
- (c) The Disco shall as soon as reasonably practicable after it has received a Proposal Notice contact the Test Proposer where the Test Coordinator is to be (pursuant to this Section of the Distribution Code) a person nominated by the Test Proposer and invite him to nominate a person. If the Test Proposer is unable or unwilling to nominate a person within seven days of being contacted by the Disco then the proposed System Test will not take place.
- 5.4.3. The Disco will notify all Users identified by it under 5.4.1 in writing of the proposed System Test which in this Section of the Distribution Code shall be known as a Preliminary Notice. The Preliminary Notice will contain:
- (a) The details of the nature and purpose of the proposed System Test, the extent and situation of the Plant and/or Apparatus involved and the Users involved.
- (b) An invitation to nominate within fourteen days a suitably qualified representative (or representatives if the Test Coordinator informs the Disco that it is appropriate for a particular User) to be a member of a Test Panel for the proposed System Test.
- (c) The name of the Disco representative (or representatives) on the Test Panel for the proposed System Test.
- (d) The name of the Test Coordinator and whether he was nominated by the Proposer of the System Test or by the Disco.
- 5.4.4. The Preliminary Notice shall be sent within one month of the receipt by the Disco of the Proposal Notice or the receipt of any further information requested under 5.3.3, whichever is the later. Where the Disco is the Test Proposer the Preliminary Notice shall be sent as soon as possible after the proposed System Test must have been formulated.

- 5.4.5. If replies to the invitation in the Preliminary Notice to nominate a representative to be a member of the Test Panel have not been received within fourteen days, the User which has not replied shall not be entitled to be represented on the Test Panel.
- 5.4.6. The Disco shall as soon as possible after the expiry of that fourteen day period appoint nominated persons to the Test Panel and notify all relevant Users – of the composition of the Test Panel.

## 5.5. TEST PANEL

- 5.5.1. A meeting of the Test Panel shall take place as soon as possible after the Disco has notified relevant Users of the composition of the Test Panel, and in any event within one month of the appointment of the Test Panel.
- 5.5.2. The Test Panel shall consider:-
  - (a) The details of the nature and purpose of the proposed System Test and other matters set out in the Proposal Notice (together with any further information requested under 5.4).
  - (b) The economic, operational and risk implications of the proposed System Test
  - (c) The possibility of combining the proposed System Test with any other tests and with Plant and/or Apparatus outages which arise pursuant to the Operational Planning requirements of the Disco, System Operator and Users
  - (d) The implications of the proposed System Test on Generating Plant subject to Dispatch by the System Operator.
- 5.5.3. Users who received a Preliminary Notice concerning the proposed System Test (whether or not they are represented on the Test Panel) shall be obliged to supply that Test Panel upon written request with such details as the Test Panel reasonably requires in order to consider the proposed System Test.
- 5.5.4. The Test Panel will meet as often as the Test Coordinator deems necessary to conduct its business and he shall be the person to convene a meeting.

## 5.6. PROPOSAL REPORT

- 5.6.1. Within two months of the first meeting, the Test Panel shall submit a report, which in this Distribution Operating Code shall be called a Proposal Report, which shall contain:
  - (a) System Test (including the manner in which the System Test is to be monitored).
  - (b) An allocation of costs (including unanticipated costs) between the affected parties, (the general principle being that the Test Proposer will bear the costs).
  - (c) Such other matters as the Test Panel considers appropriate. The Proposal Report may include requirements for indemnities to be given in respect of claims and losses arising from the System Test. All System Test procedures must comply with all applicable industry Rules and Regulation.
- 5.6.2. If the Test Panel is unable unanimously to agree on any decision in preparing its Proposal Report the proposed System Test shall not take place and the Test Panel will be dissolved.
- 5.6.3. The Proposal Report will be submitted to the Disco and to each User who received a Preliminary Notice under 5.4

- 5.6.4. Within fourteen days of receipt of the Proposal Report, each recipient shall respond to the Test Coordinator with its approval of the Proposal Reports or its reason for non-approval.
- 5.6.5. In the event of non-approval by one or more recipients, the Test Panel shall as soon as practicable meet in order to determine whether the proposed System Test can be modified to meet the objection or objections.
- 5.6.6. If the proposed System Test cannot be so modified, then the System Test will not take place.
- 5.6.7. If the proposed System Test can be so modified, the Test Panel shall as soon as practicable, and in any event within one month of meeting to discuss the responses to the Proposal Report, submit a revised Proposal Report and the provisions of 5.6.3 and 5.6.4 will apply to that submission.
- 5.6.8. In the event of non-approval of the revised Proposal Report by one or more recipients, the System Test will not take place and the Test Panel will be dissolved.

## 5.7. FINAL TEST PROGRAMME

- 5.7.1. If the Proposal Report (or, as the case may be, the revised Proposal Report) is approved by all recipients, the proposed System Test can proceed and at least one month prior to the date of the proposed System Test. The Test Panel shall submit to the Disco and all recipients of the Proposal Notice a programme which in this Distribution Code shall be called a “Final Test Programme” stating the switching sequence and proposed and timings. It should also include a list of those staff involved in the carrying out of the System Test (including those responsible for site safety) and such other matters as the Test Panel deem appropriate.
- 5.7.2. The Final Test Programme shall bind all recipients to act in accordance with the provisions contained within the programme in relation to the proposed System Test.
- 5.7.3. Any problems with the proposed System Test which arise or are anticipated after the issue of the Final Test Programme and prior to the day of the proposed System Test must be notified to the Test Coordinator as soon as possible in writing. If the Test Coordinator decides that these anticipated problems merit an amendment to or postponement of the System Test, he shall notify any party involved in the proposed System Test accordingly.
- 5.7.4. If on the day of the proposed System Test operating conditions on the System are such that any party involved in the proposed System Test wishes to delay or cancel the start or continuance of the System Test, they shall immediately inform the Test Coordinator of this decision and the reasons for it. The Test Coordinator shall then postpone or cancel, as the case may be, the System Test and shall if possible, agree with all parties involved in the proposed System Test another suitable time and date or if he cannot reach such agreement, shall reconvene the Test Panel as soon as practicable which will endeavour to arrange another suitable time and date and the relevant provisions of this Distribution Code shall apply.

## 5.8. FINAL REPORT

- 5.8.1. At the conclusion of the System Test, the Test Proposer shall be responsible for preparing a written report (the “Final Report”) of the System Test for submission to the Disco and other members of the Test Panel.



- 5.8.2. The final Report shall include a description of the Equipment and/or Apparatus, tested and of the System Test carried out, together with the results, conclusions and recommendations for submission to other members of the Test Panel.
- 5.8.3. The Final Report shall not be distributed to any party which is not represented on the Test Panel unless the Test Panel, having considered the confidentiality issues, shall have unanimously approved such distribution.
- 5.8.4. When the Final Report has been submitted under 5.8.1 the Test Panel shall be dissolved.

## 6. SECTION: SAFETY CO-ORDINATION

### 6.1. OBJECTIVE

- 6.1.1. The objective of this Section is to achieve Safety from the network when work on Equipment necessitates the provision of Safety Precautions on another Equipment on the High or Medium Voltage Equipment up to a Connection Point.
- 6.1.2. A flow chart in Appendix 4 illustrates the process utilised in this code to achieve the objective set out. In the case of a conflict between the flow chart and the provisions of an agreed procedure, the agreed procedure will prevail.

### 6.2. GENERAL

- 6.2.1. This section specifies the standard operating procedures to be used by Discos and Users of the network for the co-ordination, establishment and maintenance of necessary Safety Precautions when work is to be carried out on the Distribution Network or a User's apparatus and when there is a need for Safety Precautions on the High or Medium Voltage Equipment on the other's system for work to be carried out safely. The term "work" includes testing, other than Network Tests. This Section applies between Disco and Users and does not impose a particular set of Safety Rules on Disco and Users; the Safety Rules to be adopted and used by Disco and Users shall be those chosen by them. This Safety procedure applies to:
- (a) Directly Connected Generators
  - (b) Discos
  - (c) Consumers connected to MV or HV

### 6.3. INTERPRETATION

- 6.3.1. In this procedure, the following terms shall have the meaning:
- (a) "High Voltage equipment" means High Voltage electrical circuits (above 1 kV) forming part of a System, on which Safety From The System may be required or on which Safety Precautions may be applied to allow work to be carried out on a circuit.
  - (b) "Isolation" means the disconnection of Equipment from the remainder of the network in which the Equipment is situated by either of the following:
    - (i) an Isolating Device maintained in an isolating position. The isolating position must either be:
      - b.i.1) maintained by immobilising the Locking and Isolating Device in the isolating position and affixing a Caution Notice to it. Where the Isolating Device is Locked with a Safety Key, the Safety Key must be secured in a Key Safe. Key Safe must be retained in a safe custody; or

- b.i.2) maintained and/or secured by such other method which must be in accordance with the Local Safety Instructions of Disco or that of the User, as the case may be; or
- (ii) An adequate physical separation which must be in accordance with, and maintained by, the method set out in the Local Safety Instructions of Disco or that of the User as the case may be, and, if it is a part of that method, a Caution Notice must be placed at the point of separation.
- (c) “Earthing” means a way of providing a connection between conductors and the earth by an Earthing Device which is either:
  - (i) immobilised and Locked in an earthing position. Where the Earthing Device is Locked with a Safety Key, the Safety Key must be secured in a Key Safe. Key Safe must be retained in a safe custody; or
  - (ii) maintained and/or secured by such other method which must be in accordance with the Local Safety Instructions of Disco or that of the User, as the case may be.

## 6.4. PROCEDURE

### 6.4.1. Approval of Local Safety Instructions

- (a) In accordance with the timing requirements of its Agreement with Disco, each User will supply to Disco a copy of its Local Safety Instructions relating to its side of the Connection Point at each Connection Site.
- (b) In accordance with the timing requirements of each User Agreement, Disco will supply to each User a copy of its Local Safety Instructions relating to the Disco side of the Connection Point at each Connection Site.
- (c) Prior to connection each party must have approved the other’s relevant Local Safety Instructions in relation to Isolation and Earthing.
- (d) Either party may require that the Isolation and/or Earthing provisions in the other party’s Local Safety Instructions affecting the Connection Site should be made more stringent in order that approval of the other party’s Local Safety Instructions can be given. Provided these requirements are not unreasonable, the other party will make such changes as soon as reasonably practicable.
- (e) If approved, a party that wishes to change the provisions in its Local Safety Instructions relating to Isolation and/or Earthing after approval, must inform the other party. If the change is to make the provisions more stringent, then the other party merely has to note the changes. If the change is to relax the provisions, then the other party needs to assess and approve the new provisions and procedures referred to in 6.4.1(c).

### 6.4.2. Safety Co-ordinators:

- (a) For each Connection Point, Disco and each User must at all times have person(s) (Safety Co-ordinator(s)) to be responsible for the co-ordination of Safety Precautions when work is to be carried out on the network or parts of it which necessitates the provision of Safety Precautions on High Voltage Equipment pursuant of this section of the Grid Code. A Safety Co-ordinator may be responsible for the co-ordination of safety at more than one Connection Points of the network.

- (b) Each Safety Co-ordinator shall be authorised by Disco or a User, as the case may be, as competent to carry out the functions set out to achieve Safety from the Network at all times.
- (c) Only authorised person at Disco and the User(s) will carry out Safety activities at all times.
- (d) Contact between Safety Co-ordinators at Disco and User(s) will be made accordingly via normal operational channels, and accordingly separate telephone numbers for Safety Co-ordinators need be registered and available to the Disco and Users at all times.
- (e) If work is to be carried out on the network which necessitates the provision of Safety Precautions, in accordance with the provisions of this Code, the Requesting Safety Co-ordinator who requires safety Precautions to be provided shall contact the relevant Implementing Safety Co-ordinator to co-ordinate the establishment of Safety Precautions throughout the work.

## 6.5. RECORD OF NETWORK SAFETY PRECAUTIONS (RNSP)

- 6.5.1. Disco and Users will use the format of the RNSP forms set out in Appendix 4A, and 4B of this Code. That set out in Appendix 4A and designated as “RNSP-R”, shall be used when Disco is **the** Requesting Safety Co-ordinator, and that in Appendix 4B designated as “RNSP-I” when Disco is **the** Implementing Safety Co-ordinator. Proformas of RNSP-R and RNSP-I must be provided by Disco and Users for use at all times when Safety Precaution is required.
- 6.5.2. All references to RNSP-R and RNSP-I shall be taken as referring to the corresponding parts of the alternative forms or other tangible written records agreed between Disco and the User.
- 6.5.3. RNSP-R will have an identifying number written or printed on it, comprising a prefix which identifies the location at which it is issued, and a unique serial number consisting of four digits and suffix “R” for Disco and the User.
- 6.5.4. Each User shall apply to Disco for approval of its proposed prefix
- 6.5.5. Disco shall consider the proposed prefix to see if it is the same as a prefix used by Disco or another User to avoid confusion. Disco shall respond in writing within ten days of its decision on the prefix to the User.
- 6.5.6. If Disco disapproves, it shall explain in its response why it has disapproved and will suggest an alternative prefix. In this situation, the User shall either notify Disco in writing of its acceptance of the suggested alternative prefix or it shall apply in writing to Disco with its revised prefix proposal and the above procedure shall apply.

## 6.6. SAFETY PRECAUTIONS ON HIGH VOLTAGE EQUIPMENT

### 6.6.1. Safety Precautions

For the purpose of Co-ordination of safety relating to High Voltage Equipment, the term “Safety Precautions” means Isolation and /or Earthing.

### 6.6.2. Agreement of Safety Precautions:

- (a) The Safety Co-ordinator requesting Safety Precautions on another equipment or parts of the Distribution network will contact the relevant Implementing Safety Co-ordinator(s) to

agree the location of the Safety Precautions to be established. This agreement will be recorded in the respective Safety Logs.

- (b) It is the responsibility of the Implementing Safety Co-ordinator to ensure that adequate Safety Precautions are established and maintained, on his and/or another equipment connected to his equipment, to enable Safety from the equipment to be achieved on the High voltage Equipment, specified by the Requesting Safety Co-ordinator which is to be identified in RNSP.
- (c) When the Implementing Safety Co-ordinator is of the reasonable opinion that it is necessary for Safety Precautions on the System of the Requesting Safety Co-ordinator, other than on the High voltage equipment specified by the Requesting Safety Co-ordinator, which is to be identified in RNSP, he shall contact the requesting Safety Co-ordinator and the details shall be recorded in the RNSP forms. It is the responsibility of the Requesting Safety Co-ordinator to establish and maintain such Safety Precautions.
- (d) In the event where the requesting Safety Co-ordinator and the Implementing Safety Co-ordinator are unable to agree the location of the isolation and (if requested) Earthing, both shall be at the closest available points on the infeeds to the High Voltage equipment on which Safety from the network is to be achieved as indicated on the operating diagram.

#### 6.6.3. Implementation of Isolation:

- (a) Following the agreement of the Safety Precautions in accordance with 6.6.2 the Implementing Safety Co-ordinator shall then establish the agreed Isolation.
- (b) The Implementing Safety Co-ordinator shall conform to the requesting Safety Co-ordinator that the agreed Isolation has been established, and identify the Requesting Safety Co-ordinator's High Voltage Equipment up to the Connection Point, for which the Isolation has been provided. The confirmation shall specify:
  - (i) For each location, the identity (by means of High Voltage Equipment name nomenclature and numbering or position as applicable) of each point of Isolation, whether Isolation has been achieved by an isolating Device in the isolating position or by an adequate physical separation;
  - ((ii) Where an Isolating Device has been used whether the isolating position is either:
    - (a) Maintained by immobilising and Locking the Isolating Device in the isolating position and affixing a Caution Notice to it.
    - (b) Where the Isolating Device has been Locked with a Safety Key that the Safety Key has been secured in a Key Safe and the Key Safe will be retained in a safe custody;
  - (iii) Where an adequate physical separation has been used that will be in accordance with, and maintained by the method set out in the Local Safety Instructions of TCN or that of the User, as the case may be, and, if it is part of that method, that a Caution Notice has been placed at the point of separation.
- (c) The confirmation of Isolation shall be recorded in the respective Safety Logs.

#### 6.6.4. Implementation of Earthing

- (a) The Implementing Safety Co-ordinator shall confirm to the Requesting Safety Co-ordinator that the agreed Earthing has been established, and identify the Requesting Safety Co-ordinator's HV Equipment has been provided. The conformation shall specify:

- (i) For each location, the identity (by means of HV Equipment name, nomenclature and numbering or position, as is applicable) of each point of Earthing; and
- (ii) In respect of the Earthing Device used, whether it is:
  - (a) Immobilised and Locked in the earthing position. Where the Earthing Device has been Locked with a Safety Key, that the Safety Key has been secured in a Key Safe and the Key Safe will be retained in safe custody; or
  - (b) Maintained and/or secured in position by such other method which is in accordance with the Local Safety Instruction of Disco or that User, as the case may be.
- (c) The confirmation of Earthing shall be recorded in the respective Safety Logs.
- (d) The Implementing Safety Co-ordinator shall ensure that the established Safety Precautions are maintained until requested to be removed by the relevant Requesting safety Co-ordinator.

#### 6.6.5. Procedure for Issuing RNSP

- (a) Where Safety Precautions on another Equipment are being provided to enable work on the requesting Safety Co-ordinator's Equipment, before any work commences they must be recorded by the RNSP being issued. The RNSP is applicable to High Voltage Equipment up to the Connection Point identified in the RNSP-R and RNSP-I Forms.
- (b) Where Safety Precautions are being provided to enable work to be carried out on both sides of the Connection Point a RNSP will need to be issued for each side of the Connection Point with Disco and the respective User each enacting the role of Requesting Safety Co-ordinator. This will result in a Forms RNSP-R and RNSP-I being completed by each of Disco and the User, with each Safety Co-ordinator issuing on RNSP number.
- (c) Once the Safety Precautions have been established, the Implementing Safety Co-ordinator shall complete Form RNSP-I for recording the details specified in 6.6.2, 6.6.3 and 6.6.4.
- (d) The Requesting Safety Co-ordinator shall complete form RNSP-R, making a precise copy of the details received. On completion, the Requesting Safety Co-ordinator shall read the entries made back to the sender and check that an accurate copy has been made.
- (e) The requesting Safety Co-ordinator shall then issue the number of the RNSP taken from the RNSP-R, to the implementing Safety Co-ordinator who will ensure that the number, including the prefix and suffix, is accurately recorded in the designated space on the RNSP-I form.
- (f) The requesting Safety Co-ordinator and the implementing Safety Co-ordinator shall complete and sign appropriate parts of the RNSP-R and RNSP-I Forms respectively and then enter the time and date. When signed no alteration to the RNSP is permitted; the RNSP may only be cancelled.
- (g) The requesting Safety Co-ordinator is then free to authorise work (including a test that does not affect the implementing Safety Co-ordinator's Equipment) Where testing is to be carried out which affects the implementing Safety Co-ordinator's Equipment, the procedure set out in 6.6.7 shall be implemented.

#### 6.6.6. RNSP Cancellation Procedure

- (a) When the requesting Safety Co-ordinator decides that Safety Precautions are no longer required, he will contact the relevant implementing Safety Co-ordinator to effect cancellation of the associated RNSP.
- (b) The requesting Safety Co-ordinator will inform the relevant implementing Safety Co-ordinator of the RNSP identifying number (including the prefix and suffix), and agree that it is the RNSP to be cancelled.
- (c) The requesting Safety Co-ordinator and the relevant implementing Safety Co-ordinator shall then respectively complete Forms RNSP-R and RNSP-I with their names and contact address and shall then exchange details. On exchange of details the respective RNSP is cancelled.
- (d) Neither Safety Co-ordinator shall instruct the removal of any Isolation forming part of the Safety Precautions as part of the returning of the High Voltage Equipment to service until it is committed to each by each other that every earth on each side of the Connection Point, within the points of isolation identified on the RNSP, has been removed or disconnected by the provision of additional Points of Isolation.
- (e) Subject to provisions in 6.6.6 (d) the implementing Safety Co-ordinator is then free to arrange the removal of the safety Precautions, the procedure to achieve that being entirely an internal matter for the party the implementing Safety Co-ordinator is representing. Nothing in this Code prevents Disco and Users agreeing to a simultaneous cancellation and issue a new RNSP, if both agree.

#### 6.6.7. Testing Affecting Another Safety Co-ordinator's Equipment

- (a) The carrying out of test may affect Safety Precautions on RNSPs or work being carried out which does not require a RNSP. Testing can, for example include the application of an independent test voltage. Accordingly, where the requesting Safety Co-ordinator wishes to authorise the carrying out of such a test to which the procedures in this section of the Distribution Code apply, he may not do so and the test will not take place unless the steps in (i) to (iii) below have been followed and confirmation of completion has been recorded in the respective Safety Logs:
  - (i) Confirmation must be obtained from the implementing Safety Co-ordinator that:
    - a.i.1) no person is working on, or testing, or has been authorised to work on, or test, any part of its equipment or another Equipment (other than the equipment of the requesting Safety Co-ordinator) within the points of Isolation identified on the RNSP form relating to the test which is proposed to be undertaken, and
    - a.i.2) no person will be so authorised until the proposed test has been completed (or cancelled) and the requesting Safety Co-ordinator has notified the implementing Safety Co-ordinator of its completion (or cancellation);
  - (ii) Any other current RNSP which relate to the parts of the equipment in which the testing is to take place must have been cancelled in accordance with procedures set out in 6.6.6.
  - (iii) The implementing Safety Co-ordinator must agree with the requesting Safety Co-ordinator to permit the testing on that part of the Equipment between the points of Isolation identified in the RNSP associated with the test and the points of Isolation on the Requesting Safety Co-ordinator's equipment.

- (iv) The requesting Safety Co-ordinator will inform the implementing Safety Co-ordinator as soon as the test has been completed or cancelled and the confirmation shall be recorded in the respective Safety Logs.
- (v) When the test gives rise to the removal of Earthing which it is not intended to re-apply, the relevant RNSP associated with the test shall be cancelled at the completion or cancellation of the test in accordance with the procedure set out in either 6.6.5 or 6.6.6. Where the Earthing is re-applied following the completion or cancellation of the test, there is no requirement to cancel the relevant RNSP associated with the test pursuant to this 6.6.7.

## 6.7. EMERGENCY SITUATIONS

- 6.7.1. There may be circumstances where Safety Precautions need to be established in relation to an unintended electrical connection or situations where there is an unintended risk of electrical connection between the Distribution Network and a User's Equipment, for example resulting from an incident where one line becomes attached or unacceptably close to another.
- 6.7.2. In those circumstances, if both Disco and the respective User agree, the relevant provisions of 6.6.5 will apply as if the electrical connections or potential connections were, solely for the purposes of this Section, a Connection Point.
- 6.7.3. The relevant Safety Co-ordinator shall be that for the electrically closest existing Connection Point to that User's Equipment or such other local Connection Point as may be agreed between Disco and the User, with discussions taking place between the relevant local Safety Co-ordinators. The Connection Point to be used shall be known in this 6.7 as the "relevant Connection Point".
  - (a) The Local Safety Instructions shall be those which apply to the relevant Connection Point.
  - (b) The prefix for the **RNSP** will be that which applies for the relevant Connection Point.

## 6.8. LOSS OF INTEGRITY OF SAFETY PRECAUTIONS

- 6.8.1. In any instance when any Safety Precautions may be ineffective for any reason the relevant Safety Co-ordinator shall inform the other Safety Co-ordinator(s) without delay and, if requested, of the reasons why.

## 6.9. SAFETY LOG

- 6.9.1. Disco and Users shall maintain Safety Logs which shall be a chronological record of all messages relating to safety co-ordination under this code sent and received by the Safety Co-ordinator(s). The Safety Logs must be retained for a period of not less than one year.



## 7. SECTION: NUMBERING AND NOMENCLATURE OF ELECTRICAL APPARATUS AT OWNERSHIP BOUNDARIES

### 7.1. OBJECTIVES

- 7.1.1. The prime objective embodied is to ensure that at any site where there is an Ownership Boundary every item of Equipment or Apparatus has numbering and/or nomenclature that has been mutually agreed and notified between the owners concerned to ensure, so far as is reasonably practicable, the safe and effective Operation of the Systems involved and to reduce the risk of error.

### 7.2. GENERAL

- 7.2.1. This Section of the Code applies to the Disco and to Users, which in this Distribution Code excludes Users without Generation connected at Low Voltage (i.e. 400V and below) and protected by a fuse(s) or other device(s) rated at 100 amps or less, (except it may apply to such Users who are the sole User connected to an HV/LV transformer), and otherwise includes.
- (a) Customers
  - (b) Directly Connected Generators
  - (c) Other Authorised Distributors connected to the Disco's Distribution System
  - (d) Meter Operators
- 7.2.2. It sets out the responsibilities and procedures for Users of the Distribution System of the numbering and nomenclature of Equipment or Apparatus at Users Ownership Boundaries.
- 7.2.3. The numbering and nomenclature of Equipment or Apparatus shall be included in the Operation Diagram prepared for each site having a User's Ownership Boundary

### 7.3. PROCEDURE

#### New Apparatus

- 7.3.1. When the Disco or a User intends to install Apparatus having an interface at an Ownership Boundary the proposed numbering and/or nomenclature to be adopted for the Apparatus must be notified to the other owner(s).
- 7.3.2. The notification shall be made in writing to the relevant owner(s) at least six months prior to the proposed installation of the Apparatus.
- 7.3.3. The relevant owners shall respond in writing within one month of the receipt of the notification confirming both receipt and whether the proposed numbering and/or nomenclature is acceptable or, if not, what would be acceptable.
- 7.3.4. In the event that Agreement cannot be reached between the Disco, and the other owner(s), the **Distribution Network Operator** (DNO), acting reasonably, shall have the right to determine the numbering and nomenclature to be applied at that site.

**Existing Apparatus.**

- 7.3.5. The Disco and/or every User concerned shall supply the Disco and/or other User on request with details of the numbering and nomenclature of Apparatus on sites having an Ownership Boundary.
- 7.3.6. The Disco and every User concerned shall be responsible for the provision and erection of clear and unambiguous labeling showing the numbering and nomenclature of its Apparatus on sites having an Ownership Boundary.

**Changes to Existing Apparatus**

- 7.3.7. Where the Disco or a User needs or wishes to change the existing numbering and/or nomenclature of any of its Apparatus on any site having Ownership Boundary, the provisions of 7.3.5 and 7.3.6 shall apply with any amendments necessary to reflect that only a change is being made.
- 7.3.8. Where a User changes the numbering and/or nomenclature of its Apparatus, which is the subject of this section of the Code, the User will be responsible for the provision and erection of clear and unambiguous labelling.
- 7.3.9. Where a Disco changes the numbering and/or nomenclature of its Apparatus, which is the subject of this section of the Code, the Disco will be responsible for the provision and erection of clear and unambiguous labeling.

**7.4 STANDARDIZATION OF NUMBERING AND/OR NOMENCLATURE OF APPARATUS**

- 7.4.1 The numbering and/or nomenclature as stipulated in this Section 7 shall remain in place until the NERC gazettes a Standard Numbering/Nomenclature Code.

## PART 4: DISTRIBUTION CONSTRUCTION AND MAINTENANCE (DCM)

### 1. SECTION: DISTRIBUTION SYSTEM CONSTRUCTION, AND MAINTENANCE

#### 1.1. OBJECTIVE

- 1.1.1. For proper operation of the Distribution System, appropriate working practices to best utility practices must be maintained. As such the operating conditions for the Disco must satisfy the following:
- (a) The minimum technical requirements for Discos and Users of the Distribution Network for operating a safe and reliable Distribution System.
  - (b) The obligations and accountabilities of Discos ensuring a safe, reliable and efficient Distribution Network.

#### 1.2. GENERAL

- 1.2.1. This section of the Code provide the guidelines for construction, operation and maintenance of the Distribution System to ensure safe, reliable and efficient power delivery infrastructure with maximum security.

#### 1.3. CONSTRUCTION PRACTICE

- 1.3.1. The construction and set up of the distribution lines shall be carried out as stipulated in relevant sections of the **Nigeria Electricity Supply and Installation Standards** per the following:
- (a) Chapter Five: Distribution Networks.
  - (b) Chapter Eleven: Earthing.
- 1.3.2. Electric poles shall be erected vertically at all times and be maintained within reasonable limits of tolerance by concreting of foundation from the bottom up to 150 mm above the planting depth in all the types of soil conditions at anchor locations, cut points and transformer centres and all other locations wherever necessary. These shall be suitably designed for the particular soil condition and in any case shall not be less than 450mm x 450mm with a mix of ratio 1:2:4 commencing from the foot of the pole and extending up to 150mm above the planting depth. In addition, it may be desirable to concrete every pole in non-cohesive soil.

- 1.3.3. After the poles are erected and soil back filled and well compacted and after the early rains, the foundation shall be inspected and back filled if necessary.
- 1.3.4. For Low Voltage lines, the conductors may be of horizontal configuration or vertical configuration. Preference shall be given to vertical configuration. The phase conductors in horizontal configuration should be run on pin or shackle insulators. The neutral conductors may be run on reel insulators. For vertical configuration, the insulators may be fixed on the pole by use of D-type or other suitable clamps.
- 1.3.5. Wherever mid-span clashing of conductors is expected due to excessive winds, uneven or excessive sagging, use of fairly longer spans, etc., **an additional pole on the main spans or** spacers conforming to NESIS Regulation shall be invariably used on Low Voltage lines. For tying the power conductors on pin insulators, the top groove tie for tangent locations and the side groove tie for angle locations conforming to NESIS Regulation For dead end locations, strain insulator hardware consisting of helically formed dead-end fitting, Clevis thimble and cross-arm strap with bolts as per NESIS Regulation along with disc insulators shall be used.
- 1.3.6. The conductors of 11 kV and 33 kV lines shall be arranged in delta formation generally by placing the top conductor on top of the pole on an insulator with a bracket clamp and placing the bottom conductors on insulators mounted on a suitable cross arm.
- 1.3.7. To provide for the possibility of conductor breakage in a street or public place a continuous overhead earth wire is to be provided on the poles along the line. Suitable V-guards or earth guard stirrups are to be provided on each pole when the line runs along the street and cradle guards are to be provided when the line runs across the street. Should a line snap or fall down for whatever reason, it should make contact with these earth guards and cause the overload device, whether a fuse or a circuit breaker, to cut off the supply and render the line harmless.
- 1.3.8. In case of horizontal configuration, the earth wire may be run on cast iron knob mounted directly on the cross arm. For vertical configuration, the earth wire may be run directly on the D-clamp.
- 1.3.9. Correct capacity fuses shall be provided and maintained in good condition at all distribution transformer centres as per the following table.

TABLE 1-Tinned Copper Fuse Wire Sizes for Pole Mounted Transformers.

Capacity of Transformer	Current Rating 11 kV side	Fuse Size SWG	Current Rating LT Side	Fuse Size SWG
25 kVA	1.31 amps	38	<b>35</b> amps	Protection Kits up to 100 kVA
63 kVA	3.31 amps	35	<b>58</b> amps	
100 kVA	5.25 amps	33	<b>139</b> amps	
250 kVA	13.13 amps	23	<b>348</b> amps	2 of 15
300 kVA	15.75 amps	23	<b>417</b> amps	MCCBs 250A-2 nos.
500 kVA	26.24 amps	20	<b>696</b> amps	MCCBs 250A-4 Nos.

- 1.3.10. Spare fuses, of all the required sizes, shall be made available with all the linemen in-charge of maintenance along with their toolkits and these should be promptly replenished as and when they have been used for replacement to avoid use of improper fuses by them.
- 1.3.11. The cross-arms shall be permanently and efficiently earthed. The continuous earth wire shall be securely clamped to each support and connected with earth at four points in every kilo meter. The mechanical connectors of line-traps at the conductor end of the earth connection should be solidly bolted down to the metal parts of the cross arms and supports using suitable washers after the surface has been cleaned to remove all rust and paint.
- 1.3.12. It is not enough to have a good earth connection initially at the time of erection of the line, but it should also be maintained properly. Each stay wire shall be similarly earthed unless an insulator has been inserted in it at the top.
- 1.3.13. Earthing shall be in accordance with most recent NCP 9, NIS/IEC 60364-5-54 (1980-01) and the Nigerian Electricity Supply and Installation Standards Regulation. In all 33 kV substations, only cast iron pipes shall be used for earth electrodes.
- 1.3.14. The following table specifies the minimum size of earth wires to be used for earthing of the neutral point of the Distribution transformers:

TABLE 2

Transformer Rating.	Insulated PVC single core stranded or bare stranded copper earthing conductor.
50 kVA and below	<b>35</b> sq.mm.
75 kVA	<b>35</b> sq.mm.
100 kVA	<b>50</b> sq.mm.
150 kVA	<b>50</b> sq.mm.
200 kVA	<b>70</b> sq.mm.
250 kVA	<b>70</b> sq.mm.
300 kVA	<b>70</b> sq.mm.
500 kVA	<b>70</b> sq.mm.

- 1.3.15. The following table specifies the minimum size of earth lead to be used for equipment earthing, such as transformers, motors, generators, switchgear etc.

TABLE 3

Rating of 400 V 3 phase 50 Hz equipment in kVA.	Size of PVC insulated Copper earthing conductor.
Up to 5	<b>4</b> sq.mm.
6 to 15	<b>6</b> sq.mm.
16 to 50	<b>10</b> sq.mm.
51 to 75	<b>16</b> sq.mm.
76 to 100	<b>25</b> sq.mm.
101 to 125	<b>35</b> sq.mm.
126 to 150	<b>35</b> sq.mm.
151 to 200	<b>70</b> sq.mm.
201 and above	<b>70</b> sq.mm.

- 1.3.16. The voltage gradient at the earth electrode at the transformer centre may attain sufficiently high value during heavy flow of ground currents and become dangerous to cattle and human life. To eliminate the possibility of danger, the top of the earth electrode shall be buried below earth surface and the connecting lead should be insulated. The top of the earth electrode shall be at least 300 mm below the surface of the soil.
- 1.3.17. Earth electrodes, other than those used for earthing of the fence itself, should not be installed in the proximity of the metal fence, to avoid the possibility of the fence becoming live and thus rendering it dangerous.
- 1.3.18. The street lighting posts with underground cables require a great deal of attention due to the fact that many times these cables are connected at lower levels to the insulated wires coming from street lights. A fuse box for the phase wire shall be fitted and properly maintained at these connections. The fuse box shall be provided with a hinged door, which shall be kept closed and locked from access to public and shall be periodically inspected and maintained at least quarterly. It is preferable that these fuse boxes are provided at an inaccessible height.
- 1.3.19. The pole mounted Distribution transformers shall not be accessible to the public easily. Danger sign boards shall be visibly displayed.
- 1.3.20. Suitable Danger boards and anti-climbing devices shall be provided on the poles at locations with high human traffic such as School premises, market places etc.
- 1.3.21. The maximum span along any street in towns and cities shall not be more than 40 meters. In road crossings, the poles shall be installed on either side of the road and suitable guarding shall be provided.
- 1.3.22. The minimum clearances from any conductor of an overhead line from ground and horizontally from buildings at different places shall be maintained as indicated in Table 4 **below**. These clearances are the minimum clearances at the lowest point; i.e. at mid span under worst conditions, i.e. when sag is maximum at highest conductor temperature. In actual practice, however, it is preferable to allow a further safety margin of 0.6 meters.

TABLE 4: MINIMUM CLEARANCE OF OVER HEAD LINE FROM GROUND AND BUILDINGS FOR VARIOUS VOLTAGE LEVELS

Sl.No.	Particulars	For LV lines (meters)	For 11 kV Lines (meters)	For 33 kV Lines (meters)
a)	Minimum height of any conductor of an overhead line across any street.	5.8	6.1	6.4
b)	Minimum height of any conductor of an overhead line along any street.	5.5	5.8	6.1
c)	Minimum height of any conductor (bare) of an overhead line erected elsewhere.	4.6	4.6	5.2
d)	Minimum height of any insulated conductor of an overhead line erected elsewhere.	4.0	4.0	4.0
e)	Minimum clearance of overhead conductor horizontally from buildings	3.5 (vertical) 1.8 horizontal	4.5 (vertical) 1.8 (horizontal)	4.5 (vertical) 2.5(horizontal)

- 1.3.23. Bare wires shall not be terminated on a building.
- 1.3.24. A tapping can be made only at the point of support. To ensure good contact, only good quality, crimped connectors shall be used. Twisted joints shall be avoided.
- 1.3.25. Fuses along with isolators shall be provided to isolate different parts of the distribution system. Lightning arresters shall be provided on the 11 kV and 33 kV lines at places where the lines terminate for connections to the Equipment.
- 1.3.26. The entire pedestal mounted Equipment such as distribution transformers, switchgear, and distribution boxes etc. installed in streets and accessible to public shall be protected by locking the doors and/or providing a suitable fence with gate wherever possible. “DANGER” Boards shall be prominently displayed on the fence and equipment.
- 1.3.27. For the safety of telecommunication lines at locations where the overhead Power Line may cross over the same, the recommendations laid down in the code of practice of the Power and Telecommunication Co-ordination Committee shall be followed. The detailed drawing of the arrangement at crossings with telecommunication lines as stipulated in NESIS REGULATION Electricity Supplementary Regulations standards shall be followed.

- 1.3.28. When erecting overhead power lines, the conductors of the same shall wherever possible, be arranged to cross over (not below) the existing telephone or telegraph lines. For any special cases where it would not be convenient or economical to remove the existing telephone or telegraph **lines** and erect below the power **lines**, special guarding arrangements of suitable design shall be provided.
- 1.3.29. Where a telephone or telegraph line passes under a high voltage aerial line on suspension insulators, the protective guarding arrangements shall not be erected using the power line supports. A separate guard shall be located not less than two meters above the telephone or the telegraph line. This shall consist of two horizontal stranded solid galvanized steel conductors with additional horizontal conductors at the sides where necessary to prevent a broken power conductor from coming into contact with the telephone or telegraph line conductor. This arrangement shall be made in such a way that the broken power conductor is earthed for sufficient duration and ensure the power circuit being tripped out by automatic protective devices. The crossing of telephone or telegraph lines under power lines shall be as nearly as possible at right angles.

#### 1.4. MAINTENANCE

- 1.4.1. For safe, reliable and secure operation and maintenance of Distribution System, Discos shall prepare suitable operation, maintenance manuals and programs for the various components of the distribution system for its staff. Properly updated records shall be kept on the maintenance work done as per schedule, the details of faults, malfunctions etc., encountered in the lines and equipment during the period, the remedial action taken, etc., for each component of the distribution system.
- 1.4.2. The following pre-requisites shall be first ensured for the satisfactory maintenance:
  - a. The ability of the system to meet the probable over-loading due to transfer of loads from the adjacent systems during emergencies.
  - b. The quality of the materials used.
  - c. Trained and adequately equipped maintenance staff.
  - d. Schedule of maintenance for each component of the system.
  - e. Adequate stock level maintained for equipment and apparatus employed on the Distribution System.
  - f. Maintenance manual must be easily accessible
- 1.4.3. The maintenance work shall consist of routine inspection, cleaning, testing and adjustments, if any required and is different from the work carried out after a break down of any equipment in service, for restoring the same to the working condition, which cannot be planned in advance.
- 1.4.4. The maintenance schedules drawn shall cover the following:
  - (a) Inspection
  - (b) Preventive maintenance
  - (c) Overhauls
- 1.4.5. Inspection



This shall include the periodical inspection in service for a check on the condition of the Equipment/lines in service to verify the faults and defects that may develop during its operation so that advance action can be taken to rectify the defects in a planned manner and prevent breakdowns.

#### 1.4.6. Preventive maintenance

This shall cover the periodical work including tests required to determine the electrical and mechanical strengths to ascertain the suitability in service and ensure proper working condition. The schedule drawn shall be on the basis of data obtained from inspection and maintenance checks, giving priority to the troubles encountered during normal operation of the line or Equipment.

#### 1.4.7. Overhauls

- (a) This shall cover the preventive maintenance work to be done on the Equipment based on the past experience and manufacturers' recommendations and involves major disassembly of the Equipment. The schedule drawn shall be based on the normal life expectancy of the Equipment or data obtained from inspection and maintenance checks.
- (b) The maintenance schedules shall be drawn for all the following components of the Distribution System separately:
  - (i) Power and Distribution transformers. (ii) Pole mounted Distribution transformers and capacitors.
  - (iii) 33kV and 11 kV circuit breakers along with all the associated switchgear.
  - (iv) Low Voltage circuit breakers.
  - (v) Pole mounted auto-reclosers.
  - (vi) 33kV and 11 kV distribution lines including **Geographic Information System (G.I.S.)**
  - (vii) LV lines including switches and fuses.
  - (viii) Service connections.
- (c) Effective maintenance work shall be ensured keeping the following guidelines for the efficient working of the Distribution System and for preventing accidents that may arise due to failure of any of the components.
  - (i) The Distribution Lines shall be inspected thoroughly before and after the rainy season.
  - (ii) The defects noticed during inspection should be rectified at the time of inspection itself if they are of minor nature, whenever and wherever possible. In case of such of the defects, which cannot be rectified easily, the same have to be attended to at the earliest possible occasion duly documenting a program in advance.
  - (iii) If abnormal conditions such as excessive heating or arcing or prohibitively low clearances etc., are observed, the equipment or the line shall be immediately disconnected and rectification of defects carried out.
  - (iv) Manufacturers' instructions shall always be given due consideration and implemented.

- (v) A continuous record of all the test results shall be maintained.
- (vi) Appropriate inspection/maintenance checks/history sheets shall be maintained containing details of all inspection and maintenance work done.
- (vii) All the required Safety Precautions/Safety Devices shall be used while carrying out the maintenance works.
- (viii) The maintenance schedule shall be periodically reviewed by the Discos in the light of previous experience and updated to include all possible improvements required for ensuring adequate maintenance, prevention of accidents and reduction in interruptions.

## 1.5. OFF-SCHEDULE INSPECTIONS

1.5.1. Inspections of the following nature shall be carried out to maintain the system at the required level of Reliability in operation.

(a) Special inspections:

These shall be made immediately after severe weather conditions, such as heavy windstorms, thunderstorms and rains to detect any damage or breakage of poles, insulators, conductors and/or Equipment, and necessary action taken.

(b) Emergency inspections:

These shall be carried out on a line equipment during its breakdown, and or an accident to locate and identify the cause of trouble as early as possible in order to restore the power supply.

(c) Follow up inspections:

Whenever one or more short time interruptions are noticed which may have taken place due to temporary faults, the inspection shall be carried out to locate and identify the cause of interruptions and suitable maintenance action shall be taken whenever and wherever necessary.

(d) Check inspections:

The designated Engineer in charge of the Distribution System shall make these inspections periodically as a check on the conditions of the line and Equipment and the efficacy of maintenance. He shall point out such defects, which might not have been noticed by the maintenance staff in the first instance.

## PART 5: DATA REGISTRATION CODE (DRC)

### 1. SECTION: DATA REGISTRATION

#### 1.1. INTRODUCTION

- 1.1.1. The various sections of the Distribution Code require the Disco and Users to exchange and update data from time to time. The data which is specified in each section of the Distribution Code is summarized in Appendix 2 - Distribution Data Registration Requirements (DDRR).
- 1.1.2. The Distribution Data Registration Requirements (“DDRR”) provides a series of schedules summarizing all requirements for information of a particular type. Each class of User is then referred to the appropriate schedule or group of schedules for a statement of the total data requirements in his case.
- 1.1.3. The DDRR specifies procedures and timings for the supply of data and subsequent updating. Where the timings are covered by detailed timetables laid down in other sections of the Distribution Code, they are not necessarily repeated in full in the DDRR.
- 1.1.4. In the case of an Directly Connected Generator seeking a connection to the Disco’s Distribution System, then irrespective of its potential involvement in the wholesale market, discussions on connection will be with the Disco concerned with the connection arrangements, in addition to any discussions required with the TSP or System Operator under the relevant Grid Code. References to Directly Connected Generators in the DDRR shall include existing and prospective Directly Connected Generators.

#### 1.2. OBJECTIVE

- 1.2.1. The objective of the DDRR is to collate and list in a readily identifiable form all the data to be provided by:-
  - (a) Each category of Users to the Disco under the Distribution Code
  - (b) The Disco to each category of User under the Distribution Code

#### 1.3. GENERAL

- 1.3.1. This section of the Code applies to the Disco and to all Users which for the purpose of data registration listed below:-
  - (a) Customers - It is not intended that the Distribution Code shall generally apply to small Customers individually, their obligations will be dealt with on their behalf by their respective Disco.
  - (b) Directly Connected Generators.
  - (c) Other Discos connected to the Disco Distribution System
  - (d) Any other person who is making application for use of or connection to the Disco’s Distribution System.

## 1.4. DATA CATEGORIES

- 1.4.1. Within the DDDR the data required by the Disco is allocated to one of the following three categories.
- (a) Standard Planning Data (SPD)
  - (b) Detailed Planning Data (DPD)
  - (c) Operational Data (OD)

## 1.5. STANDARD PLANNING DATA (SPD)

- 1.5.1. Standard Planning Data is that data listed in Part 2, Annex 3.1 of this Distribution Code which is required to be supplied by all Users when making application for connection to and/or use of the Disco's Distribution System in order that the Disco may assess the implications for making the connection.
- 1.5.2. Standard Planning Data will be provided to the Disco in accordance with Part 2 of this Distribution Code.
- 1.5.3. Following an agreement for connection/use of System, it is a requirement that estimated data supplied by Users should be replaced by actual values prior to connection which will be referred to as Registered Data.

## 1.6. DETAILED PLANNING DATA (DPD)

- 1.6.1. Detailed Planning Data is that data listed in Part 2, Annex 3.1 of this Code which is required to be supplied by the Users specified for connection to and/or use of the Disco's Distribution System.
- 1.6.2. Detailed Planning Data will be provided to the Disco in accordance within agreed timescale between Disco and the Users.
- 1.6.3. Following an agreement for connection/use of System, it is a requirement that estimated data supplied by Users should be replaced by measured values prior to connection.

## 1.7. OPERATIONAL DATA (OD)

- 1.7.1. Operational Data is data, which is required by the Disco for the day to day operation of Users of the Distribution System.
- 1.7.2. Operational Data is required to be supplied in accordance with timetables set down in the relevant operating procedures and is repeated in tabular form in the schedules attached to this DDDR.

## 1.8. PROCEDURES AND RESPONSIBILITIES

- 1.8.1. Responsibility for Submission and Updating of Data

In accordance with the provisions of the various sections of the Distribution Code and unless otherwise agreed or specified by the Disco, each User is required to submit data as defined in DDDR-6 following the attached schedules.

- 1.8.2. Methods of Submitting Data

- (a) Data must be submitted to the Disco in writing and where possible in the format specified by the Disco and must indicate the name of the person who is submitting those schedules.
- (b) If a User wishes to change any data item then this must first be discussed with the Disco concerned in order for the implications to be considered and the change if agreed (such agreement not to be unreasonably withheld), should be confirmed by the submission of a revised data schedule by verbal means with confirmation in writing if short timescales are involved.
- (c) The Disco will supply data as requested by Users and as agreed by the Disco where no obligation of confidentiality exists.

#### 1.8.3. Changes to User's Data

Whenever a User becomes aware of a change to an item of data, which is registered with the Disco, the User, must notify the Disco in accordance with the appropriate section of the Distribution Code. The method and timing of the notification to the Disco is set out in the appropriate section of the Distribution Code.

#### 1.8.4. Data Accuracy and Data not Supplied

- (a) The User is solely responsible for the accuracy of data (or of changes to data) supplied to the Disco.
- (b) Any data, which the User fails to supply when required by any section of the Distribution Code, may be estimated by the Disco if and when, in the Disco's view, it is necessary to do so. Such estimates will be based upon data supplied previously for the same Plant or Apparatus or upon corresponding data for similar Plant or Apparatus or upon such other information as the Disco deems appropriate.
- (c) The Disco will advise a User in writing of any estimated data it intends to use pursuant to Sections 7.6 and 7.7 relating directly to that User's Plant or Apparatus in the event of data not being supplied. The Disco will not be liable as a result of using that estimated data. The responsibility for the accuracy of that data will rest with the User as if the data has been supplied by that User.
- (d) It is a requirement of the Distribution Code that Detailed Planning Data is updated by the User annually

## 1.9. DATA TO BE REGISTERED

#### 1.9.1. Under Distribution Data Registration Requirements (DDRR) in Appendix 2,

- (a) Schedules A, B, C – Technical Information of Directly Connected Generator to the Distribution Network.
- (b) Schedule D – Demand forecasts – as described in Section 3, time varying output/generation forecasts for the Users defined in the scope
- (c) Schedule E – Operational Planning – as described in Section 4, outage-planning information.
- (d) Schedule F – System Design Information – comprising System technical data.

- (e) Schedule G – Load Characteristics – comprising the forecast data for load points indicating for example, the maximum load, the Equipment that comprises the load, and the harmonic content of the load.

1.9.2. The schedules applicable to each class of User are as follows:-

Schedule Number	Title	Applicable to:-
Schedule A	Power Station Data	All Directly Connected Power Stations
Schedule B	Generation Set Data	All Directly Connected Generating Units or Power Park Modules
Schedule C1	Generation Set Data	For specified types of Generation Set and ancillary Plant and Apparatus i) Synchronous Generation Set ii) Fixed speed induction Generation Set iii) Doubly fed induction Generation Set iv) Transformers
Schedule C2	Disco Network Data	Disco's Distribution System Operating 33kv and below
Schedule D	Demand Forecasts	All Directly Connected Generators greater than 1MW. Other Authorised Distribution System connected to the host Disco System. All Customers connected at HV whose Demand is greater than 1MW
Schedule E	Operational Planning	Directly Connected Generators whose output is greater than 1MW. Any Other Authorised Distributor connected to the host Disco System. All Customers connected at HV whose Demand is greater than 1MW

Schedule F	System Design Information	Directly Connected Generators. Any Other Authorised Distributor connected to the host Disco's Distribution System.
Schedule G	Load Characteristics	All Customers.

## APPENDIX

### APPENDIX 1                      DEFINITIONS

In the Distribution Code the following words and expressions shall, unless the subject matter, or context otherwise requires or is inconsistent therewith, bear the following meaning:

Act	The Electric Power Sector Reform Act, 2005
Active Power	The product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof, i.e., 1000 Watts = 1 kW 1000 kW = 1 MW
Agreement	An Agreement entered into by a Distribution Company and the User.
Ancillary Service	A service, other than the primary production of electricity, which is used to operate a stable and secure Power System including but not limited to: Reactive Power, Operating Reserve, Frequency Control and Black Start Capability
Annex	An annex of this Distribution Code.
Apparatus	All the Electricity using system, including machines, fittings, accessories and appliances in which Electricity conductors are used.
Apparent Power	The product of voltage and current of an alternating current system measured in units of volt-amperes and standard multiples thereof, i.e., 1000 VA = 1 kVA 1000 kVA = 1 MVA
Appendix	An appendix of this Distribution Code.
Area of Supply	The area within which a Distribution Company is Licensed to operate Electricity Network and supply Electricity at the time.
<b>AUTHORISED AREA</b>	A geographical area <b>within</b> the territory of Nigeria where a Distribution Company is Licensed to operate for the purpose of controlling, operating and developing a Distribution System.
Bare conductor	Conductor of electricity not covered with insulation.
Breakdown	An occurrence relating to an equipment of the supply system or line, which prevents normal functioning.
Business Day	Any day other than Saturday, Sunday or a public holiday in Nigeria.
Connection Point	The drawings prepared for each Connection Point, which indicates



Drawing	the Equipment layout.
Cable	A length of electricity conductor provided with insulation. The same may or may not be provided with an overall mechanical covering.
Circuit	Arrangement of conductor(s) for the purpose of carrying electrical energy and forming a system or branched system.
Code	The document or other publication referred to as Distribution Code.
<b>COINCIDENCE FACTOR</b>	Ratio of combined peak loads of a group of connected loads to the sum of peak loads of the individual connected loads.
Commission	Nigerian Electricity Regulatory Commission
Condition	A condition in this Distribution Code
Conductor	Any Wire, Cable, Bar, Tube, Plate, etc., used for transmitting energy and / or electrically connected to the system.
Connected Load	Aggregate of manufacturer's rating of all the connected Apparatus, Equipment either portable or non-portable, in the consumer's premises. It includes all Apparatus, Equipment for which the Consumer has made declaration, for taking supply. This shall be expressed in kW or kVA. If the ratings are in kVA, the same may be converted to kW by multiplying the kVA with a Power Factor of 0.85. If the same or any other Apparatus is rated by the manufacturer in HP, the HP rating shall be converted into kW by multiplying it by 0.746.
<b>CONNECTION AGREEMENT</b>	An agreement between a User and the Disco, which specifies the terms and conditions pertaining to the connection of the User's system or Equipment to the Distribution System.
<b>CONNECTION CAPACITY</b>	The capacity of a Connection Point as specified in the Connection Agreement
<b>CONNECTION POINT/ INTERCONNECTION</b>	A point at which a User's electrical system is connected to the Distribution Company Network System.
Contract Demand	Maximum kW or kVA agreed to be supplied by the Distribution Company and indicated in the agreement executed between the parties. Wherever the agreement stipulates supply in kVA, the quantum in terms of kW may be obtained by multiplying by the Power Factor of 0.85.
Control Person	The person responsible for safety coordination, designated by the Distribution Company and any User having common electrical interface with the Distribution Company's Network System.
Demand	The demand of MW or MVA <sub>r</sub> of electricity (i.e. both Active Power and <b>Reactive Power</b> respectively) unless otherwise stated
Detailed Planning Data	Detailed additional data that the Disco requires under the Distribution Planning and Connection Code in support of the Standard Planning Data
Directly Connected	Any Generator connected to the Distribution System, regardless on

Generator	whether it holds or not a generation licence.
Distribution Company	The entity Licensed by the Nigerian Electricity Regulatory Commission to carry out the <b>management of the Distribution System</b> within an Authorised Area.
Disco	An acronym for a Distribution Company.
Distribution Network	Any connection of cables, service lines and overhead lines, meters, electrical apparatus / equipment and having design voltage of 33 kV and below <b>used</b> to transport electric power on a Distribution System
<b>DISTRIBUTION SYSTEM</b>	Any system consisting mainly of cables, service lines and overhead lines, meters, electrical apparatus / equipment and having design voltage of 33 kV and below, plus related system used in the safe operation of an Electricity Network. This system shall not include any part of a Transmission System except the terminal equipment used for the supply of electricity to high voltage (66 kV and above) consumers.
<b>DIVERSITY FACTOR</b>	Ratio of the sum of peaks of group of connected loads to the combined peak load of the group.
<b>NETWORK EMERGENCY</b>	An operating condition leading to abnormal operation of Apparatus, Equipment and plant on the Distribution System. Such condition can cause total or partial shut down of affect Apparatus, Equipment or plant.
<b>ELECTRICITY</b>	Form of energy movement of electrons across a conductor.
<b>ELECTRICITY NETWORK</b>	Any connection of cables, service lines and overhead lines, meters, electrical apparatus / equipment use to transport electric power on a Transmission or Distribution Network or both.
<b>ENERGY</b>	Unless otherwise qualified, active <b>energy</b>
<b>EQUIPMENT</b>	Tools, Apparatus used in the process of power consumption.
Fluctuating Load	A load that causes a series or cyclical voltage changes
Grid Code	The technical operating document for Users of the Transmission System approved by the Nigerian Electricity Regulatory Commission.
Harmonics	Sinusoidal voltages and currents having frequencies that are integral multiples of the fundamental frequency.
High Tension (HT)	System or supply energized at 11,000 volts or above but not exceeding 33,000 volts.
High Voltage (HV)	Meaning same as High Tension
Large Connection	A connection where the Connection Capacity is greater than <b>[500kVA]</b> or connections with generation facilities greater than <b>[300 kW]</b>
Licensing Condition	The obligations attached to the granting of License to a Company in the Nigeria Electricity Industry.
Load	An entity or electrical Equipment that consumes <b>Energy</b>

Load Factor	Ratio of average load to peak load over a designated period.
Low Tension (LT)	System or supply energized at voltage exceeding 100V but not exceeding 250 Volts. Single phase.
Low Voltage (LV)	Meaning same as Low Tension
Medium Connections	A connection where the Connection Capacity is greater than [50 kVA] and up to and including [1MVA] where no generation facility greater than [50 kW] exists for an LV connection and no generation facility greater than [300 kW] exists for an MV connection
Medium Tension (MT)	System or supply energized at 250V but less than 11,000V <b>three phase.</b>
Medium Voltage (LV)	Meaning same as Medium Tension
NERC	Nigerian Electricity Regulatory Commission
Normal Conditions	The condition in the Transmission or <b>Distribution System</b> , as applicable, when the system frequency, voltage, and transmission and/or distribution lines and equipment loading are within their Normal Operation limits.
Normal Operation	The same meaning given to it in the Grid Code
	<ul style="list-style-type: none"> <li>• <b>Operational Boundary</b> means the boundary between the <b>Apparatus</b> operated by the <b>Distributor</b> or a <b>User</b> and the <b>Apparatus</b> operated by Other <b>Distributor(s)</b> or other <b>User(s)</b>, as specified in the relevant <b>Connection Agreement</b>.</li> </ul>
	<b>Plant</b> means fixed and movable items used in the generation and/or supply and/or transmission of electricity other than <b>Apparatus</b>
Power Factor	Ratio of Active Power to Apparent Power i.e. kW to kVA.
Prudent Utility Practice	Those standards, practices, methods and procedures conforming to safety and legal requirements which are attained by exercising that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of power sector activities under the same or similar circumstances;
Reactive Power	<b>The</b> product of voltage and current and the sine of the phase angle between them, measured in KiloVar (kVAr) or Megavar (MVar).
SCADA	Supervisory Control and Data Acquisition
Schedule Outage	An outage to a <b>Consumer</b> decided by the <b>Distributor, provided that</b> it has been advertised to the affected <b>Consumers</b> at least [72 hours] in advance
Small Connection	A Low Voltage connection with a <b>Connection Capacity</b> of up to and including [50 kVA], and where there is no <b>Generation Unit</b> rated greater than [16A] per phase,
Standard Planning	the general information required by the Distributor under the

Data	Distribution Planning Code.
System	An electrical network running at various voltages.
System Operator	means the holder of a System Operator License
Transmission Network	Any connection of High Voltage apparatus, equipment, lines, and stations, having design voltage of 132 kV and above use in transporting electric power on a Transmission System.
<b>TRANSMISSION SYSTEM</b>	The System consisting of High Voltage apparatus, equipment, lines, and stations, having design voltage of 132 kV and above used in the safe operation of transmitting electrical power from the generating station bus bars up to the interconnection point with the Distribution System. This shall not include any part of the Distribution System.
<b>TCN</b>	Transmission and System Operation Company of Nigeria. The entity Licensed by the Nigeria Government to carry out the function of High Voltage network operation and System Operation.
Transmission Service Provider (TSP)	A holder of a Transmission License
User	Any person having electrical interface with, or using the Distribution System of the Distribution Company to whom this Code is applicable. Any other Distribution Company Network, Transmission System and Generating units or Power Park Modules connected to the Distribution system are also included in this term.

## APPENDIX 2 DATA REGISTRATION REQUIREMENTS

### Appendix 2A

#### DATA FOR DIRECTLY CONNECTED POWER STATIONS

<u>DATA DESCRIPTION</u>	<u>UNITS</u>
Connection Point (geographical and electrical Location plan)	Text/Diagram
Location plan	Plan
Single line diagram of existing and proposed connections or Operation Diagram when available	Diagram
Voltage of Connection Point	Volts
Number of Generation Sets	Number
Are all Generation Sets of the same design/rating	Y/N
Type of Generation Set (e.g. Synchronous, Converter Connected)	Text
Type of prime mover	Text
Is the scheme Combined Heat and Power (CHP)	Text
Operating Regime – continuous, intermittent, wind or hydro restricted, tidal, solar	Text
Is secure connection required	Y/N
Will Power Station operate in islanded mode?	Y/N
Will Power Station supply electricity to premises?	Y/N
Total Power Station Capacity (Net of unit supplied auxiliary loads) MW or Registered Capacity when available	MW
Total Power Station rated MVar output	MVar

Total Power Station output at Maximum Generation	MW
Total Power Station output at Minimum Generation	MW
Maximum power export	MW
Maximum reactive power export	MVAr
Maximum power import	MW
Maximum reactive power import	MVAr
Fault Level contribution	kA or MVA
Proposed Interface Arrangements	Text
Means of synchronizing between Disco and Owner of Power Station	Text
Means of connection and disconnection with earth.	Text
Precautions should neutral become disconnected from earth (HV only)	Text
Requirements for Top – Up supply	Text
Requirement for Standby supply	Text
Total Power Station Reactive Power Capability at Registered Capacity	
Lagging	MVAr
Leading	MVAr
Total Power Station Reactive Power Capability at Minimum Generation	
Lagging	MVAr

Leading	MVA <sub>r</sub>
Power Station auxiliary demand at Registered Capacity	MW
Power Station auxiliary demand at Registered Capacity	MVA <sub>r</sub>
Maximum auxiliary demand	MW
Maximum auxiliary demand	MVA <sub>r</sub>
Power Station auxiliary demand at Minimum Generation	MW
Power Station auxiliary demand at Minimum Generation	MVA <sub>r</sub>
Site protection arrangements	Text
Site communications and control arrangements	Text

## Appendix 2B

## GENERATION SET DATA FOR ALL DIRECTLY CONNECTED GENERATING UNITS

<u>DATA DESCRIPTION</u>	<u>UNITS</u>
<b>For All Directly Connected Generators</b>	
Number of generators to which data applies	Number
Type of Generation Set (e.g. Synchronous, Converter Connected etc)	Text
Type of Prime Mover	<b>Text</b>
Terminal Voltage	<b>Volts</b>
Generation Set rating or Registered	MVA
Capacity when available	<b>MW</b>
Generation Set rating MVA	<b>MVAr</b>
Generation Set rating MVAr	<b>MVAr</b>
Maximum Generation	<b>MW</b>
Minimum Generation	<b>MW</b>
Total Generation Set Reactive Power Capability at Registered Capacity:	
Lagging	MVAr
Leading	MVAr
Total Generation Set Reactive Power Capability at Minimum Generation:	
Lagging	MVAr
Leading	MVAr
Proposed Interface Arrangements	
Means of synchronizing between DNO and User	<b>Text</b>
Means of connection and disconnection with earth	Text



Precautions should neutral become disconnected from earth (HV only)	Text
<b>2C (i) Directly Connected Synchronous Generation Units</b>	
Type of Generation Set, round rotor or salient pole	Text
Generation Set MW/MVAr Capability/Performance Chart	Chart
State base MVA adopted per unit or % on machine rating or 100 MVA base	Text
+ve sequence or armature resistance	Specify
+ve sequence or armature reactance	Specify
Short circuit ratio	Number
Stator leakage reactance	Specify
Inertia Constant	MWsec/MVA
Stator Resistance	Specify
Direct Axis Reactance	Specify
Sub-transient	Specify
Transient Synchronous	Specify
Quadrature Axis Reactance	Specify
Sub-transient	Specify
Transient Synchronous	Specify
Time Constants	secs
Direct axis sub-transient	secs
Direct axis transient	secs
Quadrature axis sub-transient	secs
Quadrature axis transient	
<b>2C (i) Directly Connected Synchronous Generation Units</b>	
Potier Reactance (if saturation factor available)	Specify
Saturation factor (PU of field current to produce 1.2PU voltage)	Per Unit

Zero sequence resistance	Specify
Zero sequence reactance	Specify
Negative sequence resistance	Specify
Negative sequence reactance	Specify
Governor model (parameters provided separately)	Text
The AVR model (parameters provided separately)	Text
Excitation model (parameters provided separately)	Text
Rated stator current	Amps
Rated field current	Amps
Field Current Saturation Curve 50% to 120%	Graphs

**Notes:**

**The q-axis parameters will be requested where required to increase the accuracy of the model.**

The Pontier Reactance is only required if the Saturation Factor is available. The saturation factor is defined as the PU value of field current required to generate 1.2PU voltage.

The Short Circuit Ratio (SCR) of a Generation Set is one measure of the performance of a machine under short circuit conditions and is important in determining the unit's Stability performance. The reciprocal of the Synchronous Reactance ( $X_d$ ) approximates to the SCR, the only difference is that the SCR considers saturation whereas  $X_d$  is derived from the air-gap line

## 2C (ii)

**GENERATION SET DATA FOR DIRECTLY CONNECTED GENERATOR**

<b>DATA DESCRIPTION</b>	<b>UNITS</b>
<b>Fixed Speed Directly Connected Induction Generation Sets</b>	
Stator Current unity power factor	Amps
Stator Current max lagging power factor	Amps
Stator Current min lagging power factor	Amps
Magnetising reactance	Specify
Stator resistance	Specify
Stator reactance	Specify
Inner cage or running rotor resistance	Specify
Inner cage or running rotor reactance	Specify
Outer cage or standstill rotor resistance	Specify
Outer cage or standstill rotor reactance	Specify
For above state whether derived from inner outer cage or running standstill measurements	Text
Slip at rated output	Per unit
Load torque speed coefficient B	Number
Load torque speed coefficient C	Number
Inertia constant for generator prime mover drive chain	MWsec/MVA

**NOTE**

The torque speed (T-N) relationship is defined as:

$$T = T(A + BN + CN^2) \text{ where } A = 1.0 - B - C$$

Therefore only B&C are needed

Alternatively a per unit torque-speed curve can be provided

## Appendix 2 C (ii)

DATA DESCRIPTION	UNITS
<b>Fixed Speed Directly Connected Induction Generation Sets (Continued)</b>	
Describe method of adding star capacitance over operating range	Text
Capacitance connected in parallel at % of rated output	
Starting	
20%	Farrads
40%	Farrads
60%	Farrads
80%	Farrads
100%	Farrads
Maximum starting current	Amps
Starting Regime	
Symmetrical RMS current at time = t from energisation	
t = 0	Amps
t = 50 ms	Amps
t = 200 ms	Amps
t = 1 s	Amps
t = 5 s	Amps
Supply operating chart to show range of reactive import and export with compensation as a function of Active Power	Chart
Details of turbine and Governor model, described in block diagram form showing transfer functions of individual elements	Text

The User will need to provide the above characteristic for each Asynchronous Generation Set (or Power Park Module) based on the number of pole sets (i.e. Two data sets for dual speed 4/6 pole machines). For large sites, with multiple machines, the User may alternatively provide an equivalent network modelled as an Asynchronous Generation Set with matching Generating Unit or Power Park Module Transformer at the Generation Point. This equivalent should also model the site electrical network, power factor correction etc.

**Appendix 2C (iii)****GENERATING SET DATA FOR DIRECTLY CONNECTED****GENERATOR**

## Power Park Modules

The User should, if possible, provide the following Detailed Planning Data for both the static and dynamic models of their machines. For large sites, with multiple machines, the DNO may agree that the User may provide an equivalent network model. Should models not be available, the User may agree with the DNO a series of operational parameters, which describe the operation of the Power Station under a series of static and dynamic network conditions. These may cover, amongst other requirements.

**The delivery of real power:**

- The maximum rate of rise and fall of power per minute
- Voltage and frequency ranges of operation
- The ability (or not) to operate at a set reduced power and the rate at which this can be achieved.
- The instantaneous maximum output, system normal

**The delivery of reactive power**

- The range of reactive power available without compromising real power output
- The maximum range of Reactive Power output available
- The step change and/or rate of change of Reactive Power available
- The ability (or not) to control Reactive Power and hence offer Power Factor or Voltage Control facilities.

**The reaction to voltage depressions on the system**

- The ability (or not) to remain connected to the system for a series (I to n) of independent voltage depressions of depth  $=V(1-n)\%$  and length (in time)  $=T(1-n)$  md,
- The ability (or not) to provide Reactive (capacitive) Power and the magnitude of that Reactive Power, during each voltage depression.
- The fault current contribution, in accordance with IEC 60909(1) during each voltage depression.

## Appendix 2C (iv)

## GENERATION SET DATA FOR DIRECTLY CONNECTED GENERATOR

DATA DESCRIPTION	UNITS
Transformer type Unit/Station/Auxiliary	Text
Number of identical units	<b>Text</b>
Description	Text
Transformer Rating	MVA
Primary Voltage	Volts
Secondary Voltage	Volts
Transformer Voltage Ratio	Number
+ive sequence reactance at nominal tap	Specify
+ive sequence reactance at minimum tap	Specify
+ive sequence reactance at maximum tap	Specify
+ive sequence resistance at nominal tap	Specify
+ive sequence resistance at minimum tap	Specify
+ive sequence resistance at maximum tap	Specify
Zero sequence reactance	Specify
Zero sequence resistance	Specify
Winding configuration eg. DY11	Text
Type of tapchanger (on load/off load)	Text
Tap change range	%
Tap step size	%
Number of taps	Number
Maximum ratio tap	Number

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Minimum ratio tap	Number
Nominal tap position	Number
Method of voltage control	Text
Method of primary winding earthing	Text
Method of secondary winding earthing	Text

## Appendix 2C (v)

## Disco's Network Data

(Data inclusive of that which may be requested by Users of parts of the Distribution System operating at below 33kv and below)

DATA DESCRIPTION	UNITS
<b><u>Fault Level Data at Primary Substation lower voltage busbars and other points on the system that may be affected by a Generator</u></b>	
Calculated break fault level – state time from inception and fault level	<b>ms</b> and MVA
Calculated maximum peak fault current – time at first peak is 10ms – state current	kA
Maximum symmetrical fault level X/R ratio	<b>Number</b>
<b><u>Transformer Data</u></b> (For Each Transformer)	
Primary Voltage	<b>kV</b>
Secondary Voltage	<b>kV</b>
Transformer Rating	MVA
Substation Rating Export	MVA
Substation Rating Import	MVA
Substation Maximum Export to higher voltage system	MVA
Substation Maximum import from higher voltage system	MVA
Target secondary voltage	<b>kV</b>
Upper secondary voltage limit	<b>kV</b>
<b><u>Circuit data</u></b>	
Circuit Schematic Diagram and Geographic Diagram showing normal open points	Diagram
Circuit impedances	Ohms
Circuit ratings and any seasonal variations	Specify
Is the network operated radial or ring	Text



Circuit transformer voltage ratios eg HV/433/250	kV/V/V
Are circuit transformers zoned by applying the progressively higher tap settings for each group of transformers in zones along the circuit to optimize voltage regulation	Y/N
Applied tap setting for each circuit transformer (e.g. in range + 5% to – 5% - but only if available. Discos will not collect this data if it is only available from site visits)	Mark diagram
Circuit Maximum Demand Export	MVA
Circuit Minimum Demand Export or Maximum Import	MVA
Size and location of existing generation	Text
<u>Circuit parameter – for each section of circuit between the primary substation and point of common coupling with proposed Generator</u>  Cable type (underground cable or overhead line)  Length  Summer rating – state continuous or cyclic  Reactance (state base)  Resistance (state base)	Text or Diagram
	Text or diagram
	Text
	Km
	MVA
	Ohm/km
	Ohm/km
	Ohm/km

## Appendix 2D (i)

## DEMAND FORECASTS – Long Term

S/N	DATA DESCRIPTION	UNITS	TIME PERIOD COVERED	UPDATE TIME
1	Hourly Active Power and Power Factor at Annual peak conditions for specified time of the annual peak hour at the associated Grid Supply Points and at the specified time of the annual peak hour of <b>TCN</b> Demand	MW/ MVA <sub>r</sub>	8 weeks – 5 years	Week 13
2	Hourly Active Power and Power Factor at Average Conditions at the specified hour of the annual minimum <b>TCN</b> Demand	MW/ MVA <sub>r</sub>	8 weeks – 5 years	Week 35
3	Hour Power output of Directly Connected Generating Plant at the specified hour of the annual peak hour of the <b>TCN</b> Demand	MW	8 weeks – 5 years	Week 35
4	Schedules for the operation of Directly Connected Generation Sets whose output is greater than 1MW on a hourly basis	MW Date Time	2 weeks to 12 weeks ahead	1600 hrs Friday
5	Users will provide details of their proposed use of Demand Control measures aggregated to 1MW or more (averaged over any half hour) on a hourly basis for each Disco Connection Point	MW Date Time	2 weeks to 12 weeks ahead	1600 hrs Friday
6	Details of differences greater than 1MW from the schedules of operation of any Directly Connected Generating Plant on a hourly basis submitted under item 5 above	MW Date Time	0-24 hrs ahead	As specified
7	Details from Users connected to the Distribution System of any change in aggregate Demand at the point of surplus greater than 1MW of the Demand	MW Date Time	0-24 hrs ahead	As specified
8	Details of hour Active Power and Reactive Power output sent out to the Disco's Distribution System by Directly Connected Generating Plant during the previous day on a hourly basis	MW MVA <sub>r</sub>	Previous day	0800
9	Other Network Operators and other Disco's connected to the Disco's Distribution System will provide details of the amount and duration of Demand Control at the Disco's Connection Point aggregated to 1MW or more (arranged over any hour) which was implemented during the previous Operational Day	MW Time	Previous day	0800

## Appendix 2 D (ii)

**OPERATIONAL PLANNING:- MEDIUM TERM 1-2 YEARS****DIRECTLY CONNECTED GENERATING PLANT CONNECTED TO THE DISCO'S DISTRIBUTION SYSTEM AS SPECIFIED BY THE DISCO**

S/N	DATA DESCRIPTION	UNITS	TIME PERIOD COVERED	UPDATE TIME
1	For individual Generation Sets the Set numbers and Generating Plant capacity. Preferred outage dates earliest start date latest start date.	MW/ Date	Years 1-2	Week 2
2	Directly Connected Generators provide the Disco with estimates of:-			
a)	Output Usable	MW Date	Years 1-2	Week 10
b)	Outage programme	Date	Year 1	
3	Disco following discussion with Directly Connected Generator provide:-	Date	Years 1-2	Week 12
a)	Details of Generating Plant they may withdraw from service for an outage			
b)	Update of Directly Connected Generator outage programme			
4	Disco notify each Directly Connected Generator of Output Usable requirements:	MW	Years 1-2	Week 12
5	Directly Connected Generator provides estimates of Output Usable of each Generating Plant	MW Date	Years 1-2	Week 41

## Appendix 2E

## OPERATIONAL PLANNING USER PLANT AND APPARATUS

PENDING

<b>DATA DESCRIPTION</b>	<b>UNITS</b>	<b>TIME PERIOD COVERED</b>	<b>UPDATE TIME</b>
Users provide the Disco with details of proposed outages which may affect the performance of the Discos Distribution System. Details of trip testing risks of trip and other information where known which may affect the security and stability of the Disco's Distribution System shall also be included	Dates	Years 1-2 ahead	Week 28
Update of previously submitted data for 2 years ahead			
Following consultation with Users and Disco will include agreed outage proposals in the programme	Date	Years 1-2 ahead	Week 43
As changes occur	Update of Users proposals agreed in the Medium Term Plan		

## Appendix 2F

## SYSTEM DESIGN INFORMATION

DATA DESCRIPTION	UNITS
<u>General Information</u>	
<u>Type of load and control arrangements</u>	
<u>Maximum load on each phase at time of Peak Demand</u>	
<u>Fluctuating Loads:</u>	
Rate of change of Demand – Active Power and Reactive Power increasing and decreasing	MW/s MVA <sub>r</sub> /s
Shortest repetitive time intervals between fluctuations in Demand Active Power and Reactive Power	S
Largest step change Active Power and Reactive Power increasing and decreasing	MW/s MVA <sub>r</sub> /s
Maximum energy Demand per half hour	MWh
Steady state residual Demand (MW) between Demand fluctuations	MW
<u>Reactive Compensation:</u>	
Rating of individual shunt reactors (not associated with cables)	MVA <sub>r</sub>
Rating of individual capacitor banks	MVA <sub>r</sub>
Details of any automatic control logic such that operating characteristics can be determined	Text/Diagram
Point of connection to the System	Diagram
<u>Lumped Network Susceptance</u>	
Details of the equivalent lumped network susceptance of the User System referred back to the connection with the Disco's Distribution System	MVA <sub>r</sub>
Including	
Shunt reactors which are an integrated part of a cable system and which	

are not normally in or out of service independent of the cable  Excluding  Independently switched reactive compensation connected to the User's System  and  any susceptance of the User System inherent in the active and reactive demand	
<u>Fault Infeeds</u>	
Maximum and minimum short circuit infeeds into the Disco's Distribution System	MVA
X/R ratio under maximum and minimum short circuit conditions	<b>Number</b>
(Contribution from rotating plant)	
Equivalent network information at the request of the Disco	<b>Text/Diagram</b>
Interconnection Impedance	
For User interconnections that operate in parallel with the Disco's Distribution System details of the interconnection impedance shall be exchanged between the Disco and User including.  Positive Sequence Resistance  Zero Sequence Resistance  Positive Sequence Reactance  Zero Sequence Reactance / Susceptance	  % on 100  % on 100  % on 100  % on 100
If the impedance in the view of the Disco is low then more detailed information will be requested	
Demand Transfer Capability	<b>MW</b>
Information shall be exchanged on Demand transfer capability where the same Demand may be supplied from alternative Disco or User points of supply including the proportion of Demand normally fed from each point of supply	<b>Text</b>

The arrangements for manual/automatic transfer under planned/outage conditions should be provided	<b>Text/Diagram</b>
Non – Disco System Data	<b>Text</b>
The Disco will request information on circuit parameters, switchgear and Protection arrangements	Text/Diagram
Transient Overvoltages	<b>kV</b>
Demand Profile for Day of Exit Point Peak Demand	<b>MW</b>
Demand Profile for Day of Exit Point Minimum Demand	<b>MW</b>

## Appendix 2G

## LOAD CHARACTERISTICS

DATA DESCRIPTION	UNITS
Geographical and electrical point of connection and date connection required Diagrams existing and proposed connections	Text/ <b>Diagram</b>
Types of Demand:-	
Maximum Active Power Demand Registered Capacity	MW
Maximum and minimum Reactive Power requirement	MVA <sub>r</sub>
Type of load and control arrangements Eg variable speed motor type of starter employed	Text
Maximum phase unbalance	Amp/Phase at the time
Maximum harmonic content	%THVD
<u>Fluctuating Loads:-</u>	
Graphical indication of typical cycle variation of Demand (Active/Reactive)	Graphical
Load Management Data	Text
Maximum short circuit infeed based on Generation Set subtransient reactance	MVA
Maximum zero phase sequence impedance of the User's System at the connection point	% on 100 MVA
2 hour Demand profiles for Peak Demand	MW and MVA <sub>r</sub>
Monthly Peak Demand variation	MW and MVA <sub>r</sub>



## **APPENDIX 3**                      **CIVIL EMERGENCIES**

Upon the declaration of civil emergency affecting the production, transportation and consumption of electrical power by competent authority in Nigeria, it is the obligation of the affected Disco(s) to prepare and maintain plans for mitigating the effects of any civil emergency and / or fuel security shortage situation, which may occur in accordance with the Electricity Supply Emergency directive issued by the Industry Regulator. That directive should describe the steps which authority might take to deal with an Electricity production and supply emergency situation and sets down the actions which Companies in the Electricity Supply Industry should plan to take and which may be needed or required in order to deal with such an emergency.

In an electricity emergency it may become necessary to restrict User's Demand for and consumption of Electricity and may be achieved by one or more of the following methods:

- a) Appeals by the Industry Regulator to the public for voluntary restraint.
- b) The issue of order(s) under competent Nigerian Authority requiring restrictions on consumption by industry, commerce and other users deem appropriate.
- c) The issue of order(s) under competent Nigerian Authority requiring rotating disconnections and associated restrictions.

In the event that the Industry Regulator issues directives to the Disco to implement rotating disconnections, the Disco will establish an Emergency Coordinating Centre and as soon as possible establish communications with such relevant Users as is necessary to ensure operational liaison. The plans to be implemented will be similar or separate from the schemes outlined in Section 12 of the Grid Code.

The plans make provision for the need to maintain supply, so far as practicable, to consumers in protected categories. For the purpose of the Distribution Code, Security installations, Communication facilities, Hospitals and other designated facilities deem appropriate by competent Nigeria Authority shall be a protected facility in accordance with the provisions of the Civil Emergency Order.

**APPENDIX 4 RECORD OF NETWORK SAFETY PRECAUTIONS**

**Appendix 4A**

[DISCO] [\_\_\_\_\_ CONTROL CENTRE/SITE]

**RECORD OF NETWORK SAFETY PRECAUTIONS REQUEST (RNSP-R)**

**(Requesting Safety Co-ordinator's Record)**

**RNSP NUMBER**

**PART 1**

**1.1 High Voltage Equipment Identification**

**Safety Precautions** have been established by the implementing **Safety Co-ordinator** (or by another **User** on that **User's equipment** connected to the implementing **Safety Co-ordinator's equipment**) to achieve (in so far as it is possible from that side of the **Connection Point**) **Safety From** the equipment on the following **High Voltage** equipment on the **Requesting Safety Co-ordinator's equipment**:

[State identity - name(s) and, where applicable, identification of the **HV** circuit(s) up to the **Connection Point**]:

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Further **Safety precautions** required on the requesting **Safety Co-ordinator's equipment** as notified by the implementing **Safety Co-ordinator**.

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**1.2 SAFETY PRECAUTIONS ESTABLISHED**

**(a) ISOLATION**

[State the **Location(s)** at which **Isolation** has been established (whether on the implementing **Safety Co-ordinator's equipment** or on the equipment of another **User** connected to the implementing **Safety Co-ordinator's equipment**). For each **Location**, identify each point of **Isolation**. For each point of **Isolation**, state the means by which the **Isolation** has been achieved, and whether, immobilised and **Locked**, **Caution Notice** affixed, other safety procedures applied, as appropriate.]

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(b) **EARTHING**

[State the **Location(s)** at which **Earthing** has been established (whether on the implementing **Safety Co-ordinator's equipment** or on the **System** of another **User** connected to the **Implementing Safety Co-ordinator's System**). For each **Location**, identify each point of **Earthing**. For each point of **Earthing**, state the means by which **Earthing** has been achieved, and whether, immobilised and **Locked**, other safety procedures applied, as appropriate].

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1.3 **ISSUE**

I have received confirmation from \_\_\_\_\_ (name of **Implementing Safety Coordinator**) at \_\_\_\_\_ (location) that the **Safety Precautions** identified in paragraph 1.2 have been established and that instructions will not be issued at his location for their removal until this **RNSP** is cancelled.

Signed .....(**Requesting Safety Co-ordinator**)

at .....(time) on ..... (Date)

**PART 2**

2.1 **CANCELLATION**

I have confirmed to \_\_\_\_\_ (name of the implementing **Safety Co-ordinator**) at \_\_\_\_\_ (location) that the **Safety Precautions** set out in paragraph 1.2 are no longer required and accordingly the **RNSP** is cancelled.

Signed .....(**Requesting Safety Co-ordinator**)

at .....(time) on ..... (Date)

**APPENDIX 4B**

[DISCO] [\_\_\_\_\_ CONTROL CENTRE/SITE]

**RECORD OF NETWORK SAFETY PRECAUTIONS IMPLEMENTATION (RNSP-I)**

(Implementing Safety Co-ordinator's Record)

PART 1

**RNSP NUMBER**

**1.1 High Voltage Equipment IDENTIFICATION**

**Safety Precautions** have been established by the implementing **Safety Co-ordinator** (or by another **User** on that **User's equipment** connected to the implementing **Safety Co-ordinator's equipment**) to achieve (in so far as it is possible from that side of the **Connection Point**) **Safety From The System** on the following **High Voltage equipment** on the **Requesting Safety Co-ordinator's equipment**.

[State identity - name(s) and, where applicable, identification of the **High Voltage** circuit(s) up to the **Connection Point**]:

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Recording of notification given to the **Requesting Safety Co-ordinator** concerning further **Safety Precautions** required on the **Requesting Safety Co-ordinator's equipment**.

**1.2 SAFETY PRECAUTIONS ESTABLISHED**

(a) **ISOLATION**

[State the **Location(s)** at which **Isolation** has been established (whether on the implementing **Safety Co-ordinator's equipment** or on the **System** of another **User** connected to the implementing **Safety Co-ordinator's equipment**). For each **Location**, identify each point of **Isolation**. For each point of **Isolation**, state the means by which the **Isolation** has been achieved, and whether, immobilised and **Locked**, **Caution Notice** affixed, other safety procedures applied, as appropriate.]

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(b) **EARTHING**

[State the **Location(s)** at which **Earthing** has been established (whether on the implementing **Safety Co-ordinator's equipment** or on the **System** of another **User** connected to the **Implementing Safety Co-ordinator's System**). For each **Location**, identify each point of **Earthing**. For each point of **Earthing**, state the means by which **Earthing** has been achieved, and whether, immobilised and **Locked**, other safety procedures applied, as appropriate].

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1.3 **ISSUE**

I have confirmed to \_\_\_\_\_ (name of **Requesting Safety Co-ordinator**) at \_\_\_\_\_ (location) that the **Safety Precautions** identified in paragraph 1.2 have been established and that instructions will not be issued at my location for their removal until this **RNSP** is cancelled.

Signed .....(**Implementing Safety Co-ordinator**)

at .....(time) on ..... (Date)

PART 2

2.1 **CANCELLATION**

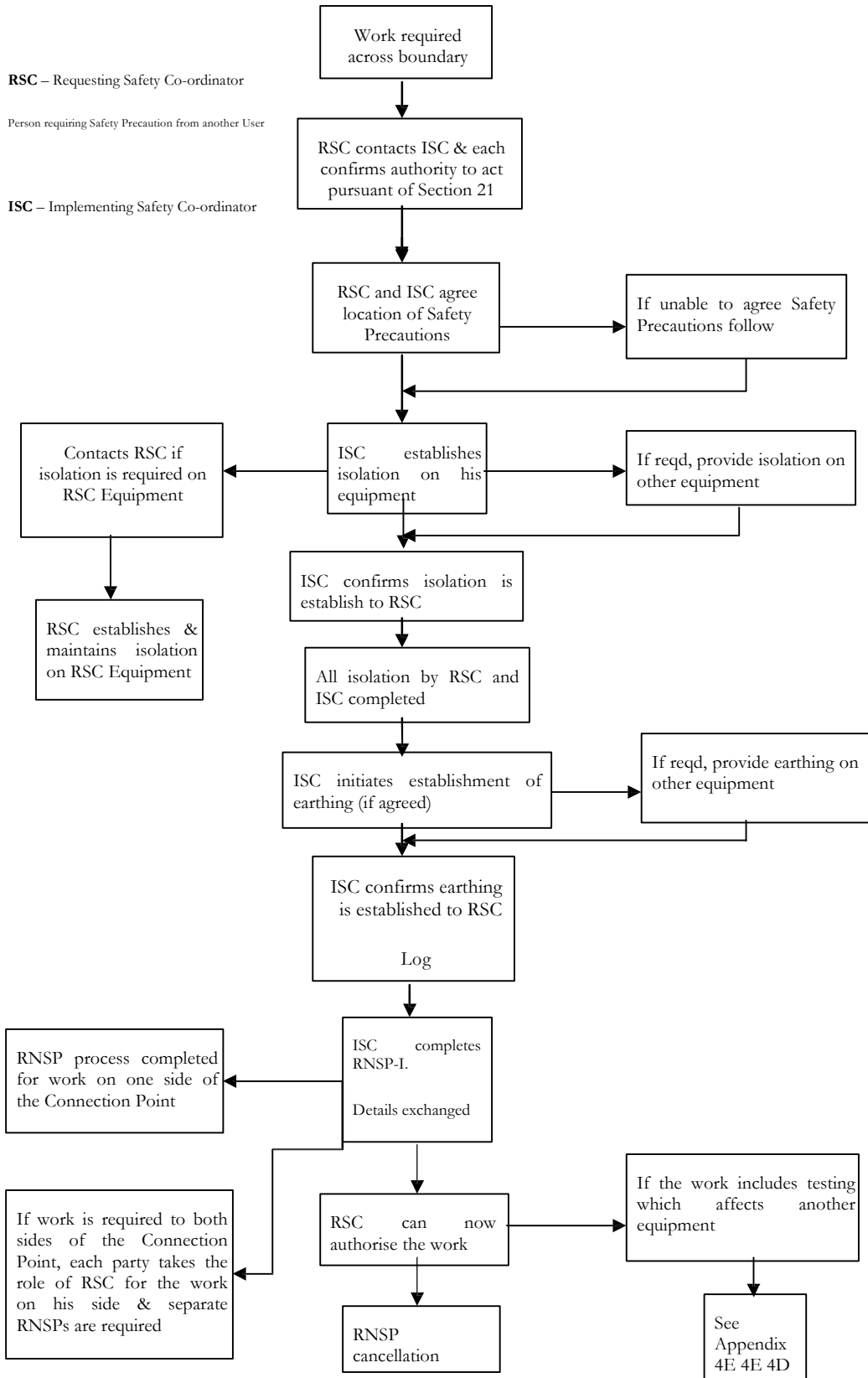
I have received confirmation from \_\_\_\_\_ (name of the **Requesting Safety Co-ordinator**) at \_\_\_\_\_ (location) that the **Safety Precautions** set out in paragraph 1.2 are no longer required and accordingly the **RNSP** is cancelled.

Signed .....(**Implementing Safety Co-ordinator**)

at .....(time) on ..... (Date)

(Note: This form to be of a different colour from RNSP-R)

**APPENDIX 4C – RNSP ISSUE PROCESS**

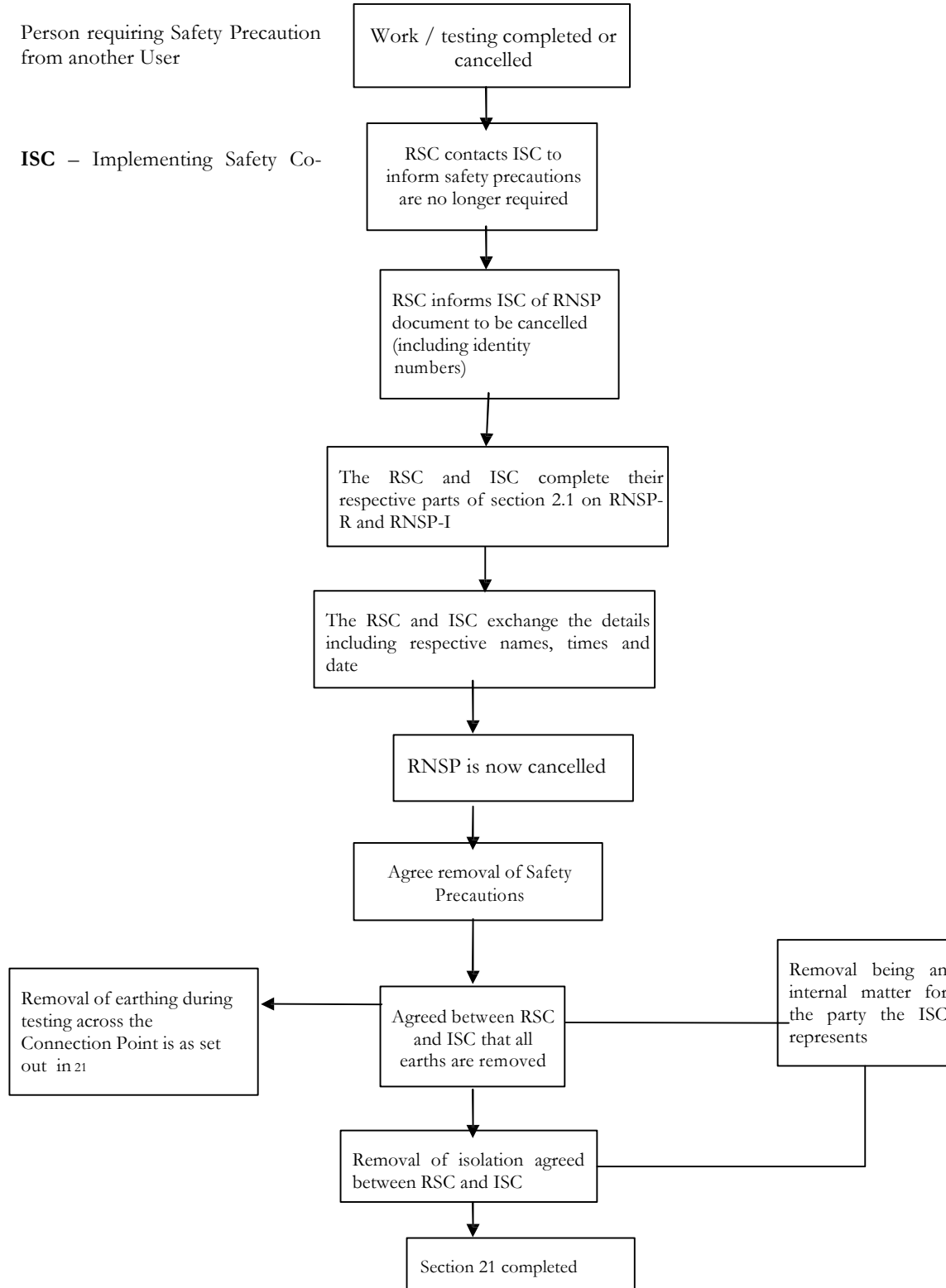


**APPENDIX 4D – RNSP CANCELLATION PROCESS**

**RSC** – Requesting Safety Co-ordinator

Person requiring Safety Precaution from another User

**ISC** – Implementing Safety Co-



**APPENDIX 4E – RNSP TESTING**

**RSC** – Requesting Safety Co-ordinator

Person requiring Safety Precaution from another User

