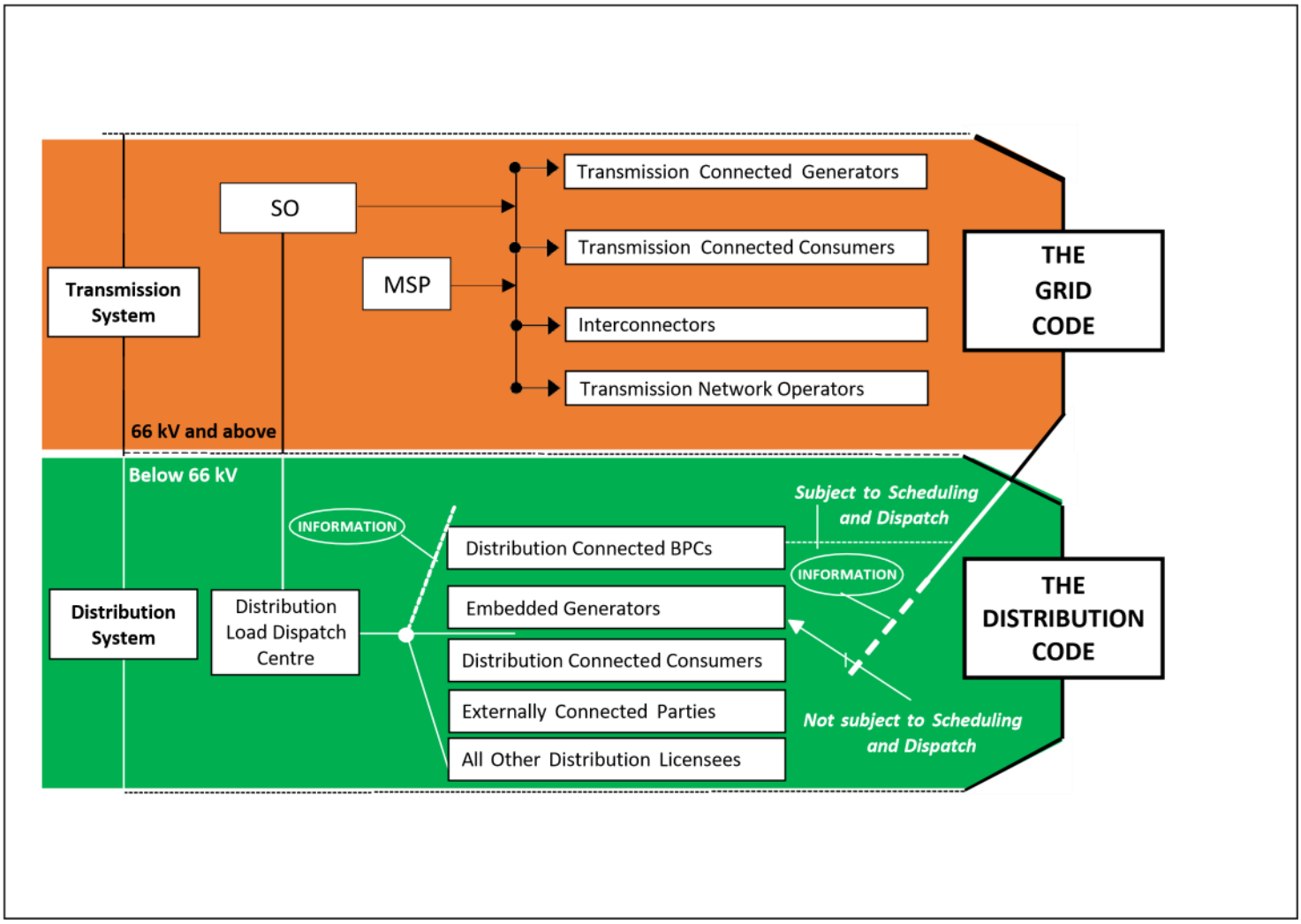
DISTRIBUTION CODE

COVER PAGE

Relationship Diagram of Power System



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DISTRIBUTION CODE

DISTRIBUTION CODE

DISTRIBUTION CODE

CODE MANAGEMENT

CONTENTS

CODE MANAGEMENT

CM 1 INTRODUCTION & SCOPE

CM 1.1 The Code Management section contains provisions of general application to all the provisions of the Distribution Code with the objective to ensure cohesion among various sections of the Distribution Code to the benefit of all Users. Furthermore, this sub-code relates to the administration, enforcement, compliance of the Distribution Code along with treatment of various provisions of the Distribution Code under usual, unusual, and unforeseen circumstances. The mechanism for the revision and modifications of the Distribution Code is also contained herein.

CM 2 APPLICATION OF CODE

The provisions of this Distribution Code shall apply to the DNO and all the entities using the distribution and/or also transmission network of the DNO connected either directly or indirectly to the distribution and transmission network of the DNO.

CM 3 COMPLIANCE

CM 3.1 A User or an entity connected to DNO's network shall comply with this Distribution Code unless the Consumer or the entity has been advised otherwise by the DNO. The requisite level of compliance with the Code shall be made a part of the contract between a Consumer and the DNO and the Distribution Service Manual.

CM 3.2 In case a DNO is found to be in breach where a breach of the Code by a DNO is found to be caused by a User or any entity connected to the DNO's distribution system not complying with the Code, the DNO is deemed to have complied with the Code unless the DNO does not act in accordance with the provisions of this Code and seeks the User's compliance.

CM 3.3 The Distribution Code applies to any person or entity who is using, planning to use or interacting with the Distribution System of the DNO.

CM 4 UNFORESEEN CIRCUMSTANCES

CM 4.1 In case of emergence of unforeseen circumstances, not included in the Distribution Code, should the circumstances dictate the DNO shall take prompt unilateral action to remedy the problem.

CM 4.2 If immediate action is not necessary the DNO shall promptly consult all affected Users in aneffort to reach an agreement to take necessary mitigation actions. If agreement cannot be reached in the 24 hours, the DNO shall determine the most appropriate course of action under intimation to Registrar NEPRA. While arriving at its determination, the DNO shall take into account the views expressed by the Users and other circumstances peculiar to a particular event. Each User shall comply with such instructions as issued by the DNO provided that the instructions do not contravene the technical parameters of a particular User's System registered in the Distribution Code. The DNO shall promptly refer all such unforeseen circumstances and any determination thereof to the Panel for consideration as per CM 5.4.

CM 5 THE DISTRIBUTION CODE REVIEW PANEL

CM 5.1 All the DNOs shall jointly establish and maintain the Distribution Code Review Panel within three months of the notification of the code, which shall be a standing body to undertake the functions detailed in CM 5.4

CM 5.2 The panel shall function in accordance with the DCRP Operating Procedure (DCRP-OP) duly approved by NEPRA. Subsequent to the establishment of the panel, it shall formulate its rules and procedures to conduct business and submit to NEPRA within three months of the establishment of the Panel.

CM 5.3 The Panel shall consist of;

a. one member appointed by each Ex-WAPDA DNO;
b. a person appointed by the Authority;
c. the following;
   (i) 1 person representing Embedded Generators.
   (ii) 1 person representing Bulk Power Consumers.
   (iii) 1 representative from KE.
   (iv) 1 member from the Industry or Academic Institution or PEC.
   (v) 1 representative from the System Operator (SO).
   (vi) 1 representative from NGC
   (vii) 1 representative from Metering Service Providers (MSP).
   (viii) 1 representative of Suppliers.
   (ix) 1 Representative from the Market Operator (MO).

The chairpersonship of the DCRP shall rotate every Three (3) years between DNOs.

The chairperson shall be from EX-WAPDA DNO's or KE.

The decisions of the DCRP, after approval by the Authority, shall become binding on the DNO and all Distribution Code Users.

Representation within each category shall be based on rotation and mutual agreement as detailed in the DCRP-OP.

CM 5.4 The Panel shall:

a. keep the Distribution Code and its workings under review;
b. any Distribution Code User (including DCRP Members) or the Authority can seek amendment in the Distribution Code by making a formal application to the Panel in the prescribed format;
c. review requests for derogation from the requirements of the Distribution Code from DNOs or Users; and decide upon whether to grant the derogation;
d. submit agreed amendment recommendations to NEPRA for approval; noting that all amendments to the Distribution Code shall be contingent upon NEPRA's approval;
e. issue guidance on the Distribution Code and its implementation, performance, and interpretation, as and when requested by any User;
f. resolve any matters of disputes between a DNO and its Users; and

g. consider what changes are necessary to the Distribution Code arising out of any unforeseen circumstances as referred by the DNO under CM

CM 6 COMMUNICATIONS BETWEEN THE DNOS AND USERS

CM 6.1 Unless otherwise specified in the Distribution Code, the methods of operational communication and data transfer shall be agreed between the DNO and Users from time to time.

CM 6.2 All non-operational communications (data information and notices) between a DNO and Users shall be in writing and issued to the appropriate officers of the DNO and each User.

CM 6.3 If for any reason a DNO or a User re-locates its Control facility, theDNO or the User must inform the other party in writing of the move and advise the other party of any changes to their Control Telephony (dedicated telephone system).

CM 6.4 All instructions and communications given by Control Telephony are to be recorded by whatever means and will be accepted by a DNO and Users as evidence of those instructions or communications.

CM 6.4.1 All recordings of instructions and communications must be kept intact for at least sixty (60) months to allow for potential investigation.

CM 6.5 All communications between the System Operator and DNOs and Users will be in accordance with the Grid Code.

CM 6.6 Each User and DNO shall provide and keep updated a list of personnel and contacts for communication for operation and control and exchange of data and information between other DNOs and Users.

CM 7 MISCELLANEOUS

CM 7.1 Data and Notices

CM 7.1.1 References in the Distribution Code to 'in writing' shall include typewriting, printing, lithography, and other modes of reproducing words in a legible and non-transitory form such as electronic communications.

CM 7.1.2 Where applicable all data items shall refer to nominal Voltage and Frequency.

CM 8 JURISDICTION OF THE CODE

The geographic Jurisdiction of the Code for each DNO shall be the Service Territory of each DNO (to be provided by each DNO). The functional jurisdiction of this Code shall include all substations and lines rated at Distribution Voltage.

CM 9 COORDINATION WITH SYSTEM OPERATOR

The DNO shall provide the System Operator metering data including peak load, projected load, voltage, frequency, and Embedded Generation availability. This data will be available to the System Operator to be used for operation and protection of specific 132kV lines and substations as described in the Grid Code.

Illustration: - Relationship Diagram of Power System at the beginning shows the functional inter-relationships between Grid Code and Distribution Code and interfaces with the Network Users.

CM 10 INDEMNITY TO THE DISTRIBUTION COMPANIES

Each User shall indemnify the DNO against any claim, action,damage, loss, liability, expenses or outstanding which the DNO pays, suffers, incurs or is liable for in respect of any breach by that User or any officer, agent, or employee of that User.

CM 11 FORCE MAJEURE CONDITIONS

CM 11.1 The DNO or a User (as the case may be) shall not be considered to be in default of its obligation to comply with one or more provisions of the Distribution Code if it is prevented from such compliance by Force Majeure. The defaulting party, the DNO or the User (as the case may be), shall give notice and the full particulars of such Force Majeure to NEPRA and the other concerned party (or parties) in writing or by telephone as soon as reasonably possible after the occurrence of the Force Majeure. Telephone notices given shall be confirmed in writing as soon as reasonably possible and shall specifically state full particulars of the Force Majeure, the time and date when the Force Majeure occurred, and when the Force Majeure is reasonably expected to cease. The Distribution Code Users affected shall, however, exercise due diligence and all necessary efforts to remove such disability and fulfil their obligations under the Distribution Code.

CM 11.2 Mere economic hardship shall not be considered Force Majeure. Acts of negligence or wrongdoings shall also be excluded from Force Majeure.

CM 12 MATTERS TO BE AGREED

Unresolved matters between Distribution Companies and Users are referred to the Distribution Code Review Panel (DCRP) for resolution. The DCRP will need to refer to the Authority any matters requiring interpretation of the Distribution Code provisions.

CM 13 INFORMATION DISSEMINATION

The DNO shall establish, operate, and maintain web site providing necessary information about the transmission and distribution system status, distribution use of system pricing, congestion, operating procedures, technical bulletins, technical committee meetings, and other relevant information and data.

CM 14 PRESERVATION OF CONTRACTS PRIOR TO ENACTMENT OF NEPRA ACT

During the subsistence of the agreements entered into by the DNO prior to the enactment of NEPRA Act, nothing contained in this Distribution Code shall be applied in a manner which is inconsistent with the agreements and materially increases the obligations or impairs the rights of the Users under their agreements.

CM 15 NON-COMPLIANCE

Any Act of non-compliance of any of the provision of this Distribution Code by any of the User or entity shall be subject to penalties as per NATIONAL ELECTRIC POWER REGULATORY AUTHORITY (FINE) REGULATIONS, 2021.

CM 16 CODE ADMINISTRATION

Distribution Companies shall be responsible for the enforcement and administration of the distribution code. Details of the administration are given in DCRP-OP.

The Chairperson's DNO shall act as host and its MIRAD (Market Implementation & Regulatory Affairs Department) shall serve as the DCRP secretariat.

CM 17 DISTRIBUTION CODE AMENDMENT AND EXEMPTION PROCESS

CM 17.1 The Authority shall approve the Distribution Code, its Amendments or any Exemption from its provisions. While approving any Amendment or Exemption, the Authority may consider but not be constrained, by the recommendations of the DCRP on the relevant matter.

CM 17.2 All requests for Amendment to or Exemption from the Distribution Code shall be submitted to the DCRP and thereafter processed and examined by the DCRP. The DCRP after thorough evaluation shall make recommendations to Authority for its final approval.

CM 17.3 The DCRP shall maintain an up-to-date approved copy of the Distribution Code, including all approved Amendments incorporated in the text of the document, on its website. Further, the DCRP shall also publish the details of every Exemption granted on its website.

CM 17.4 The Distribution Code shall be thoroughly reviewed and revised after every five (5) years or earlier as and when required. The findings of this review shall be submitted to the Authority.

CM 17.5 Grid Code Amendment

CM 17.5.1 Any DNO, User or Authority can propose any amendment in the Distribution Code, provided that the Amendment application request includes the following information:

a) The parts, sub-codes and conditions proposed to be amended;

b) A clear justification of the Amendments, including on any distortion, gap or issue of concern in the existing Distribution Code conditions, or any new or change in policies, legal provisions in the Act and relevant regulatory framework including the Authority approved regulations;

c) Description on how the Amendments proposed would address the issues and conditions identified in the justification;

d) An indicative or summary text proposed for the Amendment;

e) Any other information and relevant supporting documents the applicant consider necessary to explain and justify the proposed amendment.

CM 17.5.2 The Amendment request shall be admitted once all the required information has been submitted. The SO may request additional information or clarifications to add to the Amendment request.

CM 17.5.3 A DCRP meeting shall be called within a period not more than two (2) weeks after admission of the request for Amendment.

CM 17.5.4 The DCRP shall review the request for Amendment and based on the review and discussions in meetings, submit to the Authority its recommendations within one (1) month of its admission for its approval.

CM 17.5.5 The Authority shall consider the Amendment in light of the recommendations of DCRP, and may require additional information from the DCRP or carry out public or stakeholders' consultations to arrive at an informed decision.

CM 17.5.6 The Authority may return the request to the DCRP with comments and instructions to address in the Amendment. The DCRP shall review and re-submit the Amendment after addressing the comments and instructions by the Authority within fifteen (15) days of receipt of such instructions.

CM 17.5.7 After the Authority approves an Amendment, it shall be the responsibility of the DCRP to inform all Users and DNOs about the same.

CM 17.5.8 If the Authority considers that an Amendment in the Distribution Code is required to be made, the Authority may direct the DCRP to make such Amendment within thirty (30) days and submit the draft Distribution Code with relevant Amendments for the approval of the Authority. Provided that a meeting of the DCRP may be convened to consider and submit recommendations on the Amendment to the Authority, in support or otherwise, for consideration. Provided further that if the DCRP does not comply with the directions of the Authority within the specified period without providing just cause, the Distribution Code shall be deemed to have been amended.

CM 17.6 Distribution Code Exemption

CM 17.6.1 A User or DNO can seek Exemption from complying with one or more provisions of the Distribution Code for Plant, Apparatus, Systems or Equipment which existed prior to the approval of this Distribution Code, and which may be considered on the following grounds:

a) to provide for existing Plant and/or Apparatus that has not been designed in accordance with the provisions of this Distribution Code;

b) to facilitate a smooth transition into this Distribution Code from the existing Plant, Apparatus, Systems or Equipment;

c) to ease one or more temporary constraints that prevent compliance and necessitate exemption; and/or

d) to deal with any variation from this Distribution Code in the Legacy Contracts.

CM 17.6.2 A User or DNO seeking Exemption from one or more provisions of the Distribution Code shall make a written request to the DCRP and shall be required to justify the request in terms of both the specific circumstances and the expected duration. As a minimum, the application request must include the following information:

a) detail of the applicant;

b) relevant provisions of the Distribution Code and the required performance;

c) a description of the relevant Plant and/or Apparatus and/or equipment and the nature and extent of non-compliance (where applicable);

d) a description of the proposal for restoring compliance (where applicable) including details of actions to mitigate risks and restore compliance including timelines;

e) a description of the reasonable alternative actions that have been considered; and

f) a statement of the expected duration of the non-compliance.

CM 17.6.3 On receipt of a request for Exemption with all the information required, the DCRP shall promptly consider such request (by seeking independent third-party expert advice/opinion on the request, if necessary) and submit its recommendations to the Authority within one (1) month of the admission of the application for a final decision.

CM 17.6.4 The Authority shall consider the request in light of the recommendations of the DCRP and shall decide on the request as appropriate. In deciding on the request, the Authority may require additional information, and/or invite the applicant or members of the DCRP to seek clarification on the request, and/or publish on its website for comments by other potentially affected Users and DNOs.

CM17.6.5 The Authority determination shall be public and uploaded to the NEPRA website. It shall be considered as the final decision for the DCRP to communicate to the applicant and/or for taking further action, as may be appropriate.

CM 17.6.6 If an Exemption is granted, then the relevant User or DNO shall not be obliged to comply with the applicable provisions of the Distribution Code (to the extent and for the period of the Exemption) and shall comply with any alternative provision as set forth in the Exemption.

CM17.6.7 An Exemption from the Distribution Code shall have an expiry date in order to review its continued needs and monitor performance towards compliance.

CM 17.6.8 An Exemption granted to a User or DNO shall be transferable for the approved period/term. However, in the event of transfer of ownership of Plant and Apparatus of the User or DNO, the transferee shall need to seek a concurrence of the Exemption from the Authority.

CM 17.6.9 Where a material change in circumstances has occurred, a review of any existing Exemption, and any Exemption under consideration, may be initiated by the Authority or the DCRP or at the request of User or DNO.

CM 18 HIERARCHY

Where there is the potential for conflict between the various codes and contracts governing the power system, the following hierarchy, in descending order, shall be used to decide the correct approach:

a) NEPRA Act;

b) NEPRA Performance Standards (Transmission);

c) NEPRA Performance Standards (Distribution);

d) The Grid Code;

e) The Distribution Code;

f) Connection Agreement (stand-alone or as part of other agreements); and

g) Any other contract or agreement between/among the parties.

CM 19 DISPUTES

CM 19.1 When there is a dispute between a DNO and any User (existing or prospective), both parties will endeavour to resolve it amicably through negotiations. In case, they are unable to do that within one (01) month, they will be entitled to raise the dispute before the DCRP for settlement. The DCRP will examine the case and try to work out a solution within one (01) month. If either of the parties to the dispute is still not satisfied with the DCRP's suggested solution, it will have the right to raise the dispute to NEPRA whose decision on the issue will be final and binding to both the parties.

CM 19.2 Given the D-Code on the Consumer side only applies to Consumers with 1MW or more, likewise this disputes section does not apply to Consumers below 1MW.

CM 20 LAW REVISIONS

All laws, regulations, standards, procedures, documents referred to in the Distribution Code will include their latest revision, which are made to them from time to time.

CM 21 SEVERABILITY

In the event that any provision of this Code is declared invalid by a competent court, such provision shall be ineffective to the extent declared invalid without affecting the validity of the rest of the Code which shall remain binding on the Parties hereto.

CM 22 RULES OF INTERPRETATION

In this Code:

1) the headings, diagrams and table of contents are for convenience only and shall be ignored in construing this Agreement;

2) except where the context determines otherwise, the singular includes the plural and vice versa and the masculine gender includes the feminine;

3) references to Clauses, recitals and Schedules are, unless otherwise specified, references to Clauses of, and Schedules and recitals to this Code;

4) reference to any publication, statute, rule, code, regulation, instrument, or standard means the same as amended, supplemented, or re-enacted

from time to time;

5) reference to any agreement means the same as amended, supplemented, or replaced from time to time;

6) unless otherwise provided herein, whenever a consent or approval is required by one party from the other party, such consent or approval shall be in writing and shall not be unreasonably withheld, conditioned, or delayed;

7) the words “include,” “including,” and “in particular” are used by way of illustration only, and shall not be construed as, nor shall they have the effect of, limiting the generality of the preceding words;

8) references to a User or DNO are references to a User or DNO of this Code, including that User’s assigns or transferees permitted in accordance with the terms of this Code and its successors in title;

9) the Schedules (and if any schedules or tables thereto) to this Code form part of this Code, and capitalised terms and abbreviations used in the Schedules (and if any schedules or tables thereto) which are not defined therein shall have the meanings given to them in the definition annex of this Code and in the event of any conflict between the main body of this Code and a Schedule, the main body of this Code shall prevail over the provisions of the Schedule;

10) if a period of time is specified as from a given day, or from the day of an act or event, it shall be calculated exclusive of that day;

11) reference to any notice or notification means a notice or notification made in writing or as otherwise expressly provided in this Code;

12) a reference to “day” means a calendar day; And

13) where transmission is used in this document it may refer to transmission assets owned by the DNO where it acts as a TNO whereby the detailed management of the assets comes under the Grid Code.

End of CM

DISTRIBUTION OPERATING CODE

DISTRIBUTION OPERATING CODE NO. 1

LOAD FORECASTS

CONTENTS

DISTRIBUTION OPERATING CODE NO. 1: LOAD FORECASTS

DOC 1.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 1.1.1 This Code is concerned with load forecasting as related to Operational Planning Timescales with the specific objective of ensuring that the Standards of Security and Quality of Supply as prescribed in the PerformanceStandards (Distribution) are maintained for all the Consumers served by the DNO at all times.

DOC 1.1.2 The general objectives of this Code are:

(a) to determine load forecast to be developed on the basis of information to be provided by all the Consumers having a connected load of 1 MW and above to the DNOs, information to be provided by other Users of the DNO**,** and data in respect of all other industrial, agriculture**,** commercial and domestic Consumers available to the DNO; and

(b) where a supplier other than the DNO supplies Consumers, they shall provide the DNO with load forecasts for all their Consumers.

DOC 1.1.3 The Scope applies to all Consumers connected to the DNO System.

DOC 1.1.4 Where a Consumer is required to provide load data to a DNO, this means Active Load forecasts from the Consumers at the point of supply to the Consumers.

DOC 1.1.5 References in this sub-code to data to be supplied on an hourly basis refers to it being supplied for each period of 24 hours ending on each day.

DOC 1.1.6 All information supplied to the DNO shall be in writing.

DOC 1.1.7 References in this sub-code to data being supplied on a 24-hour basis refers to it being supplied for each period of 24 hours ending on each day.

DOC 1.1.8 The term ‘Operations’ means operations in real time.

DOC 1.2 DATA EXCHANGE AND INFORMATION FLOW

DOC 1.2.1 Load forecast Information

DOC 1.2.1.1 The DNO shall co-ordinate all Load forecast information for each Connection Point to meet the requirements of the Grid Code.

DOC 1.3 LOAD FORECAST DATA

DOC 1.3.1 Planning Periods

DOC 1.3.1.1 Information for the following rolling timescales is required by each DNO:

(a) Operational Planning Phase (Medium term);

(b) Programming Phase (Short term); and

(c) Control Phase (Real time).

DOC 1.3.1.2 In DOC1 Year 0 means the current Licensee Calendar Year at any time, Year 1 means the next Licensee Calendar Year, Year 2 means the Licensee Calendar Year after year 1 and so on.

DOC 1.3.2 Operational Planning Phase (8 weeks to 2 years ahead)

DOC 1.3.2.1 The information to be supplied to the DNO during the Operational Planning Phase is specified in DOC 1 Appendix 1.

DOC 1.3.3 Programming Phase (24 hours to 8 weeks ahead)

DOC 1.3.3.1 The information to be supplied to the DNO during the Programming Phase is specified in DOC 1 Appendix 2.

DOC 1.3.3.2 For the period 2 to 8 weeks ahead the information shall be supplied to the DNO by 1600 hours each Thursday.

DOC 1.3.3.3 For the period up to 2 weeks ahead the information shall be updated and supplied to the DNO by 0900 hours each Wednesday.

DOC 1.3.3.4 The DNO may require the information specified in Appendices 1 and 2 of this sub-code to be updated if it reasonably considers it necessary and to be supplied to the DNO by 0800 hours each day (or such other time as specified by the DNO from time to time) for the next day. On Thursdays and Saturdays the information should be supplied for the following two days.

DOC 1.3.4 Control Phase (0 to 24 hours ahead) DOC 1 Appendix 3.

DOC 1.3.4.1 The following information shall be supplied to the DNO at reasonable times to be specified by the DNO for the un-expired period covered by the Control Phase.

(a) Intimation by all the Embedded Generators to the DNO in case the difference of their hourly output is more than 1 MW as compared to their schedule of generation already notified under DOC 1.3.3.3.

(b) Intimation by all the Bulk Power Consumer to the DNO the detail of changes in the load if such changes are more than 1 MW.

DOC 1.3.4.2 On the basis of information provided by the Consumers as outlined in DOC 1.1.2 and DOC 1.3.4.1 above the DNO shall work out its load forecast for the next schedule day.

DOC 1.3.5 **Post Control Phase**

DOC 1.3.5.1 The following data shall be supplied to the DNO by 0200 hours each day:

Details of hourly Active Power and Reactive Power output sent out to the DNO's System by Embedded Generator not subject to central Scheduling and Dispatch during the previous day on a half hourly basis.

DOC 1.4 DNO AND USER FORECASTS

DOC 1.4.1 The following factors shall be taken into account by the DNO and Users when conducting load forecasting in the Operational Planning Phase:

(a) historic load data;

(b) weather forecasts (Note: Responsibility for weather correction of Consumer's load rests with the User);

(c) incidence of major events or activities;

(d) Consumer Generating Unit Schedules;

(e) load transfers;

(f) interconnection facilities with adjacent distribution companies; and

(g) any other factor reasonably considered necessary.

End of DOC 1

DISTRIBUTION OPERATING CODE NO. 2

OPERATIONAL PLANNING

CONTENTS

OPERATING CODE NO. 2

OPERATIONAL PLANNING

DOC 2.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 2.1.1 Distribution Operating Code No. 2 deals with the co-ordination through various timescales, of planned outages of facilities, which affect the Operation of the DNO's System or require the commitment of DNO resources.

DOC 2.1.2 DOC2 supplements the obligation of each DNO to provide certain information to System Operator under the Grid Code and establishes proceduresto enable the collection of such data from Users specified in DOC 2.1.6

DOC 2.1.3 The means of providing the information to the DNO and its confirmation includes any non-transitory written form, or any other suitable means of electronic transfer which enables the recipient to retain the information.

DOC 2.1.4 In order for the DNO to fulfil the requirements of this DOC2 it should be noted that the information set out in G Code OC 4, to be provided by System Operator,shall form the basis of Operational Planning under this DOC2.

DOC 2.1.5 The objectives of DOC2 are;

a. to set out the Operational Planning procedures, requirements, and typical timetable for the co-ordination of outage requirements for facilities to be provided by the Users to enable the DNO to operatethe Distribution System in accordance with the security, reliability and quality standards as set out in this Code, Performance Standards (Distribution) and Distribution Service Manual; and

b. to specify the information to be provided by Users to the DNO to allow it to comply with the Grid Code.

DOC 2.1.6 The scope of this Code applies to the following Users of the DNO's Distribution System:

a. Embedded Generator in the DNO's System whose registered capacity is greater than 1MW but not subject to Central Despatch;

b. another DNO connected to the DNO's DistributionSystem;

c. Consumer with Own Generation where the DNO reasonably considers it appropriates; and

d. all Bulk Power Consumers connected to the DNO's Distribution System.

DOC 2.2 PROCEDURE

DOC 2.2.1 <u>Embedded Generator</u>

DOC 2.2.1.1 Information relating to all facilities connected to the Distribution System of the DNO, or that which may affect its Operation, shall be co-ordinated with the DNO.

DOC 2.2.2 <u>Other Plant and Apparatus</u>

DOC 2.2.2.1 Information relating to all facilities connected to the Distribution System of the DNO, or that which may affect its Operation, shall be co-ordinated with the DNO.

DOC 2.3 TIMESCALES AND DATA

DOC 2.3.1 Detailed implementation of data gathering, and timescales shall be agreed locally between the DNO and each of the Users. Due recognition shall begiven by the DNO to voltage levels, capacities, and load levels of facilitieswhen assessing information requirements.

DOC 2.3.2 All information shall be provided on a weekly basis, where week 1 commences in the first week of January as published from time to time.

DOC 2.3.3 The rolling timescales involved in DOC2 are illustrated in Figure 1 on page 20 are as follows:

a. Operational Planning Phase

i. Medium Term – covers the next calendar year and the year that follows it

ii. Short Term – covers the current calendar year down to 8 weeks ahead

b. Programming Phase

i. Covers 24 hours to 8 weeks ahead inclusive

c. Control Phase

i. covers 0 to 24 hours ahead

DOC 2.3.4 In DOC2 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.

DOC 2.4 OPERATIONAL PLANNING PHASE

DOC 2.4.1 Medium Term Programme (Current Year 1-2 ahead Appendix 2)

DOC 2.4.1.1 Users and Embedded Generators (not subject to Central Despatch) shall provide the DNO with information in accordance with DOC 2 Appendix 1.

DOC 2.4.2 Short Term Programme (Current Year down to 8 weeks ahead DOC2 Appendix 2).

DOC 2.4.2.1 The previous Medium-Term Programme shall be updated to form the basis of the Short-Term Programme. The DNO shall continually review this programme as necessary and periodically discuss it with the relevant parties as appropriate.

DOC 2.4.2.2 It shall take account of such review and discussions and any additional outages, and the following further details of each outage proposed shall be notified at this stage by the appropriate party.

a. return to service timing of circuits (if different from the programme);

b. specific facilities to be worked upon; and

c. any other information that may be reasonably specified by the DNO from time to time.

DOC 2.4.2.3 At any time and from time to time during the current Calendar year up to the Programming Phase (8 weeks ahead), all the relevant Users specified in DOC 2.1.6 may notify reasonable changes and additions to the outages previously notified during the Medium-Term planning process. The DNO shallconsider whether the changes shall adversely affect system security, stability,reliability and quality or other parties connected to the DNO's network and shall discuss with the party in question. Where the change is so discussed the DNO shall

inform the other affected Users.

DOC 2.5 PROGRAMMING PHASE (24 hours to 8 weeks ahead inclusive)

DOC 2.5.1 The Short-Term Programme shall form the basis of the Programming Phase and a rolling suggested programme for the following week and subsequent 7-week period respectively shall be prepared weekly by the DNO.

DOC 2.5.2 The DNO shall update the programme each week and take account of any additional or varied outages.

DOC 2.5.3 Any decision to depart from the outages and actions determined during this phase shall immediately be notified to the DNO, who shall inform other affected parties.

DOC 2.5.4 The DNO shall endeavour to give as much notice as possible to a Generator which may be operationally affected by an outage which is to be included in a programme referred to in DOC 2.5.1

DOC 2.5.5 Where a Generator which may be operationally affected by the DNO's System outage programme referred to in DOC 2.5.1 and is concerned on grounds relating to safety and operability of the unit and about the effect which an outage within such outage programme might have, it may contact the DNO to explain its concerns and discuss whether there is an alternative way of taking such outage (having regard to technical feasibility). If there is such an alternative way, but the DNO refuses to adopt that alternative way in taking that outage, the Generator may refer the matter to Review Panel under agreed disputes resolution procedures to decide about the way the outage should be taken.

DOC 2.5.6 Generation Scheduling Information

DOC 2.5.6.1 The DNO shall obtain Scheduling information from Generators for other Embedded Generator not subject to Central Despatch where it considers it appropriate.

DOC 2.5.6.2 The Scheduling information shall specify the following on an individual Generating Unit basis:

a. the period the unit is required;

b. the planned half hourly output; and

c. any other information the DNO reasonably considers necessary

DOC 2.5.7 The Disco shall set timelines for all User data submission and consequent PCC responses, so as to allow the PCC to fulfil is submission duties to the SO.

DISTRIBUTION OPERATING CODE No 2

DOC 18

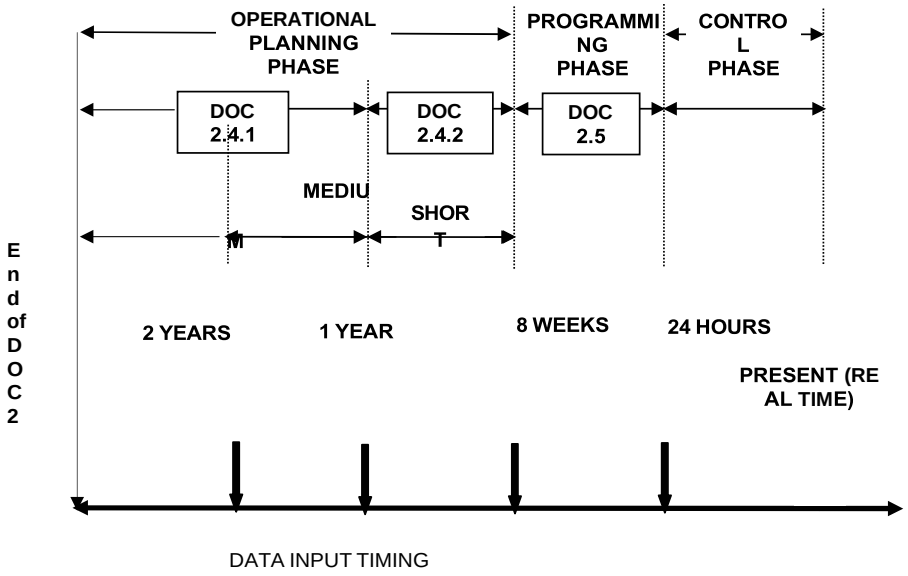


Figure 1

DISTRIBUTION OPERATING CODE NO. 3

SYSTEM RESTORATION

CONTENTS

DISTRIBUTION OPERATING CODE NO. 3: SYSTEM RESTORATION PLANNING

DOC 3.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 3.1.1 Black Start

DOC 3.1.1.1 Distribution Operating Code No. 3 covers the system recovery procedures following a Total or Partial Shutdown of the Total System as recognised by System Operator and that System Operator intends to implement Black Start procedures after having given notification to the DNO.

DOC 3.1.2 The objectives of DOC3 are to lay down the requirements, actions, and procedures with a view to assist System Operator in the restart of the Total System or tooperate the Total System under abnormal situations which require co- ordination between all Users of the DNO with a common approach to give uniformity of priorities. It also specifies requirements to be met during force majeure conditions.

DOC 3.1.3 The DNOs shall identify and list-out the black start facilities and inform System Operator any changes to this information.

DOC 3.1.4 DOC3 will apply to;

a. All DNOs.

b. All Generators including Embedded Generators.

c. Bulk Power Consumers.

d. Consumers having a connected load of more than 1MW.

e. Externally connected Consumers.

DOC 3.2 PROCEDURE – BLACK START

DOC 3.2.1 Total System Shutdown is a situation when all generation has ceased with no electricity supply from External Interconnections.

DOC 3.2.2 Partial Shutdown is a situation where all generation has ceased in a separated part of the Total System and there are no available interconnections to the other parts of the Total System.

DOC 3.2.3 System Recovery

DOC 3.2.3.1 Certain Embedded Power Stations may be identified, as having an ability to start up from shut down without connections to external power supplies. Such Power Stations are to be referred to as Black Start stations.

DOC 3.2.3.2 The DNO in conjunction with System Operator shall segregate the DNO's load into suitably sized components to allow progressive re- energisation of the DNO's distribution system. The size of the areas of load will be determined by System Operator; and will be commensurate with the sizeof Generating Unit to be re-started.

DOC 3.2.3.3 For the avoidance of doubt provided it is in line with the above System Operator Requirements, prioritisation for restoration of 11kV Feeders is to be done as per DNO Policy.

DOC 3.2.4 Re-synchronising Islands of Supply

DOC 3.2.4.1 The DNO's regional distribution control centres in the case of partial or full shut down shall follow the standard predefined instructions of System Operator to help recover the system from a black start condition.

DOC 3.2.5 System Incident Procedures

To co-ordinate activities, Users and the DNO shall ensure that there are multiple and suitable communication paths available and that where appropriate senior members of staff are appointed to manage these abnormal situations.

DOC 3.2.6 The DNO shall abide by the requirements of the System Operator restoration plan and shall ensure that its personnel are familiar with and are trained and experienced in their standing instructions and obligations so as to be able to implement the required procedures.

End of DOC 3

DISTRIBUTION OPERATING CODE NO. 4

OPERATIONAL LIAISON

CONTENTS

DISTRIBUTION OPERATING CODE NO. 4
OPERATIONAL LIAISON

DOC 4.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 4.1.1 Distribution Operating Code No.4 sets out the requirements for the exchange of information relating to Operations and/or Events on the DNO's System or the System of any User connected to the DNO's System, which have had or may have had, or shall have or may have an Operational Effect on the DNO's System or the System of any other User.

DOC 4.1.2 The requirement to notify in DOC4 relates generally to communicating what is to happen what has happened but not the reasons why. However, DOC4 provides, when an Event has occurred on the DNO's System which itself has been caused by (or exacerbated by) an operation or Event on a User's System, the DNO in reporting the Event on the DNO's System to another User can pass on what it has been told by the first User in relation to the Operation on that User's System.

DOC 4.1.3 The objective of this DOC4 is to provide for the exchange of information between DNO and User so that the implications of the Operation and /or Event can be properly understood and considered and the possible risks arising from it can be assessed, minimized, and appropriate action can be taken by the relevant party in order to maintain the integrity and security of theTotal System of System Operator. DOC4 does not seek to deal with any actions arising from the exchange of information, but merely with the exchange of relevant information.

DOC 4.1.4 DOC4 applies to the DNO and to Users as mentioned inCM 2 of Distribution Code. The procedure for operational liaison of the DNO with System Operator is set out in the Grid Code.

DOC 4.2 PROCEDURE

DOC 4.2.1 Communications

DOC 4.2.1.1 The DNO and each User connected to its Distribution System shall nominate officers and agree on communications channels to make effective the exchange of information required under DOC4.

DOC 4.2.1.2 The DNO shall establish reliable and suitable communication facilities at its Distribution Voltage sub-stations. All operating instructions, messages and data received from or sent to the concerned Grid Sub-station and Distribution Power Control Centres (PCC) shall be duly recorded at such sub-station.

DOC 4.2.2 Requirement to notify Operations

DOC 4.2.2.1 In the case of an Operation on the System of a User connected to the DNO's Distribution System, which shall have or may have an OperationalEffect on the DNO's System, the User shall notify the DNOin accordance with DOC4.

DOC 4.2.2.2 In the case of an Operation on the DNO's System or on receipt of notification of an Operation on the NGC Transmission System or a connected TNO system, which shall have or may, in the opinion of the DNO, have an Operational Effect on the System of a User connected to the DNO's System, the DNO shall notify the User that such incident has occurred.

DOC 4.2.2.3 An Operation may be caused by another Operation or an Event on another's

DNO System and in that situation the information to be notified is differentfrom that where the Operation arose independently of any other Operation or Event.

DOC 4.2.2.4 Whilst in no way limiting the general requirement to notify in advance or post operation, the following are examples of situations where, inasmuch as they may have or have had an effect on the Operation of the DNO Distribution System or another System, notification shall be required of:

a. the implementation of a Scheduled Outage of facility which has been arranged pursuant to DOC2;

b. 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 synchronising;

c. Operation of any circuit breaker and associated relays for planned or load shedding, unit tripping or reduction in output or forced tripping;

d. Voltage control;

e. Violation by Users of its obligations under the agreement or Distribution Service Manual and Performance Standards (Distribution);

f. Potential for excessive loading on the facilities including inter-connecting facilities;

g. Unavailability of any control and protection facilities;

h. Change in the exchange of power between DNO and other systems/Users;

i. Unusual/abnormal event which may impact the functioning and performance of parties connected to the DNO's system; and

j. this section should include certain operational liaison in the form of notification procedures to the employees to caution and prepare them to take remedial steps in case of contingency event or emergency situation.

DOC 4.2.3 Form

DOC 4.2.3.1 A notification under DOC2.4.1 shall be of sufficient detail to describe the Operation, stating the cause, to enable the recipient of the notification reasonably to consider and assess the implications and risks arising and shall include the name of the individual reporting the Operation. The recipient may ask questions to clarify the notification

DOC 4.2.3.2 A notification by the DNO of an Operation which has been caused by another Operation (the “First Operation”) or by an Event on a User’s System, shall describe the Operation and shall contain the information which the DNO has been given in relation to the First Operation or that Event by theUser.

The notification (other than in relation to the information which the DNO is merely passing on from a User) shall 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 DNO’s System and shall include the name of the individual reporting the operation onbehalf of the DNO.

DOC 4.2.3.3 Where a User is reporting an Operation or an Event which itself has been

caused by an incident or scheduled or planned action affecting (but not on) its System the notification to the DNO shall contain the information which theUser has been given by the person connected to its System in relation to thatincident or scheduled or planned action (which the User must require, contractually or otherwise the person connected to its System to give it) and the DNO may pass on the information contained in the notification.

DOC 4.2.3.4 A notification by the DNO of an operation under DOC4 which has been caused by an Operation or an Event on the NGC Transmission System or a connected TNO system, may describe the Operation on the DNO's System and shall contain the information which the DNO has been given in relation to the Operationor an Event on the NGC Transmission System or a connected TNO system by System Operator. The notification (other than in relation to the information which the DNO is merely passingon from System Operator) shall be of sufficient detail to enable the recipient of the notification to consider and assess the implications and consequences arising from the Operation on the DNO's System and shall include the name of the individual reporting the Operation on behalf of the DNO. The recipient may ask questions to clarify the notification.

DOC 4.2.3.5 A User may pass on the information contained in a notification to it from the DNO to a Generator with a Generating Unit connected to the System or to another DNO connected to its System if it is required (by a contract pursuant to which that Generating Unit or that DNO is connected to the System) to do so in connection with the equivalent of an Operation on its System (if the Operation on the DNO's Systemcaused it).

DOC 4.2.3.6 Other than as provided in DOC4.2.3.5, a User may not pass on any information contained in a notification to it from the DNO or in a notification to another User from the Licensee to any other person connected to its System.

Each User shall procure that any other Users receiving information, which was contained in the notification to a User from the Licensee, which is not bound by the Distribution Code, does not pass any information on other than as provided above.

DOC 4.2.4 Timing

DOC 4.2.4.1 A notification under DOC 4.2.2 shall be given as far in advance as possible and in any event shall be given in sufficient time as shall reasonably allow the recipient to consider and assess then implications and risks arising.

DOC 4.2.5 Requirement to Notify Events

DOC 4.2.5.1 In the case of an Event on the System of a User connected to the DNO's System, which has or has had an Operational Effect on the DNO's System or on the NGC Transmission System a connected TNO system, the Usershall notify the DNO in accordance with this DOC4.

DOC 4.2.5.2 In the case of an Event on the DNO's System or on receipt of notification of an Event on the NGC Transmission System or a connected TNO system, which shall have or may, in the opinion of the DNO, have an Operational Effect on the System of a User connected to the DNO's System, the DNO shall notify the User in accordance with this DOC4.

DOC 4.2.5.3 An Event may be caused by (or exacerbated by) another Event or by an Operation on NGC system, another DNO or User System and in that situation the information to be notified is different from that where the Event arose independently of any other Event or Operation.

DOC 4.2.5.4 Whilst in no way limiting the general requirement to notify the following are examples of situations where notification shall 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, facilities including Protection; and

d. increased risk of inadvertent Protection operation.

DOC 4.2.6 Form

DOC 4.2.6.1 A notification under DOC 4.2.5 of an Event which has arisen independently of any other Event or of an Operation, shall describe the Event (although it need not to state the cause of the Event) and subject to that it shall be of sufficient detail to enable the recipient of the notification to consider and assess the implications and risks arising. The recipient may ask questions to clarify the notification.

DOC 4.2.6.2 A notification by the DNO of an Event which has been caused by (or exacerbated by) another Event (the "first Event") or by an Operation on a User's System shall describe the Event and shall contain the information which the DNO has been given in relation to the first Event or that operation by the User. The notification (other than in relation to the information which the DNO is merely passing on from a User) shall be of sufficient detail to enable the recipient of the notification reasonably to consider and assess the implications and risks arising from the Event on the DNO's System and shall include the name of the individual reporting the Event on behalf of the DNO. The recipient may ask questions to clarify the notification.

DOC 4.2.6.3 Where a User is reporting an Event or an Operation which itself has been caused by (or exacerbated by) an incident or scheduled or planned action affecting (but not on) its System the notification to the DNO shall contain the information which the User has been given by the person connected to its System in relation to that incident or scheduled or planned action (which the User must require the person connected to its System to give it) and the DNO may pass on the information contained in the notification.

DOC 4.2.6.4 A notification by the DNO of an Event under DOC 4.2.5.2 which has been caused by (or exacerbated by) an Event or an Operation on the NGC Transmission System or a connected TNO system,, shall describe the Event on the DNO's System and shall contain the information which the DNO has been given in relation to the Operation on the NGC Transmission System or a connected TNO system,. The notification (other than in relation to the information which the DNO is merely passing on from NGC) shall be of sufficient detail to enable the recipient of the notification reasonably to consider and assess the implicationsand risks from the Event on the DNO's System and shall include the name of the individual reporting the Event on behalf of the DNO. The recipient may ask questions to clarify the notification.

DOC 4.2.6.5 A User may pass on the information contained in a notification to it from the DNO to a Generator with a Generating Unit connected to its System or to another DNO connected to its System if it is required (by a contract pursuant to which that Generating Unit or DNO is connected to its System) to do so in connection with an Event on its System (if the Event on the DNO's System

caused or exacerbated it).

DOC 4.2.6.6 Other than as provided in DOC 4.2.6.5, a User may not pass on any information contained in a notification to it from the DNO (and a User receiving information which was contained in a notification to another User from the DNO may not pass on such information) to any person connected to its System, but may only say that there has been an incident onthe Total System and (if known and if power supplies have been affected) an estimated time of return to service. Each User should ensure that any other User receiving information, which was, contained in a notification to such Userfrom the DNO, which is not bound by the Distribution Code, does not passany information on other than as provided above.

DOC 4.2.6.7 Except in an emergency situation the notification shall 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

DOC 4.2.6.8 Where an Event has been reported to the DNO by a Generator under DOC 4.2.5 relating to a Generating Unit and in order for the Generator to assess the implication of the Event on its System more accurately, it may ask the DNO for details of the Fault Levels on infeeds from the Distribution System to that Generating Unit at the time of the Event, and the DNO shall, as soon as reasonably practicable, give the Generatorthe information provided that the DNO has that information.

DOC 4.2.7 Timing

DOC 4.2.7.1 A notification under DOC 4.2.5 shall be given as soon as possible after the occurrence of the Event, or time that the Event is known of or anticipated by the giver of the notification under DOC4

DOC 4.2.8 System Control of the System Operator

DOC 4.2.8.1 Where a part of a DNO's System is, by agreement, under the System Control of the System Operator then the requirements and provisions of OC6 of the Grid Code shall apply to that situation as if the DNO's system is a part of NGC System.

DOC 4.2.9 System Control of the DNO

DOC 4.2.9.1 Where a part of a System of a User is, by agreement, under the System Control of the DNO then the requirements and provisions of this DOC4 shall apply to that situation as if the User's System is a part of the DNO's System.

DOC 4.2.10 Significant Incidents

DOC 4.2.10.1 Where an Event on the DNO's System or the Dedicated System of a User has had or may have had a significant effect on the System of any of the others, the Event shall be reported in writing to the owner of the System affected in accordance with the provisions of DOC5. Such an Event shall be termed a "Significant Incident".

DOC 4.2.10.2 Where a DNO notifies a User of an Event under DOC4, which the User considers has had or may have a significant effect on that User's dedicated System, that User shall require a DNO to report that Event in writing and shall notify the DNO accordingly. Such an Event shall also be termed a "Significant Incident".

DOC 4.2.10.3 Without limiting the general descriptions set out in DOC 4.2.10.1 or DOC4.2.10.2 a Significant Incident shall include Events which result in, or may result in, the following:

a. operation of facilities controlled either manually or automatically;

b. voltage outside the limits, prescribed in Performance Standards (Distribution);

c. System frequency outside the limits, provided in the grid code;

d. System Stability failure (transient and voltage both);

e. Likelihood of system collapse or shut down;

f. Thermal overloading of the facilities; and

g. Tripping of large amounts of load or generation.

End of DOC 4

DISTRIBUTION OPERATING CODE NO. 5

EVENT INFORMATION EXCHANGE

CONTENTS

DISTRIBUTION OPERATING CODE NO. 5
EVENT INFORMATION EXCHANGE

DOC 5.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 5.1.1 Distribution Operating Code No. 5 sets out the requirements for reporting in writing all Events which were initially reported verballyunder DOC4 and those specified events to be reported under the Grid Code and Distribution Code.

DOC 5.1.2 DOC5 also provides for the joint investigation of Significant Incidents by the Users involved and the DNO and/or NGC or the System Operator.

DOC 5.1.3 The Objective of DOC5 is to facilitate the provision of more detailed information in writing and, where agreed between the DNO and Users involved, joint investigation of those Significant Incidents reported verbally under DOC4.

DOC 5.1.4 DOC5 applies to the DNO and to Users, which in DOC5 means other Distribution Companies and Embedded Generators connected at High Voltage.

DOC 5.2 PROCEDURE

DOC 5.2.1 Communications

DOC 5.2.1.1 The DNO and each User specified in DOC 5.1.4 shall nominate officers and establish communication channels to ensure the effectiveness of this DOC5. Such officers and communication channels may be the same as those established under DOC4.

DOC 5.2.2 Written Reports of Events by Users to the DNO

DOC 5.2.2.1 In the case of an Event, which has been reported verbally to the DNO under DOC 4.2.2 and subsequently has been determined by the DNO to be a Significant Incident, a written report shall begiven to the DNO by the User in accordance with DOC5. The DNO shall not pass this report on to other affected Users but may use the information contained therein in preparing a report under DOC5 to a User in relation to a Significant Incident on the DNO's System, which has been caused, by (or exacerbated by)the Significant Incident on the User's System.

DOC 5.2.3 Written Reports of Events by the DNO to Users

DOC 5.2.3.1 In the case of an Event, which has been reported verbally to the User under DOC 4.2.2 and subsequently has been determined by the User to be a Significant Incident, if requested by the User a written report shall be given to the Userby the DNO in accordance with DOC5. The User shall not pass this report on to other affected Users but may use the information contained therein in preparing a report under DOC5 for another DNO connected to its System in relation to a Significant Incident, which has been caused by (or exacerbated by)the Significant Incident on the DNO's System.

DOC 5.2.4 Form

DOC 5.2.4.1 A report under DOC 5.2.2 shall be in writing and shallbe

sent to the DNO or User, as the case may be, containing written confirmation of the verbal notification given under DOC4 together with more details relating to the Significant Incident, althoughit need not state the cause of the Event save to the extent permitted under DOC 4.2.3.1 and DOC 4.2.3.2 and such further information which has become known relating to the "Significant Incident" sincethe verbal notification under DOC4. The report should, as a minimum, contain those matters specified in the DOC 5 Appendix 1 which is not intended to be exhaustive to this DOC4. The recipient may raisequestions to clarify the notification, and the giver of the notification shall, in so far as it is able, answer any questions raised.

DOC 5.2.5 Timing

DOC 5.2.5.1 A written report under DOC 5.2.2 shall be given as soon as reasonably practicable after the verbal notification under DOC4 and in any event a preliminary report shall normally be given within 24 hoursof such time.

DOC 5.2.7 Joint Investigation into Significant Incidents

DOC 5.2.7.1 Where a Significant Incident has been declared and a report submitted under DOC4 either party or parties may request in writing that a joint investigation be carried out. This investigation must then be performed.

DOC 5.2.7.2 The composition of such an investigation panel shall be appropriate to the incident to be investigated and agreed by all parties involved in a decision by the DCRP.

DOC 5.2.7.3 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.

DOC 5.2.7.4 A joint investigation shall take place where two-thirds of the majority of the members of the DCRP agree to it. The form and rules of the procedure for, and all matters (including, if thought appropriate, provisions for costs and for party to withdraw from the joint investigation once it has begun) relating to the joint investigation shallbe agreed at the time of a joint investigation.

DOC 5.2.7.5 Any joint investigation under DOC4 is separate from any inquiry which may be carried out under the Grid Code disputes resolution procedures.

End of DOC 5

DISTRIBUTION OPERATING CODE NO. 6

COORDINATION OF SAFETY AT THE CONNECTION POINT

CONTENTS

DISTRIBUTION OPERATING CODE NO. 6
COORDINATION OF SAFETY AT THE CONNECTION POINT

DOC 6.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 6.1.1 Distribution Operating Code 6 ("DOC 6") specifies the Safety Management System criteria to be applied by the DNO to meet NEPRA license obligations, imposed on owners and/or operators of the DNO's System.

DOC 6.1.2 Similar criteria and standards of Safety Management Systems are required to be provided as per their agreements or Distribution Service Manual by other Users of the Distribution System when carrying out work or tests at the operational interface with the DNO.

DOC 6.1.3 DOC6 sets out the requirements with a view to ensuring safety of persons (both public and otherwise) working on Distribution Systems when carrying out work or tests at the operational and Ownership Boundaries.

DOC 6.1.4 DOC6 specifies the Safety management criteria to be applied by the DNO and all Users of the DNO's Distribution System and those who interface with it;

a. Embedded Generators;

b. Other Distribution Companies connected to the DNO's System;

c. Any other party reasonably specified by the DNO; and

d. Bulk Power Consumers.

DOC 6.2 PROCEDURE

DOC 6.2.1 Approved Safety Management Systems

DOC 6.2.1.1 A Safety Management System (safety Code) specifying the principles and procedures, and where appropriate, the documentation to be applied so as to ensure the health and safety of all who are liable to be working or testing on the DNO's System, or on Plant and Apparatus connected to it, shall be developed by the DNO, and approved by NEPRA.

DOC 6.2.2 Operational Boundaries and Principles

DOC 6.2.2.1 At sites or locations where an Operational Boundary exists, which Safety Management System (Safety Code) in terms of ownership, construction, commissioning, testing, operation, maintenance, and replacement of the distribution facility developed by the Licensee shall be adopted by both the DNO and User. This shall include provision for Control Persons to be nominated by the DNO/User to operate to Safety Management Systems in use by field personnel where appropriate.

DOC 6.2.2.2 A system of documentation shall be maintained by the DNO and the User which records the inter-system safety precautions taken when:

a. work or testing is to be carried out on High Voltage Plant and/or Apparatus across the Operational Boundary; and

b. isolation and/or earthing of the other's System is needed

DOC 6.2.2.3 Where relevant, copies of the Safety Management System (safety

code) and related documentation shall be exchanged between the DNO and Users for each Operational Boundary at the time of their connection with the DNO's Distribution System.

DOC 6.2.3 Authorised Personnel

DOC 6.2.3.1 Safety Management System must include the provision for written Authorisation of personnel concerned with the control, operation, work or testing of Plant and Apparatus forming part of, or connected to, the DNO's System.

DOC 6.2.3.2 Each individual Authorisation shall indicate the class of operation and/or work permitted and the section of the System to which the Authorisation applies.

DOC 6.3 ENVIRONMENTAL SAFETY

DOC 6.3.1 Site Safety and Security

DOC 6.3.1.1 Arrangements shall be made to ensure site safety and security as required by statutory requirements.

DOC 6.3.2 Site Specific Hazards

DOC 6.3.2.1 Arrangements shall be made by all parties to ensure that personnel are warned by an appropriate means of hazards specific to any site, before entering any area of the site. This shall include hazards that may be temporary or permanent. Where these risks include contamination or similar risks or threats, suitable decontamination facilities and procedures shall be provided.

DOC 6.3.3 Inspections by Management / Safety Representatives

DOC 6.3.3.1 Arrangements shall be made to facilitate inspections by DNO management and Safety Representatives to sites accommodating DNO owned Plant and Apparatus.

DOC 6.4 SYSTEM CONTROL

DOC 6.4.1 Control Responsibilities

DOC 6.4.1.1 The DNO and Users shall jointly agree and set down in writing schedules specifying the responsibilities for System Control of Equipment and facilities. These shall ensure that only one party is responsible for any particular item of Plant or Apparatus at any given time.

DOC 6.4.1.2 The DNO and each User shall at all times have nominated a person or persons responsible for the co-ordination of electrical safety from the System standpoint pursuant to this DOC6.

DOC 6.4.1.3 The principal of control responsibilities and their specifics such as outlined below but not limited to must be clearly spelled out and agreed to between parties. Some of these are: -

a. Ease of control

b. Least interruptible and most practical

c. Safe, operationally effective, and dependable

DOC 6.4.2 Control Documentation

DOC 6.4.2.1 The DNO and Users shall maintain a suitable system of documentation which records the co-ordination of relevant safety precautions for work.

DOC 6.4.2.2 All documentation relevant to the Operation of the Distribution System, and safety precautions taken for work or tests, shall be held by the DNO and the appropriate User for a period of not less than one year.

DOC 6.4.3 System Diagrams

DOC 6.4.3.1 Diagrams illustrating sufficient information for control personnel to carry out their duties shall be exchanged by the DNO and the appropriate User.

DOC 6.4.4 Communications

DOC 6.4.4.1 Where the DNO reasonably specifies the need, suitable communication systems and protocols shall be established between the DNO and other Users to ensure the control function is carried out in a safe and secure manner.

DOC 6.4.4.2 Where the DNO reasonably decides a backup or alternative routing of communication is necessary to provide for the safe and secure Operation of the DNO's System the means shall be agreed with the appropriate Users.

DOC 6.4.4.3 Schedules of telephone numbers / call signs shall be exchanged by the DNO and appropriate User to enable control activities to be efficiently co-ordinated.

DOC 6.4.4.4 The DNO and appropriate Users shall establish 24-hour availability of personnel with suitable Authorisation where the joint operational requirements demand it.

DOC 6.5 SCHEDULES OF RESPONSIBILITY

DOC 6.5.1 Ownership, Operation and Maintenance Schedules

DOC 6.5.1.1 Schedules specifying the responsibilities for ownership, Operation and maintenance shall be jointly agreed by the DNO and appropriate Users for each location where an operational interface or joint responsibilities exist.

DOC 6.5.2 Maintenance of Schedules and Diagrams

DOC 6.5.2.1 All schedules and diagrams shall be maintained by the DNO and appropriate Users and exchanged as necessary to ensure they reflect the current agreements and network configuration.

DOC 6.5.2.2 Submission to NEPRA of annually report on training activities regarding safety measures by the DNO.

End of DOC 6

DISTRIBUTION OPERATING CODE NO. 7

PLANT IDENTIFICATION

CONTENTS

DISTRIBUTION OPERATING CODE NO. 7
PLANT IDENTIFICATION

DOC 7.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 7.1.1 Distribution Operating Code 7 ("DOC7") sets out the responsibilities and procedures for notifying the relevant owners of the numbering and nomenclatures of Apparatus at Ownership Boundaries.

DOC 7.1.2 The numbering and nomenclature of Apparatus shall be included in the Operation Diagram prepared for each site having an Ownership Boundary.

DOC 7.1.3 The prime objective embodied in DOC7 is to 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, so far as is reasonably practicable the safe and effective Operation of the Systems involved and to reduce the risk of error.

DOC 7.1.4 DOC7 applies to the DNO and to Users, which in DOC7 means other Distribution Companies, and Embedded Generators connected to the DNO's System.

DOC 7.2 PROCEDURE

DOC 7.2.1 <u>New Apparatus</u>

DOC 7.2.1.1 When the DNO or a User intends to install Apparatus on a site having an Ownership Boundary the proposed numbering and / or nomenclature to be adopted for the Apparatus must be notified to the other owners.

DOC 7.2.1.2 The notification shall be made in writing to the relevant owners and shall consist of an Operation Diagram incorporating the proposed new Apparatus to be installed and its proposed numbering and / or nomenclature.

DOC 7.2.1.3 The notification shall be made to the relevant owners prior to the proposed installation of the Apparatus.

DOC 7.2.1.4 The relevant owners shall respond on 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.

DOC 7.2.1.5 In the event that agreement cannot be reached between the DNO and the other owners, the DNO, acting reasonably, shall have the right to determine the numbering and nomenclature to be applied at that site.

DOC 7.2.2 <u>Existing Apparatus</u>

DOC 7.2.2.1 The DNO shall supply every User and every User shall supply the DNO on request with details of the numbering and nomenclature of Apparatus on sites having an Ownership Boundary.

DOC 7.2.2.2 The DNO and every User shall be responsible for the provision and erection of clear and unambiguous labelling showing the numbering and nomenclature of its Apparatus on sites having an Ownership Boundary.

DOC 7.2.3 <u>Changes to Existing Apparatus</u>

DOC 7.2.3.1 Where the DNO or a User needs or wishes to change the existing numbering and / or nomenclature of any of its Apparatus on any site

having an Ownership Boundary, the provisions of DOC 7.2.1 shallapply with any amendments necessary to reflect that only a change is being made.

DOC 7.2.3.2 In case of an emergency or Significant Incident which has impacted Operation and requires existing apparatus to be replaced by new one urgently, the apparatus may be replaced first to normalize Operations. The procedure for numbering and or/nomenclature may then be followed as per provisions of DOC 7.2.1.

DOC 7.2.3.3 Where a User changes the numbering and / or nomenclature of its Apparatus, which is the subject of DOC7, the User shall beresponsible for the provision and erection of clear and unambiguous labelling.

DOC 7.2.3.4 Where a DNO changes the numbering and / or nomenclature of its Apparatus, which is the subject of DOC7, the DNO shall be responsible for the provision and erection of clear and unambiguous labelling.

End of DOC 7

DISTRIBUTION OPERATING CODE NO. 8

SYSTEM TESTS

CONTENTS

DISTRIBUTION OPERATING CODE NO. 8
System Tests

DOC 8.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 8.1.1 Distribution Operating Code No. 8 ('DOC8') sets out the responsibilities and procedures for co-ordinating and carrying out System Tests, which will have or may have an effect on the Systems of the DNO, Users or other DNOs including NGC systems. System Tests are those tests which involve either simulated or the controlled application of irregular, unusual or extreme conditions on theTotal System or any part of the Total System. However, these tests do not include commissioning or recommissioning tests or any other tests of a minornature.

DOC 8.1.2 The objectives of DOC8 are to:

a. ensure that the procedures for co-ordinating and carrying out System Tests are such that, so far as practicable, System Tests do not threaten the safety of personnel or the general public and cause minimum threat to the security, reliability and quality of power supply, the integrity of electrical facilities and are not detrimental to the DNO, Users, and other DNOs; and

b. set out procedures to be followed for establishing and reporting System Tests.

DOC 8.1.3 DOC8 applies to the DNO and to Users, which in DOC8 means, other Distribution Companies, Embedded Generators and all other parties connected to the DNO's system, whose System Tests would come withinthe parameters of this DOC8 who would coordinate the tests with the DNO.

DOC 8.2 PROCEDURE

DOC 8.2.1 General

DOC 8.2.1.1 If the System Test proposed by the DNO or the User connected to the DNO's System shall or may have an effect on the NGC Transmission System or a connected TNO system, then the provisions of DOC8 or the relevant provisions of the Grid Code shall apply.

DOC 8.2.1.2 System Tests which have a minimal effect on the Distribution System or Systems of others shall not be subject to this procedure; minimal effect shall be taken to mean variations in voltage, frequency, and waveform distortion of a value not greater than those figures which are defined in the Distribution Planning and Connection Code.

DOC 8.2.2 Proposal Notice

DOC 8.2.2.1 When the DNO or a User intends to undertake a System Test which shall have or may have an effect on the System of others normally twelve months' notice, or as otherwise agreed by the DNO, of the proposed System Test shall be given by the person proposing the System Test (the 'Test Proposer') to the DNO and to those Users who may be affected by such a System Test.

DOC 8.2.2.2 The proposal shall be in writing and shall contain details of the nature and purpose of the proposed System Test and shall indicate the extent and situation of the facilities involved.

DOC 8.2.2.3 If the information set out in the proposal notice is considered insufficient by the recipient, they shall contact the party proposing the test with a written request for further information which shall be supplied as soon as reasonably

practicable. The DNO shall not be required to do anything under DOC 8 until it satisfied with the details supplied in the proposal or pursuant to a request for further information.

DOC 8.2.2.4 If the DNO wishes to undertake a System Test the DNO shall be deemed to have received a proposal of that System Test.

DOC 8.2.3 Preliminary Notice and Establishment of Test Panel

DOC 8.2.3.1 The DNO shall carryout the overall co-ordination of the System Test, using the information supplied to it under DOC 8 and shall identify in its reasonable estimation, which Users other than the party proposing the test, may be affected by the proposed System Test.

DOC 8.2.3.2 A Test Co-ordinator, who shall be a suitably qualified person, shall be appointed by the DNO with the agreement of the Users which the DNO has identified may be affected and shall act as Chairman of the TestPanel referred to in DOC 8.2.4 (the Test Panel).

DOC 8.2.3.3 All Users identified under DOC 8.2.3.1 shall be given in writing, by the Test Co-ordinator, a preliminary notice of the proposed System Test. The preliminary notice shall contain:

a. The Test Co-ordinator's name and nominating company.

b. The details of the nature and purpose of the proposed System Test, the extent and situation of Plant or Apparatus involved, and the Users identified by the DNO under DOC 8.2.3.1.

c. An invitation to each User to nominate within one month a suitably qualified representative, or representatives where appropriate, to be a member of the Test Panel for the proposed System Test.

DOC 8.2.3.4 The preliminary notice shall be sent within one month of the receipt of the proposal notice or the receipt of any further information requested under DOC 8.2.2.3.

DOC 8.2.3.5 As soon as possible after the expiry of that one-month period all relevant Users and the Test Proposer shall be notified by the Test Co-ordinator of the composition of the Test Panel.

DOC 8.2.3.6 Where the test has impacts on total system then:

a. SO shall be a member of that test panel; and

b. Grid Code OC 10. OPERATIONAL TESTING requirements shall be taken into account.

DOC 8.2.4 Test Panel

DOC 8.2.4.1 A meeting of the Test Panel shall take place as soon as possible after the relevant Users and the Test Proposer have been notified of the composition of the Test Panel, and in any event within one month of the appointment of the Test Panel.

DOC 8.2.4.2 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 DOC 8.2.2);

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 DNO, the System Operator and Users; and

d. implications of the proposed System Test on the Scheduling and Despatch of Generating Plant, insofar as it is able to do so.

DOC 8.2.4.3 Users identified under DOC 8.2.3.1 and the DNO (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.

DOC 8.2.4.4 The Test Panel shall be convened by the Test Co-ordinator as often as he deems necessary to conduct its business.

DOC 8.2.5 Proposal Report

DOC 8.2.5.1 Within two months of the first meeting the Test Panel shall submit a report, which in this DOC 8 shall be called a proposal report, which shall contain;

a. proposals for carrying out the System Test (including the manner in which the System Test is to be monitored);

b. an allocation of costs (including un-anticipated costs) between the affected parties, (the general principle being that the Test Proposer shall bear the costs); and

c. such other matters as the Test Panel consider 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 legislation.

DOC 8.2.5.2 If the Test Panel is unable to agree unanimously on any decision in preparing its proposal report, the disputed matter regarding System Testing and inspection shall be referred to the Distribution Code Review Panel for resolution.

DOC 8.2.5.3 The proposal report shall be submitted to all those who received a preliminary notice under DOC 8.2.2.

DOC 8.2.5.4 Within fourteen days of receipt of the proposal report, each recipient shall respond to the Test Co-ordinator with its approval of the proposal report or its reason for non-approval.

DOC 8.2.5.5 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.

DOC 8.2.5.6 If the proposed System Test cannot be so modified, the matter be referred to the Distribution Code Review Panel for resolution.

DOC 8.2.5.7 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 DOC 8.2.5.3 and DOC 8.2.5.4 shall apply to that submission.

DOC 8.2.5.8 In the event of non-approval of the revised proposal report by one or more recipients, the disputed matter shall be referred to the Distribution Code Review Panel for resolution.

DOC 8.2.6 Final Test Programme

DOC 8.2.6.1 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 Panelshall submit to the DNO and all recipients of the proposal notice a programme which in this DOC 8 shall be called a final test programme statingthe switching sequence and proposed timings, a list of those staff involved in the carrying out of the System Test (including those responsible for the site safety) and such other matters as the Test Panel deem appropriate.

DOC 8.2.6.2 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.

DOC 8.2.6.3 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 Co-ordinator as soon as possible in writing. If the Test Co-ordinator 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.

DOC 8.2.6.4 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 Co-ordinator of this decision and the reason for it. The Test Co-ordinator 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 shallendeavour to arrange another suitable time and date and the relevant provisions of this DOC 8 shall apply.

DOC 8.2.7 Final Report

DOC 8.2.7.1 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 other members of the Test Panel.

DOC 8.2.7.2 The final report shall include a description of the facilities, tested and of the System Test carried out, together with the results, conclusions, and recommendations.

DOC 8.2.7.3 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.

DOC 8.2.7.4 When the final report has been submitted under DOC 8.2.7 the Test Panel shall be dissolved.

End of DOC 8

DISTRIBUTION OPERATING CODE NO. 9

TESTING AND MONITORING

CONTENTS

DISTRIBUTION OPERATING CODE NO. 9
TESTING AND MONITORING

DOC 9.1 INTRODUCTION, OBJECTIVE & SCOPE

DOC 9.1.1 To ensure that the DNO's System is operated reliably, efficiently, and economically and within its license obligations, and in order to meet obligations as provided in Grid/Distribution Codes, Statutory obligation of Performance Standards (Distribution) the DNO, shall organise and carry out testing and /or monitoring of the effect of Users' electrical apparatuson the DNO's System.

DOC 9.1.2 The testing and / or monitoring procedures shall be specifically related to the technical criteria detailed in the Distribution Planning Code and Connection Code. They shall also relate to the parameters submitted by Users in the Distribution Data Registration Code (DDRC).

DOC 9.1.3 The testing carried out under this Distribution Operating Code 9 ('DOC 9') should not be confused as an extension of System Tests outlined in DOC 8.

DOC 9.1.4 The objective of DOC 9 is to specify the DNO requirements to test and/or monitor its Distribution System to ensure that Users are not operating outside the technical parameters provided by themselves and required under the Distribution Planning Code, and Connection Code and / or the Distribution Operating Codes.

DOC 9.1.5 DOC 9 applies to all the Users of the DNO's System, which covers the following:

(a) Other Distribution Companies

(b) Embedded Generators

(c) Bulk Power Consumers

(d) Generators

(e) Any other parties connected to the distribution network of theDNO.

DOC 9.2 PROCEDURE RELATED TO QUALITY OF SUPPLY

DOC 9.2.1 The DNO shall from time to time determine the need to test and/or monitor the quality of supply at various points on its Distribution System.

DOC 9.2.2 The requirement for specific testing and / or monitoring may be initiated by the receipt of complaints from the Consumers as to the quality of supply on its Distribution System.

DOC 9.2.3 In certain situations the DNO may require the testing and / or monitoring to take place at the point of connection of a User with the DNO's System.

DOC 9.2.4 Where testing and / or monitoring is required at the Connection Point, the DNO shall advise the User involved and shall make available the results of such tests to the User.

DOC 9.2.5 Where the results of such tests show that the User is operating outside the technical parameters specified in DDC 2.4, the User shall be informed accordingly.

DOC 9.2.6 Where the User requests, a retest shall be carried out only once and the test witnessed by a User representative.

DOC 9.2.7 A User demonstrated to be operating outside the limits specified in DDC 2.4 shall rectify the situation or disconnect the facility causing the problem from its

electrical System connected to the DNO's System immediatelyfor such time as is agreed with the DNO.

DOC 9.2.8 Continued failure to rectify the situation by the User shall result in the User being disconnected or de-energised in accordance with the Connection Agreement with the DNO's System either as a breach of the Distribution Code or Distribution Service Manual, where appropriate.

DOC 9.3 MONITORING AND PROCEDURES RELATED TO CONNECTION POINT PARAMETERS

DOC 9.3.1 The DNO from time to time shall monitor the effect of the User on the DNO's System.

DOC 9.3.2 The monitoring shall normally be related to;

a. Amount of Active Power and Reactive Power transferred across the Connection Point.

b. Voltage, frequency, and harmonics.

DOC 9.3.3 Where the User is exporting to or importing from the DNO's System Active Power and Reactive Power in excess of the parameters in the Connection Agreement the DNO shall inform the User and where appropriate demonstrate the results of such monitoring.

DOC 9.3.4 The User may request technical information on the method of monitoring and, if necessary, request another method reasonably acceptable to the DNO.

DOC 9.3.5 Where the User is operating outside of the specified parameters, the User shall immediately restrict the Active Power and Reactive Power transfers to within the specified parameters.

DOC 9.3.6 Where the User requires increased Active Power and Reactive Power in excess of the physical capacity of the Connection Point or the authorized kW load of the User, shall restrict power transfers to those specified in the Connection Agreement until a modified Connection Agreement has been applied for from the DNO and physically established.

End of DOC 9

DISTRIBUTION OPERATING CODE NO. 10

POWER CONTROL CENTRE

CONTENTS

DISTRIBUTION OPERATING CODE NO. 10
POWER CONTROL CENTRE

DOC 10.1 SCOPE AND PCC DUTIES

DOC 10.1.1 To ensure that the DNO's System is operated reliably, efficiently, and economically and within its license obligations, and in to meet obligations as provided in Grid/Distribution Codes, Statutory obligation of Performance Standards (Distribution); the DNO, shall organise, manage and operate a Power Control Centre (PCC).

DOC 10.1.2 The scope of the PCC shall be to manage the real-time operation of the distribution system and the interfaces with the SO, embedded generators, other networks, RES & BESS, and shall ensure all necessary flow data management.

DOC 10.1.3 For the avoidance of doubt the PCC is part of the DNO not the Disco in general.

DOC 10.2 PCC AND THE SO

DOC 10.2.1 The PCC shall provide gross Demand Forecasts to SO in accordance with Grid Code OC 2.

DOC 10.2.2 The PCC having monitored Embedded Generation output shall provide a forecast of net power consumption from Transmission System after excluding Embedded Generation.

DOC 10.2.3 In order to enable the SO to carry out central system-level demand forecast, the DNOs must be able to provide requisite information under GC OC 2.6.1 including:

a. maintenance schedules,

b. historical feeder tripping data

c. generation data of Embedded/Captive plants.

DOC 10.2.4 The study for reactive compensation under DPC 3.7 may also be shared with SO for better coordination, in compliance with GC OC 5.5.8.5.

DOC 10.2.5 Data reported under DOC 5 regarding operation planning, reactive compensation, events, embedded/captive generation profile are to be shared with SO for use in Demand Forecasts, Operation Planning and RCC operations.

DOC 10.3 PCC AND EMBEDDED GENERATORS

DOC 10.3.1 PCC may provide Active and Reactive Power setpoints of Embedded Generators (CC 6.9 & 7.4.1, 7.5.8) and the required coordination with the SO.

DOC 10.3.2 The droop setting of Embedded Generators in CC 7.4.1 needs to be coordinated with SO.

DOC 10.3.3 The PCC shall monitor Embedded Generator's Active Power, as is provided in CC 10.4.

DOC 10.3.4 If allowed under agreements with the Generator the PCC may instruct Active Power levels, in any case the PCC will instruct reduction in Active Power levels if there is a threat to the Distribution Network. The PCC may request maximum generation if there is a serious power shortage.

DOC 10.3.5 Reactive Power output or absorption and voltage level management will be in accordance with PCC instructions.

DOC 10.4 PCC AND OTHER NETWORKS

DOC 10.4.1 The PCC shall manage all live operational exchanges with other networks.

DOC 10.4.2 The PCC shall inform the SO as necessary about the associated information.

DOC 10.5 PCC, SUPPLIERS AND BPC

DOC 10.5.1 The PCC shall have staff responsible for day-to-day interaction with Electric Power Suppliers.

DOC 10.5.2 The PCC shall have staff responsible for day-to-day interaction with Bulk Power Consumers.

DOC 10.5.4 The PCC shall apply Load Management (Demand Side Management) and Load Shedding in a technically, socially and commercially appropriate manner

DOC 10.6 PCC FLOW DATA MANAGEMENT

DOC 10.6.1 Under SPR 6.2 each DNO is required to install metering on each 11kV feeder, under SPR 6.3 the DNO is required to integrate its IT infrastructure

DOC 10.6.2 It is imperative that the PCC stores all this data in a manner that:

a. Can be efficiently analysed.

b. Can be shared with the SO as is relevant.

c. Is available to NEPRA for their regulatory processes.

d. Can be shared with other stakeholders where relevant for planning purposes.

DOC 10.7 PCC WITH RES & BESS

DOC 10.7.1 In case of integration of RES and BESS the PCC shall act as per DPC 16.

DOC 10.7.6 Battery Storage Systems (BESS) will give bidirectional frequency response in both generation and demand modes. They can also ramp-up and down in a planned manner to mitigate RES changes.

End of DOC 10

DISTRIBUTION PLANNING CODE

CONTENTS

DISTRIBUTION PLANNING CODE

DPC 1 INTRODUCTION

DPC 1.1 The Distribution Planning Code (DPC) contains distribution system planning and specifies criteria and principles to be followed by the DNO in the planning and development of its Distribution System. DPC also applies to Users of the DNO's System in the planning and development of their Systems in so far as they affect the DNO's System.

DPC 1.2 The User's requirements may necessitate the reinforcement of or the extension to the DNO Distribution System and in some cases may require the DNO to seek reinforcement of or extension to the relevant NGC/ DNO interface and capacity, such work being identified by the DNO or NGC as appropriate shall be a part of the discussions with the User concerning the User's requirements. Such requirements, if not already covered in the Connection Agreement may require modification of the agreement.

DPC 2 SCOPE

DPC 2.1 The Distribution Planning Code ('DPC') applies to the following:

a. All Generators and DNOs or any other entity who is using or planning to use the Distribution System of the DNO;

b. NGC; and

c. The System Operator

DPC 2.2 This sub-code outlines the following:

a. General principles, aims and objectives of Distribution Planning.

b. Recommended planning criteria voltages, power factor, equipment loading criteria, Fault Level, and security standards.

c. Load planning.

d. Power System Losses.

e. Loss Reduction.

f. Load Management.

DPC 3 DISTRIBUTION PLANNING CRITERIA

DPC 3.1 General Principles

Primary Planning Criteria (Voltage, Capacity, Reliability & Technical Losses) as applicable to all Distribution Voltage facilities, including grid stations, feeders, distribution transformers and LT feeders, is provided in this chapter. If the system is planned and designed to operate within the prescribed limits as specified in the Performance Standards (Distribution) and DDC and this Code, the technical losses will remain within acceptable values.

Lines and substations owned by a DISCO at 66kV or 132kV shall be planned in accordance with the Grid Code. These plans would be reflected in the Secondary Transmission Plans (STPs) prepared by such DISCO in the manner required under the Grid Code.

The DNO planner shall follow the following basic principles.

a. During normal operating conditions and without a system component fault condition present, all equipment, and facilities of the DNO shall operate within normal ratings of the distribution facilities and the system voltages will be within the permissible limits as specified in the Performance Standards (Distribution), and this sub-code when the system is operating within the range of minimum load to the forecast maximum peak load.

b. During system emergency conditions and without and facilities of a DNO system or equipment fault condition present, the equipment may be operated with overload or/and under voltage for a specified time limit and for specific number of hours as per manufacturer recommendations and IEC Standards. Planning criteria is based on normal and emergency equipment ratings. Emergency ratings are those, which can safely exist for a specified number of hours as per IEC Standard/manufacturer instructions.

c. 66kV systems shall be retained with-in the existing DNO service area only and shall not be extended further as far as possible and practicable. These systems should be gradually reduced and ultimately eliminated with load transferred to 132 kV (and above) systems. New development plans shall be based on 132 kV systems, which shall be developed in consultation with the System Operator and NGC for an economic development of the Total System.

DPC 3.2 Aims

The DNO shall plan and develop its transmission System and Distribution System, particularly to ensure that subject to the availability of adequate generating and transmitting capacity, the system shall be capableof providing Consumers with a safe, reliable, and efficient supply of electricity as per the requirements and provisions of Grid Code, Distribution Code, Performance Standards (Distribution), Consumer Eligibility Criteria and Distribution Service Manual.

The DNO's Distribution System shall conform to the statutory requirements of the NEPRA Act, Rules & Regulations made under the Act, and the Distribution Licence.

DPC 3.3 Objectives

a. System must deliver specified voltages as per this Code and NEPRA Performance Standards (Distribution)-Rules under all system conditions at all times.

b. 11kV feeder shall not be loaded beyond its permissible limits as defined by the original equipment manufacturer or relevant IEC Standards.

c. To provide a safe, reliable, and secure supply in an economic and efficient manner.

d. To propose and plan new 11kV feeders, bifurcation/ augmentation of existing feeders and new grid stations to take care of Clause (a), to Clause (c).

e. To provide for an orderly, timely and least cost expansion of an adequate future distribution system.

f. To forecast the load growth and propose new grid stations and/or lines after exploring all the possible options of reinforcement, augmentation or extension of existing DNO system.

g. To develop five-year distribution investment/ development plans.

h. To facilitate the Use of DNO's System by BPCs and other DNOs for competition purposes.

i. To exchange Planning Data with the System Operator.

j. To provide Standards of Distribution Power Supply.

DPC 3.4 Recommended Planning Criteria Voltages

The voltage limits need to be in accordance with the provisions of the Distribution Performance Standards. The suggested limits are.

a. Delivery voltage at the receiving end is as under;

i. Normal Conditions

- 400/230 Volts, 11kV ± 5%

ii. Contingency Conditions

Single Outage Contingency (N-1)

- 400/230 Volts, 11kV ± 5%

DPC 3.5 Power Factor

Power factor shall be maintained above 90% lagging by User where applicable as per Customer Service Manual and DPC 11 (d).

DPC 3.6 Equipment Loading Criteria

The loading limits of all the distribution facilities of the lines and grid stations should be in accordance with IEC Standards, manufacturers recommendations with due regard to ambient temperature conditions**.**

DPC 3.7 Capacitive Reactance Compensation

Shunt capacitors un-switched/switched type shall be installed on the Distribution System and transmission system at suitable location for improvement of Power Factor, voltage profile and reduction of transmission and distribution losses. The size and location of capacitor installations shall be determined by the DNO planning electrical simulation software on the basis of reliable field data to avoid over voltages under light load periods. Useful formulae are given in the DPC Appendix-I, which may be applied for determining approximate size and location of capacitor installations or (the present procedures, which the distribution planning engineers, are following, whichever is more appropriate).

DPC 3.8 Security Standards

The DNO's Distribution System shall be planned and maintained so as tofulfil the following security standards except under Force Majeure Conditionsthat are beyond the reasonable control of the DNO.

a. In case of single contingency failure in or to any 33/11kV sub-station excluding equipment, controlling any outgoing 11kV Feeders, the load interrupted shall not exceed 50% of the total load on the sub-station.

b. In case of breakdown on transmission or distribution system the electricity supply interruption and restoration should be regulated as per the provisions of Performance Standards (Distribution).

DPC 4 RELAY COORDINATION

Each year each DNO shall submit to the System Operator a relay coordination study. This study shall be on the basis laid out by the system operator. The System Operator will prepare a system wide relay coordination study and advise each DNO of any required changes to the relay settings.

DPC 5 LOAD ASSESSMENT AND FORECASTING TECHNIQUES

DPC 5.1 The DNO shall prepare each year a short to medium term load forecast for a period of at least 10 (ten) years (the planning period shall be 10 years. The load forecast used for operating purposes can be for one year only) for its Service Territory as well Concessional Territory Area of Supply taking into account historic and the probable load growth and consumption pattern of the Consumers. The DNO shall adopt appropriate and established load forecasting methodology using reliable data and relevant indices. The methods may include one or more of the following.

a. Historical population and load growth analysis

b. Land use and zoning methods

c. End-use energy methods

d. Any other reasonable and justifiable method

The forecast shall also take into account:

a. Impact of net-metering and embedded generation;

b. Energy efficiency programs or measures;

c. Development of any new technology e.g., Electric Vehicles (EVs) etc.;

d. Development of the competitive electric power suppliers and traders demand in the power market.

DPC 5.2 The load forecast shall define a specific load area and type of Consumers and for a specific timeframe. The specific load area shall be identified such as residential, commercial, light industrial and heavy industrial.

The DNO shall work out the annual energy requirement and Peak Load for each of the coming five years relating to each point of interconnection on the basis of its load forecast.

The DNO shall install metering at each substation to provide kVA load per substation and kVA load on each 11kV feeder. The diversity factor can be calculated as follows:

$$\text{Diversity Factor} = \frac{\text{sum of all feeders monthly peak MW loads}}{\text{Substation monthly peak load MW load}}$$

If this value is less than 1 it is an indication that the metering or readings are in error.

This information can be used for Load forecasting to determine kVA/substation or substation served area and kVA feeder load/feeder and kVA load per feeder area served.

Energy sales can be used to determine the required load forecasts. Therefore the DNO shall provide kWh meters at the substations. The energy meters will provide sales information and can be used to determine the system load

factor as follows;

$$\text{Load Factor} = \frac{\text{kWh in period}}{\text{Peak kW load x hours in period}}$$

Load can be used to calculate kW load for substation or a particular feeder and with a given power factor can calculate the kVA load of the respective sub-station or feeder.

DPC 6 MAPS AND RECORDS

The DNO shall develop procedures and guidelines of digitized mapping ofthe distribution network, including instructions requiring essential needs of revisions and updates on maps and records and digitalizing wherever required as per the obligations placed under its distribution licence.

The existing maps showing the service territory as well as concessional territory of each DNO are to be provided by the DNO. The DNO shall be responsible to verify the accuracy of the existing maps and revise themaps as necessary to update any system improvements that have been made. The mapping process shall be digitized to facilitate revisions and making the maps available to responsible planning, operating and maintenance personnel of the DNO, the System Operator, and NEPRA.

Each DNO shall be responsible for operating and maintaining the distribution systems within the Service Territory as established in its distribution licence.

DPC 7 LOAD PLANNING

Each DNO shall annually make load flow calculations to determine the loading on distribution feeders, transmission lines, transformers, and sub-stations. The load flow studies shall be made for summer and winter peak conditions.

The load flow calculations shall be analysed to identify overloaded facilities according to equipment loading criteria for each type of facility.

When overloaded facilities are identified the DNO shall prepare plans either to shift load to relieve overloads or develop upgrading, reinforcement, augmentation, and expansion plans for new facilities if the shifting of load is not recommended on permanent basis for a prolonged period.

DPC 8 LOAD FLOW STUDIES

The plans, procedures and suitable measures shall be outlined as far as practicable, to maintain the optimum circuit (feeders) and equipment (transformer) loading. The need and provision of requisite load flow studies shall be specified by the distribution planning engineers.

DPC 9 PLANNING CAPABILITIES OF DNO AND SYSTEM PLANNING SOFTWARE

State-of-the-art Distribution Load flow software programs shall be used by each DNO to analyse the 11 kV Distribution systems. The program Modules will satisfy the requirements for Distribution System Planning of the DNO and the planning package will, at least, contain the following modules:

a. Load Flow Analysis including single plan unbalanced load solution algorithm

b. Capacitor Application and Optimization

c. Short Circuit Analysis

d. Voltage Regulation

e. Dynamic Feeder Optimization (area wise), including load transfer switching between feeders with a single and/or multiple sources. The function shall allow for system reconfiguration and is to perform operational and contingency analysis.

f. DER Hosting capacity analysis on feeder

g. Load Forecast

h. Harmonic Analysis

Transmission load flow software programs shall be used by each Licensee to analyse its transmission systems. The program modules will satisfy the requirements for Transmission System Planning. This analysis shall be in accordance with the Grid Code.

DPC 10 POWER SYSTEM LOSSES

The DNO must account for the power system losses that occur in energy conversion and transmission and distribution facilities.

This is particularly relevant in distribution planning where losses are high; particularly for older highly loaded equipment.

DPC 11 SYSTEM IMPROVEMENT PLANS AND LOSS REDUCTION

The DNO shall make concerted efforts to make distribution system improvements through an effective and comprehensive planning process so as to operate more efficiently. The losses are the highest for the 11 kV and 400 V distribution systems. Periodic review of basic design parameters, construction techniques, and operating procedures for the distribution system can identify possible areas for improvement, which can increase the available energy accordingly.

In addition to the items mentioned in the objectives the following items but not limited are candidates for loss reduction efforts.

a. Use compression or bolted connector, eliminate wrapped wire connection on distribution lines.

b. The selection of size of the conductor on the LT feeder should be on the basis which lends to a maximum of 5% voltage drop (regulation) along the entire length of the LT feeder on the basis of full load current of the LT feeder.

c. Sizing the future distribution system, voltage levels, the provision ofthe Consumer Eligibility Criteria shall be followed while providing new service connection preferring to have diversity mix in Consumer on the feeders avoiding excessively long feeders and regular maintenance practices as included in this code.

d. Require power factor correction capacitors be installed at Consumers premises on LT side with a connected load of 50 kVA or greater and with a power factor of less than 0.9 as per the provisions of Distribution Service Manual. Installation shall be at consumer’s end and shall be consumer’s responsibility.

e. By proper installing the energy meters in vertical position and properly fixed.

f. Implementation of equipment removal order in time.

g. Regular monitoring and checking of disconnected Consumers.

h. Maintenance and monitoring of rise and fall consumption register.

i. Attempts should be made to precisely estimate the breakdown of the losses along various sections of the distribution system by accurately modelling the distribution system in the state of art distribution software.

j. Use insulated bus bars for making Consumer connection to the secondary distribution system.

k. Use of insulated cables for overhead secondary system.

l. Replacement of defective meters.

m. Trimming of trees, which are touching the electric lines.

n. Reducing the lengthy LT lines or eliminating the LT lines by installing low-capacity distribution transformers for groups of Consumers.

o. Installation of sectionalizing switches/auto re-closer on branch lines and distribution transformers.

p. Area planning, augmentation of conductor, transformer, additional transformers, conversion of lengthy sub-services by LT lines, bifurcation of feeders, aerial bundled cables etc.

DPC 12 DISTRIBUTION OPEN ACCESS PROVISIONS

DPC 12.1 Each DNO must plan, design, construct, maintain and operate its network to allow the transfer of electricity between the systems of parties, which are connected to or have access to its network.

DPC 12.2 Demand Side Management (DSM)

DPC 12.2.1 DSM or Load Management initiative is a planning technique that may be used in reducing the peak load of Consumers over period of time.

DPC 12.2.2 DNO shall ensure the volunteer load reduction by the Bulk Power and large industrial Consumers by a percentage as mutually agreed for managing the required level of load on demand side.

It is to ensure that heavy motive loads are not started during the heavy load periods for load management purposes.

DPC 12.2.3 DSM actions will treat all Consumers equally independent of who supplies them.

DPC 12.2.4 Note this does not apply to Load Shedding which is an emergency process either automatic or manual to prevent system collapse.

DPC 13 DISTRIBUTED GENERATION METERING

DPC 13.1 The DNO shall install AMI/ AMR Meters on Distributed Generation (Net-Metering prosumers) and maintain complete record in central data base. Further, the DNO shall get Login credentials and necessary software access through Solar Installers for DG capacity of 25kW and above to monitor and

control as and when required to stabilize its distribution network.

DPC 14 DISTRIBUTED GENERATION NETWORK CAPABILITY

DPC 14.1 The DNO shall also conduct proper analyses and devise a comprehensive mechanism based on GIS Enterprise / digital mapping to evaluate the hosting capacity of its distribution network for Distributed Generation (Net Metering prosumers).

DPC 15 ASSET PERFORMANCE MONITORING

DPC 15.1 Each DNO shall install Asset Performance Monitoring System (APMS) to its general duty distribution transformers / PMTs especially for capacity of 100kVA and above. Installation of APMS on existing transformers shall be completed in phased manner.

DPC 16 BATTERY ENERGY STORAGE SYSTEM

DPC 16.1 The DNOs shall evaluate the need and feasibility for installation of Battery Energy Storage System (BESS) in distribution network through comprehensive system studies to achieve operational efficiency, high reliability and system stability.

End of Planning Code

DISTRIBUTION DESIGN CODE

CONTENT

DISTRIBUTION DESIGN CODE

DDC 1 INTRODUCTION

The DNO must develop, operate, and maintain an efficient, secure, and coordinated system of electricity supply that is both economical and safe.

DDC sets out principles and standards to be applied in the design process of the DNO's System and any User connections to the Distribution System of the DNO.

Nothing contained in DDC is intended to inhibit design innovation. DDC is, therefore, cognizant of the performance requirements of the DNO's System to be operated and managed in an efficient, secure, safe, and economical manner as per the provisions of the Performance Standards (Distribution)-Rules.

DDC described Design Criteria, frequency and voltage parameters, design principles of equipment, cables and lines and other electrical facilities in terms of their loading thresholds. Loading thresholds for design purpose shall be considered as 100% of rated capacity only, i.e. overload capability shall be conserved for operational use.

DDC 2 DESIGN STANDARDS

DDC 2.1 Standardization of Sizes, Ratings and Grid Stations Layout

Standardization of sizes, ratings, and grid stations layout and 11/0.4kV three-phase distribution system shall be done by the DNO. The specifications and layouts of the grid stations shall conform to IEC and Pakistan Standards Institute (PSI) specifications.

The minimum size/rating of the power transformer especially in 66/11kV grid stations should be assigned, declared, and indicated as to what type of independent breaker is to be installed. However, it is recommended that 7.5 MVA and above transformers should be controlled by a separate circuit breaker. The Distribution transformer shall be controlled by separate circuit breakers at LT and either with Fuse or Circuit Breaker at HT side.

DDC 2.2 Design Criteria for Distribution Lines

These criteria shall apply to all distribution lines and to be operated and maintained by the DNO at Distribution Voltages for both overhead lines and underground cables.

The lines shall be designed and constructed in accordance with relevant provisions of IEC Standard or subsequent approved standards applicable to overhead lines and under-ground cables.

The distribution network fed from 132/11 kV, 66/11 kV, 33/11 kV 11/0.4kV transformers shall be initially planned as independent networks within their respective service area. A service area of any particular substation shall mean for this purpose, an area where load shall normally be supplied by that sub-station through one or more number of feeders, as required, without exceeding the specified KVA-Km Loading limit of any feeder within the area and provisions of DPC 10.

The DNO shall take suitable measures, sufficiently in advance, to augment the capacity of its 11 kV feeders if in the event of the specified KVA-KM loading of any particular feeder is being exceeded.

The design of the distribution lines shall incorporate features to enable their augmentation, in future, with minimum interruption to power supply to other Consumers. The existing Rights of Ways shall be fully utilized by the DNO.

KVA-Km loading limits for conductors may be calculated in accordance with a sample calculation shown at DDC Appendix 1.

The designing of the distribution system should be on the basis of optimum economic loading criteria.

DNO shall consider and provide back feeding options while designing/planning commissioning of 11 KV feeder.

DDC 2.3 Frequency and Voltage

The DNO's System and any User connections to that System shall be designed to enable the frequency and voltages supplied to Consumers to comply with the NEPRA Performance Standards (Distribution)-Rules, Grid and Distribution Codes.

DDC 2.4 Voltage Disturbances and Harmonic Distortion

The DNO and Users shall take appropriate and necessary measures so that their system does not cause any distortion of the system voltage, supply waveform as per the provision made in the Performance Standards (Distribution) and Distribution Service Manual, and in accordance with IEEE Standard 519-1992 or equivalent IEC Standard and shall be revised from time to time.

The DNO and Users shall take appropriate and necessary measures so that there is not:

a. Excessive voltage sag or swell

b. Excessive voltage and loading imbalance

c. Transient or other instability

DDC 3 DESIGN PRINCIPLES

DDC 3.1 Specification of Equipment, Overhead Lines and Underground Cables

a. The principles of design, manufacturing, testing and installation of Distribution Equipment, overhead lines, and underground cables, including quality requirements, shall conform to applicable standards such as IEC, IEEE, Pakistan Standards or approved current practices of the DNO.

b. The specifications of Equipment, overhead lines and cables shall be such as to permit the Operation of the DNO's System inthe following manner;

   i. within the safety limits as included in the approved Safety Code of the DNO or the relevant provisions of the Performance Standards (Distribution);

   ii. within operating frequency and voltage ranges as provided in this code or Performance Standards (Distribution); and

   iii. within the thermal ratings as provided by the manufacturer or relevant IEC specifications.

c. Equipment shall be suitable for use at the operating frequency, within

specified operating voltage range and at the design short-circuit rating of the DNO's System to which it is connected having due regard to fault carrying capabilities and making and breaking duties of the circuit breakers. In appropriate circumstances, details of the System to which connection is to be made shall be provided by the DNO to the prospective User.

d. The standards, publications and specifications referred to in paragraphs (a) to (c) above are such standards, publications, and specifications current at the time that the facility was manufactured (and not commissioned) in the case of facility on the Total System or awaiting use or re-use. If any such facility is subsequently moved to a new location or used in a different way, or for a different purpose, or is otherwise modified then such standards, publications and specifications current at the time that the facility was manufactured (and not commissioned) shall apply provided that in applying such standards, publications and specifications the facility is reasonably fit for its intended purpose and use having due regard to the obligations of the DNO under their respective licenses and the User under the Distribution Service Manual.

DDC 4 EARTHING

A DNO must ensure that the neutrals and body of the power transformer at a grid station shall be connected to earth mesh provided in the yard of the grid stations through independent leads. The neutral wire should additionally be connected to earth rod and mesh through a separate lead. All other installations in the yard be connected to earth mesh. The earth resistance shall be up to or less than 2Ω for Grid Station equipment.

The earthing of a distribution transformer, the neutral and body of the transformer shall be connected to ground rods as per IEC and PSI Standards Design Specifications.

Earthing of Consumer Service and its meter shall be as per design standards adopted by the DNOs; and consistent with IEC, and IEEE Standards.

The earth resistance of the distribution transformers and HT/LT structures/poles shall not be more than 2.5Ω and 5Ω respectively.

The DNO shall perform verification of its electrical system's earthing at a frequency defined by NEPRA's Power Safety Code.

End of DDC

CONNECTION CODE

CONTENTS

CONNECTION CODE

CC 1 INTRODUCTION

This section deals with the connection principles, requirements, guidelines, and procedures for the entities other than NGC seeking either new connection with DNO's network or modifying existing connection.

In this sub-code of the Distribution Code, the network connection requirements have been outlined which specify both the minimum technical/functional, design and operating criteria that must be complied with by any User connected to or seeking connection with the DNO's network.It also prescribes the application procedures to be adopted by the prospectiveUsers, and the obligation that needs to be fulfilled by the DNO related to providing connection and operating its system after the connection has been provided. Furthermore, it specifies the information requirements on the part ofprospective and existing Users of the DNO's system. The procedures contained in this chapter are applicable to the following.

a. Embedded Generators

b. Other Distribution Companies

c. Externally Connected Consumers

d. Externally Connected Parties

e. BPCs.

CC 2 SCOPE

This chapter deals with connection to the DNO’s network at Distribution Voltages in respect of the entities listed in CC1. The time limits related to provide new connection to Applicants provided in this sub-code shall not be inconsistent with the time limits as provided in NEPRA Performance Standards (Distribution)-Rules clause 4(c). These time limits have also been detailed in the Distribution Service Manual approved by NEPRA.

CC 3 PURPOSE AND AIMS

The Connection Code provides the framework for connection to the DNO's network. It has the following aims:

a. to enumerate the principles and guidelines for establishing aconnection and use of the network;

b. to establish and streamline the process to be followed by a prospective or existing User to establish or modify a connection to DNO’s network;

c. to manage and prepare the distribution network of the DNO, and the connection point for applicant seeking the connection;

d. to establish processes to ensure ongoing compliance with technical and operating requirements indicated in this sub-code;

e. to achieve long-term economic benefits in terms of costs and system reliability towards an orderly development of the distribution system; and

f. to establish a uniform, consistent and fair policy of Connection to the DNO’s distribution system.

CC 4 PRINCIPLES

The conditionalities and the procedures covered under this Connection Code are based on, among others, the following principles, and assumptions:

a. All Users shall have an opportunity to form a connection to the network; and have access to the services provided by the DNO.

b. To provide a uniform treatment in identifying terms and conditions for each applicant.

c. The treatment will significantly depend on whether the applicant is passive, i.e. no generation, or active, with generation either standard or SWE. Significantly more information will be required from active applicants.

d. Where a User later wishes to add generation to their internal network this will be considered to be a modification of a connection and a new connection application will be required.

CC 5 OWNERSHIP BOUNDARIES

CC 5.1 The point or points at which supply is given or taken between the DNO's System and Users shall be agreed upon between the DNO and the User as required. For supplies at Low Voltage (LV) the general rule is that the point of supply will be at the Users terminals of the DNO's owned metering equipment but not inconsistent with Distribution Service Manual and Consumer Eligibility Criteria. For High Voltage (HV) supplies, including connections between Distribution DNOs and Users, and where necessarybusbar connected supplies at Low Voltage, the points of supply shall be subject to specific agreement between the parties in each case.

CC 5.2 The respective ownership of Plant and Apparatus shall be recorded in a Connection Agreement between the DNO and the User as required. In the absence of a separate agreement between the parties to the contrary, construction, commissioning, control, operation, and maintenance responsibilities shall follow ownership.

CC 5.3 For supplies at High Voltage, the DNO shall with the User's agreement prepare a responsibility schedule and, an Operation Diagram determined by the DNO during the application process for connection showing the agreed Ownership Boundary. Copies of these documents shall be retained bythe DNO and User. Changes in the boundary arrangements proposed by either party must be agreed in advance and shall be re-coded on the DNO Operation Diagram.

CC 5.4 <u>Bifurcation of Network between Distribution Companies and Azad Jammu and Kashmir (AJK) Network</u>

AJK Electricity Department is taking power from PESCO, IESCO and GEPCO at 11kV voltage. The Network Bifurcation Point shall be the jumpers of 11kV Power cable connected to the panel.

CC 5.5 <u>Nomenclature</u>

The DNO shall supply the User and the User shall supply the DNO details of the numbering and nomenclature of Apparatus at or near the Ownership Boundary.

CC 6 ESTABLISHING OR MODIFYING CONNECTION

CC 6.1 Process and Procedures

The entities listed in CC 1 seeking a new connection or modification of an existing connection shall adopt the following process and the procedures.

The DNO shall follow the connection process detailed in **Error! Reference s ource not found.** attached at the end of this sub-code, whereas BPCs, and Special Purpose Transmission Licensee (SPTL), Housing Colonies, Defence Establishment, and Embedded Generators shall submit their applications to the respective DNO . The DNO shall evaluate their application for providing the connection and shall forward to the System Operator (wherever applicable) what DNO considers to be necessary.

CC 6.2 Intention Application

The entity wishing to modify its existing connection or connect to the network of the DNO at Distribution Voltages for the first time shall prepare an intention proposal. The proposal must indicate:

a. The type of facilities he intends to establish (distribution and/or transmission system).

b. Size of the facility and range including load factor.

c. Proposed Connection Point.

d. Tentative Schedule for connection.

e. Protection and metering requirements.

f. Voltage level at which the connection is required/modified.

g. Maximum and minimum active and reactive power requirements.

h. Type and characteristics of the proposed load to be connected.

i. Whether the facilities will be passive or active and if active the type of generation that will be connected. This requirement particularly applies to:

- Externally Connected Consumers; and
- Externally Connected Parties.

In addition intention proposal shall be made available at the offices of the DNOs or on-line.

Provision of on-line intention application should also be made by DNO.

The respective DNO must evaluate the intention application within 30 business days (Preliminary evaluation time) based on the following considerations and make communication with the applicant.

a. Evaluate the application and accompanied information.

b. Check feasibility of the proposed connection.

c. Study transmission and/or distribution congestion or reinforcements required due to connection.

d. List out design functional requirements and performance standards

and specification and communicate to the applicant in the next communication.

e. Prepare preliminary cost estimate for connection.

f. Indicate if additional information is required from the applicant.

g. If the applicant has made Connection Agreements with other Code Users.

h. Prepare load flow studies for the year, the facility shall go into service.

If DNO requires additional information from the applicant, the applicant must be requested within 30 business days (preliminary evaluation time) to provide such information. If DNO does not require such information the applicant must be made on “offer to Connect” within the 30-day time period to apply for connection to their network.

In case the applicant has been requested to provide additional information, he must provide such information within 10 business days after receipt of request from DNO. The DNO shall consult the System Operator and other DNOs regarding the proposed connection if necessary.

The DNO must provide the information/data related to its network to applicant, which shall help the applicant to prepare its application. The technical data, which may vary depending on the connection requirements and the type, rating, and location of the facility to be connected is to be attached with the application.

CC 6.3 Service and Network Design Conditions

a. Substation Drawings and Data

i. Switchyard equipment connection lay out of all the substations under their control.

ii. Equipment foundation layout.

iii. Foundation structural (civil) drawings

iv. Earthing Layout

v. Construction and Maintenance Standards

vi. Procedures related to safety and switching

vii. One-line Diagrams

Connection diagrams and connection flow chart are provided at end of this sub-code.

Any other information relevant to the submission of an application for connection.

The DNO must use its reasonable endeavours to advise the Applicant of technical risks, rights, obligations, and responsibilities in respect of the proposed connection.

CC 6.4 Application for Connection or Modification

On receipt of offer for connection from the DNO the applicant must submits application within 30 business days from the Date of Offer for connection. The application must provide the following information for further evaluation by DNO.

a. Technical Feasibility Report.

b. Detailed Design of the facility the applicant intends to install.

c. A final committed Implementation Schedule showing proposed milestone dates for construction and commissioning of the applicant's connection facilities.

d. Details of the Protection arrangements and settings keeping in view the protection schemes adopted by the Grid Code and concerned DNO.

e. Copies of all Safety Rules and Local Safety Instructions applicable at Applicant's Sites.

f. Proposed usage of the facilities.

DNO shall carryout preliminary evaluation of the application and if the application meets requirements of this Code and the technical criteria for connection/ modification, it shall send its concurrence to the Applicant to allow connection with its network. Where the DNO believes it necessary the System Operator shall be consulted and shall evaluate the application with reference to the Grid Code and its obligations as System Operator.

If the Applicant wants to have connection at multiple connection points of the network of DNO, then he shall include all the connection points in the same application, however, the term and conditions for each connection point may vary in accordance with the conditions prevailing at each connection point

The DNO shall evaluate the application and its contents within 30 (thirty) days and invite the applicant to have negotiations for Connection Agreement.

CC 6.5 Connection Agreements

If the Applicant wishes to accept the Offer to Connect, the Connection Applicant must:

a. Agree and apply for licence from NEPRA to operate as an Embedded Generator, or a Special Purpose Transmission Licensee.

b. Agree to be bound by relevant provisions of the Grid Code (if applicable) and Distribution Code.

c. Must follow all relevant rules and regulations already issued or to be issued in future by the DNO, GoP, NEPRA, or the relevant Authorities including Safety Code of the concerned DNO.

d. The detailed environmental framework is not being provided in the Grid Code and Distribution Code; however, the applicant must agree to abide by all such requirements, which are set out by the environmental agencies or NEPRA Licences, Rules, and Regulations.

e. Enter into a Connection Agreement with each relevant distribution DNO and, in doing so, must use its reasonable endeavours tonegotiate in good faith with all parties with which the Applicant must enter into such a Connection Agreement.

The DNO must, within 10 business days of receipt of communication regarding Connection Agreement shall convey its comments on the metering, and protection arrangements.

If the DNO believes the connection may cause deteriorated quality and reliability of supply at the connection points of other Users caused by the Applicant's connection to the network and subsequent operation, the application will be rejected, and the applicant will need to revise and reapply.

In the event of disagreement between the parties, Review Panel shall be the arbitrator whereas the final decision shall be made by NEPRA only, if requested by the Review Panel.

CC 6.6 The design of connection between DNO's distribution system and Users shall be in accordance with the principles set out in the Grid Code, Distribution Code, Performance Standards(Distribution), Consumer Eligibility Criteria and Distribution Service Manual, as applicable.

Before entering into the Connection Agreement, it shall be necessary for the DNO to be reasonably satisfied that the User's system and installation/equipment at the boundary with the DNO's distribution systemor network shall comply with all appropriate requirements of the Distribution Code/Grid Code and applicable design specifications of the DNO.

CC 6.7 In terms of overall time limits for providing connection as provided in Performance Standards (Distribution) for Distribution Voltages the time shall start from the date of submission of formal application by the Applicant on receipt of offer from the DNO till such time the User is provided with the connection. The time stated in this section shall not include any time required that is beyond the control of the DNO.

The time schedules for Distribution Voltage connection is summarized as under.

Preliminary evaluation time of Intention Application	= 30 days	
Additional information required if any from the Applicant	= 10 days	
Offer for Connection to the Applicant	= 15 days	
Submission of formal application for Connection by the Applicant	= 30 days	
Final evaluation of Application by the DNO	= 30 days	106 Days
Negotiation and Connection Agreement	= 07 days	
Comments of the System Operator on Connection Agreement	= 10 days	
Providing Connection on Distribution Voltage	= 59 days	

CC 6.8 Communication

Where for operational reasons, DNO determines that a means of routine and emergency operation, communication between the DNO and the User is required, then the same shall be provided and maintained by the DNO.

CC 6.9 Supervisory Control and Data Acquisition (SCADA) System

DNO shall have a communication system and supervisory control and data acquisition (SCADA) system to monitor and control its network including generators connected to its network. At the generating station, a RTU shall be provided for monitoring and control of each generating unit. In addition, RTU provided by the Generator shall have facility of dispatching and loading the generating unit by the DNO from DNO's Power Control Centre.

CC 6.9.1 The SCADA System will be used by the DNO for real time monitoring and control of the Distribution Network during normal, contingency, emergency, extreme emergency and restorative conditions.

CC 6.9.2 All Users shall install remote telemetry equipment and associated auxiliary components, at their respective facilities for exchanging real time data and control signals with the DNO's SCADA System through standard IEC protocols. The cost of integration of Users telemetry equipment (Remote Telemetry Units RTUs, SAS/PCS/DCS Gateways etc.) with the DNO's SCADA System, both at Main and Backup Control Centers, will be borne by the relevant Users.

CC 6.9.3 Remote telemetry equipment, which may include RTU, PCS/DCS/SAS Gateways, IEDs or any other such equipment/Facility (to be installed with prior approval of the DNO), shall be capable of exchanging real time data and control signals with the DNO's SCADA System through standard IEC data communication protocols.

CC 6.9.4 The remote telemetry equipment of Users shall be compatible with the DNO SCADA master station protocol requirements and must provide redundant and standard IEC interfaces for data connectivity with PCC. It shall also be capable of time stamping of signals and events on minimum resolution of 1 millisecond or finer resolution as specified by the DNO.

CC 6.9.5 All Users shall maintain the remote telemetry, networking and communication equipment at their respective sites and shall be responsible to expand and upgrade the equipment as and when required by the DNO. All such equipment shall have at least 50% spare capacity for future expansion. The cost of such expansion and upgradation of User's remote telemetry system along with its auxiliary components and its integration with DNO SCADA System will be borne by the relevant Users.

CC 6.9.6 SCADA Signals Interface Cabinets/Cubicles (SIC) shall be installed in the User's Control Centre/Control Facility, for the transmission of signals and indications to and from the DNO. The provision and maintenance of the wiring and signalling from the User's Plant and equipment to the interface cabinets shall be the responsibility of the User.

CC 6.9.7 In case of Generators, signals and indications must be provided to the DNO on individual Generating Unit basis.

CC 6.9.8 In cases where the Users are equipped with or intending to develop their own SCADA System or any other telemetry system such as Automatic Meter Reading (AMR), Smart/Secured Metering System (SMS), Web portals based telemetry, Awareness System, etc., covering all or part of its Distribution System or Plant/equipment and the DNO considers necessary to exchange the information collected into such system, data communication/exchange through

standard IEC protocols between the DNO's and User's SCADA or other such system, as the case may be, shall be established.

CC 6.9.9 If any change occurs in the User's Plant and equipment, User shall be responsible to incorporate all such changes in the remote telemetry equipment.

CC 6.9.10 The DNO shall have the capability to deactivate and reactivate the scanning of a given RTU, as well as the capability of monitoring the availability of all RTUs from the PCC.

CC 6.9.11 In the absence of any such remote telemetry system or during development phase of such remote telemetry facilities, Users shall provide the real time data/information related to its plant and equipment to DNO through interim alternate arrangements with prior approval of DNO.

CC 7 CONNECTION ARRANGEMENTS AND REQUIREMENTS FOR GENERATORS

The DNOs are required under this sub-code to process a connection application or to submit an Offer to Connect for the provision of distribution network services to the Generator's generating unit or group of generating units.

For the purposes of this sub-code an Externally Connected Consumer or an Externally Connected Party shall, if it has generation on its network or intends to add generation to its network, be considered to be an Embedded Generator.

If an Embedded Generator requests for connection to the network of DNO, the DNO shall negotiate in good faith with the Generator to reach an agreement in respect of the open-access arrangements as per the provisions of its licence. In the event of disagreement between the parties, this shall be manged in accordance with CM 20 Disputes.

The Generator shall follow the same procedure for seeking connection to the network as mentioned in CC 6 of this code. However, as a basis for negotiation for the Connection Agreement, the Generators:

a. must provide to the DNO with such information as is reasonably requested relating to the expected operation of its generating units; and

b. the DNO must provide to the Generator such information as is reasonably requested to allow the Generator to fully assess the commercial impact of the connection arrangements sought by the Generator.

A Generator may seek open-access arrangements at any level of power transfer capability between zero and the maximum power output of the Generator's generating unit or group of generating units as per the provisions of the Grid Code and Distribution Code.

CC 7.2 Disconnection and Reconnection

The following procedures need to be adopted for disconnection of any facility from the network.

CC 7.2.1 Voluntary Disconnection

For the voluntary disconnection of any equipment or the facility, the User must give at least two months advance notice that it intends to disconnect its

facility from the DNO's network or subject to the procedure set out in the Connection Agreement.

However, it shall be ensured that disconnection and reconnection procedures are made an integral part of the Connection Agreement.

Before taking decision for disconnection of the equipment or the facility, it must be ensured that by such disconnection there is no impact on the quality or reliability of supply to other Users. If an impact is found, it shall be handled as per the provision of the contract between DNO and the User to resolvethe issue.

Prior to disconnection, the DNO must inform the System Operator about the disconnection proposal and its expected impact on the network.

The voluntary disconnection and subsequent re-connection shall be subject to fulfilment of all the requirements placed under the provision of Distribution Licence, NEPRA Act and Rules, and Distribution Service Manual.

CC 7.2.2 Involuntary Disconnection

The DNO may disconnect equipment or the facility of User or entity if:

a. The User is not operating its facility in accordance with the Connection Agreement or the provisions of Grid/Distribution Codes, in accordance with the law of the land, or the Distribution Service Manual giving advance notice depending upon the situation.

b. In case of operational emergencies due to which electrical system of the DNO is incapable of providing the required services.

c. In the event of emergencies, the User's facility must be disconnected in an orderly manner or as indicated in the Connection Agreement, so that the security of the system, as per Grid Code, is not affected.

d. A defaulted User must not bring proceedings against the DNO to seek to recover any amount for any loss or damage incurred due to the disconnection.

CC 7.2.3 Reconnection of the Equipment or the Facility

The DNO, following an outage or emergency, must reconnect the User's Facility after confirming that:

a. The User has rectified all such circumstances, which were the cause of disconnection.

b. The DNO must charge a reasonable cost as indicated in theConnection Agreement for reconnection of the facility which was disconnected due to default.

c. The facilities, which were disconnected due to emergencies, must be reconnected as soon as the causes of the emergency have been eliminated, and the network has returned to steady state operating conditions.

CC 7.3 General Connection Requirements on Generators

CC 7.3.1 Connection Related Obligations of Generators

Generators proposing to connect to the DNO's system shall submit a detailed design report that covers, as a minimum, the following subjects:

a. Suitability requirements

b. Adequate Fault Levels at the Site
c. Maintenance outage co-ordination
d. Stability requirements.
e. Insulation level requirements (switching insulation levels and high voltage protection)
f. Lightning protection for average isokeraunic levels for the site.
g. Efficient and simple operational co-ordination procedures
h. Plant Dispatch obligations
i. Isolation Equipment
j. Grounding method (Solid, through NGR or isolated).

CC 7.3.2 Generating Plant Performance Requirements

For Embedded Generators, the electrical parameters shall be specified by the DNO at the time of Offer for Connection. A Generating Unit must be capable of supplying its Registered Capacity within the System frequency range of 49 to 51Hz as per the Grid Code. The output power should not be affected by voltage changes within the permitted operating range as provided in this Code, Grid Code or Transmission Performance Standards. The Generating Unit shall comply with the voltage and frequency requirements as set by the DNO in the Connection Agreement not inconsistent with the Codes and Performance Standards at all times.

CC 7.3.3 Co-ordination with Existing Protection

It shall be necessary for the Protection associated with Embedded Generating Plant to co-ordinate with the Protection associated with the DNO's systemas follows:

a. For Generating Unit directly connected to the DNO's system, the Generating Unit must meet the target clearance times for fault current interchange with the DNO's system in order to reduce to a minimum the impact on the DNO's system due to faults on circuits owned by Generators. The DNO shall ensure that the DNO Protection settings meet its own target clearance times. Protection systems of both parties must be well-coordinated and periodically tested for their functioning as expected.

   The target clearance times are measured from fault current inception to arc extinction of the circuit breaker and shall be specified by the DNO to the requirements of the connecting network of the DNO's system.

b. The settings of any Protection controlling a Circuit Breaker or the operating values of any automatic switching device at any point of connection with the DNO's system shall be agreed upon between the DNO and the Generator in writing during the initial connection consultation process.

   The Protection settings or operating values shall not be changed without the express agreement of the DNO and/or the System Operator, if applicable.

c. It shall be necessary for the Generating Plant Protection to co-ordinate with any auto-reclose policy specified by the DNO.

d. Any Generating Unit connected to the DNO's system shall be required to withstand, without tripping, the Negative Phase Sequence loading incurred during the clearance of a close-up phase-to-phase fault by System Back-up Protection which shall be within the Generating Unit short-term rating in the DNO's system. The DNO shall advise the

Generator of the expected Negative Phase Sequence loadings during the Connection Agreement process.

CC 7.3.4 Islanding

It is conceivable that a part of the DNO's system, to which Embedded Generators are connected can, during emergency conditions, become detached from the rest of the distribution and transmission System. It shall be necessary for the DNO to decide, dependent on local network conditions,if it is desirable for the Embedded Generators to continue to generate onto the islanded DNO's system.

If no facilities exist for the subsequent resynchronization with the rest of the DNO's system, then the Embedded Generator shall under DNO's instruction, ensure that the Generating Unit is disconnected for resynchronization.

Under emergency conditions there is an expectation that some generation shall continue to operate outside the frequency limits specified in the Grid Code. However, for Embedded Generators connected to the DNO's system it is likely that this could mean connection within an automatic low frequency load disconnection zone. Consequently, Embedded Generators should ensure that all Protection on Generating Unit should have settings to co-ordinate with those on the automatic low frequency load disconnection equipment, which shall be detailed by the DNO.

An active Externally Connected Consumer or an Externally Connected Party must take particular care when there is the possibility of islanding. It is expected that the DNO will agree and put in place a specific procedure to cover this eventuality.

CC 7.3.5 Generating Unit Commissioning Tests

Where a Generator requires connection to the DNO's system in advance of the commissioning date, for the purposes of testing, the Generator must comply with the requirements of the Connection Agreement. The Generator shall provide the DNO with a commissioning programme, approved by theDNO if reasonable in the circumstances, to allow commissioning tests to be co-ordinated.

Under certain circumstances either more or less detailed information than that specified above might need to be provided and shall be made available by the Generator at the request of the DNO.

CC 7.3.6 Any relevant information regarding technical design and operational criteria as mentioned in CC 5.4 of the Grid Code may also be supplied along with the following information.

a. Earthing requirements/negative sequence current injection

b. AGC (frequency and speed governing characteristics)

c. Emergency generator disconnection conditionalities.

d. Power quality requirements
   i. Harmonics
   ii. Resonance
   iii. Voltage flicker / dips

e. Voltage unbalance

f. Adequate and accurate metering equipment.

CC 7.3.7 Preferred Connection Arrangement

Two schemes have been shown in the annex at the end of the C-Code for interconnection of generators. The existing generators are using these schemes; however, the new generators may design new configurations, which shall be acceptable by DNO after evaluation of the prevailing system conditions.

CC 7.4 Connection Requirements on Alternating Current (AC) Generators

CC 7.4.1 Frequency and Voltage Control

Each Generator's generating unit must be capable of contributing to frequency and voltage control of the NGC's Transmission System or a connected TNO system, by continuous modulation of Active Power and Reactive Power output. Therefore, to achieve this requirement it shall require that: (a) Each Generating Unit must be fitted with a fast acting, proportional speed governor, and a unit load controller or equivalent control device to provide frequency regulation under normal operating conditions; and (b) The generating unit must ensure that a continuously acting automatic excitation control system is provided to manage constant terminal voltage control of the Generating Unit without instability over the entire operating range of the Generating Unit. The requirements for excitation control facilities shall be included in the Connection Agreement.

Reactive Power Supply and Voltage Regulation

The Generators shall maintain a network voltage or reactive power output as required by the System Operator within the reactive capability of the Generators by use of an Automatic Voltage Regulator (AVR).

CC 7.4.2 Frequency Withstand Capabilities

The Power System Frequency is nominally 50 Hz but could rise to 53.0 Hz or fall to 47.0 Hz in exceptional circumstances. Design of Embedded Generator Plant and Apparatus shall ensure stable operation of their facility within that range in accordance with the following:

Table CC1: System Frequency Limits

	Frequency	Requirement
Below Nominal	47.0 Hz - 47.5 Hz	Operation for a period of at least 20 seconds is required each time the Frequency is below 47.5 Hz
	47.5 Hz – 48.0 Hz	Operation for a period of at least 15 minutes is required each time the Frequency is within the range 47.5 - 48.0 Hz
	48.0 Hz - 49.0 Hz	Operation for a period of at least 90 minutes is required each time the Frequency is within the range 48.0 - 49.0 Hz
Nominal	49.0 Hz – 51.0 Hz	Continuous operation
Above Nominal	51.0 Hz - 51.5 Hz	Operation for a period of at least 90 minutes is required each time the Frequency is within the range 51.0 – 51.5 Hz
	51.5 Hz – 52 Hz	Operation for a period of at least 15 minutes is required each time the Frequency is above 51.5 Hz
	52.0 Hz – 53.0 Hz	Operation for a period of at least 20 Seconds is required each time the Frequency is above 52.0 Hz

For the avoidance of doubt, disconnection, by Frequency or speed-based relays is not permitted within the Frequency range 47.0 Hz to 53.0 Hz before lapse of time period given in Table CC 2 unless otherwise as specified by the DNO.

CC 7.4.3 Control Arrangements

The generator shall have a governor to maintain frequency.

CC 7.4.4 Black Start Capability

It shall be necessary for each Embedded Generator to notify the DNO if its Generating Unit has a restart capability without support from an external power supply. Or otherwise, the generator will provide the Black start facility if

required/identified by SO under GC.

CC 7.4.5 Data Requirements

The Applicant shall provide the following data with the Intention Application. The Applicant shall also provide a Single Line Diagram of the proposed facility which must indicate all the current carrying parts/equipment connectedat all the voltage levels of the proposed substation.

a. Names of the substation and its operating voltage
b. Connection of the Operators Network and Generators
c. Metering arrangement
d. Protection arrangement
e. Make of the equipment
f. If double busbar is being operated by splitting, it shall be indicated accordingly
g. Any other useful information not listed above.

Equipment Data

Circuit Parameters:

a. Rated voltage (kV)
b. Operating voltage (kV)
c. Positive phase sequence reactance
d. Positive phase sequence resistance
e. Positive phase sequence susceptance
f. Zero phase sequence reactance (both self and mutual)
g. Zero phase sequence resistance (both self and mutual)
h. Zero phase sequence susceptance (both self and mutual)

Transformers

a. Rated MVA
b. Voltage Ratio
c. Winding arrangement
d. Positive sequence reactance
e. Max, min, and nominal tap positions
f. Positive sequence resistance
g. (max, min, and nominal tap)
h. Zero sequence reactance
i. Tap changer range
j. Tap change step size
k. Tap changer type: on load or off circuit
l. Earthing method: Direct, resistance or reactance
m. Impedance (if not directly earthed)
n. Phase connection.

Switchgear

b. Switchgear. For all circuit breakers: Rated voltage (kV)
c. Operating voltage (kV)
    i. Rated 3-phase rms short-circuit breaking current, (kA)
    ii. Rated 1-phase rms short-circuit breaking current, (kA)
    iii. Rated 3-phase peak short-circuit making current, (kA)
    iv. Rated 1-phase peak short-circuit making current, (kA)
    v. Rated rms continuous current (A)DC time constant applied at testing of asymmetrical breaking abilities (secs.)

Generating Unit Data

a. Rated terminal volts (kV)
b. Rated MVA
c. Rated MW
d. Dependable Capacity MW
e. Minimum Generation MW
f. Short circuit ratio
g. Direct axis synchronous reactance
h. Direct axis transient reactance
i. Direct axis sub-transient reactance
j. Direct axis short-circuit transient time constant.
k. Direct axis short-circuit sub-transient time constant.
l. Quadrature axis synchronous reactance.
m. Quadrature axis sub-transient reactance.
n. Quadrature axis short-circuit sub-transient time constant.
o. Stator time constant.
p. Stator leakage reactance.
q. Armature winding direct-current resistance.
r. Maximum Emergency Capability.
s. Installed Capacity.
t. Maximum action and reaction power output.
u. Type of generating plant (synchronous, asynchronous etc).
v. Type of prime movers
w. Operating regime of generator in continuous intermittent, peak lopping.
x. Fault Level contribution.
y. Method of voltage control.
z. Zero sequence
aa. Negative sequence
bb. Automatic voltage regulation.
cc. Speed governor and prime mover data.
dd. Capacity and stand by requirements.
ee. Auxiliary load of individual unit and powerhouse.

Interface Arrangements

a. The means of synchronization between the DNO and the User;

b. Details of arrangements for connecting with earth that part of the Generator's System directly connected to the DNO's System;

c. The means of connection and disconnection which are to be employed; and

d. Precautions to be taken to ensure the continuation of safe conditions should any earthed neutral point of the Generator's System operated at HV become disconnected from earth.

More or less detailed information than that contained above might need to be provided, subject to the type and size of generation or the point at which connection is to be made to the DNO's System. This information shall need to be provided by the Generator at the reasonable request of the DNO.

CC 7.5 Connection Requirements on SWE Generators

CC 7.5.1 Information Provision

SWE Embedded Generators should provide the appropriate signals (as agreed by the DNO's Control Centre) from the following list:

a. Wind speed (m/s) (for SWE Embedded Generators comprised of wind turbines)

b. Wind direction (degrees (0 = North)) (for SWE Embedded Generators comprised of wind turbines)

c. Solar irradiance (W/m2) (for SWE Embedded Generators comprised of PV modules)

d. Percent of Plant in operation (%) (for all SWE Embedded Generators)

e. Available power estimation (MW) (for all SWE Embedded Generators)

Short circuit contribution shall be provided for the SWE Embedded Generator with all DC Embedded Generating Units in service.

CC 7.5.2 SWE Embedded Generator performance requirements during normal Voltage operating range

a. SWE Embedded Generators must remain connected for Voltage changes at the Connection Point in the normal operating range.

b. The Active Power output under steady state conditions of any SWE Embedded Generator should not be affected by Voltage changes in the normal Voltage operating range.

CC 7.5.3 SWE Embedded Generator performance requirements during Voltage disturbances

a. SWE Embedded Generators shall be designed to withstand Voltage drops and peaks, as illustrated in Figure 1.

b. Vmin and Vmax in Figure 1 correspond to the appropriate ranges, based on the Connection Point rated Voltage.

c. The SWE Embedded Generator shall be able to withstand Voltage drops to zero, measured at the Connection Point, for a minimum period of 0.15 seconds without disconnecting, as shown in Figure 1.

d. The SWE Embedded Generator shall be able to withstand Voltage peaks with a maximum Voltage of up to 120% of the nominal Voltage, measured at the Connection Point, for a minimum period of 2 seconds without disconnecting, as shown in Figure 1.

e. Figure 1 shall apply to all types of faults (symmetrical and asymmetrical) and the bold line shall represent the minimum Voltage of all the phases.

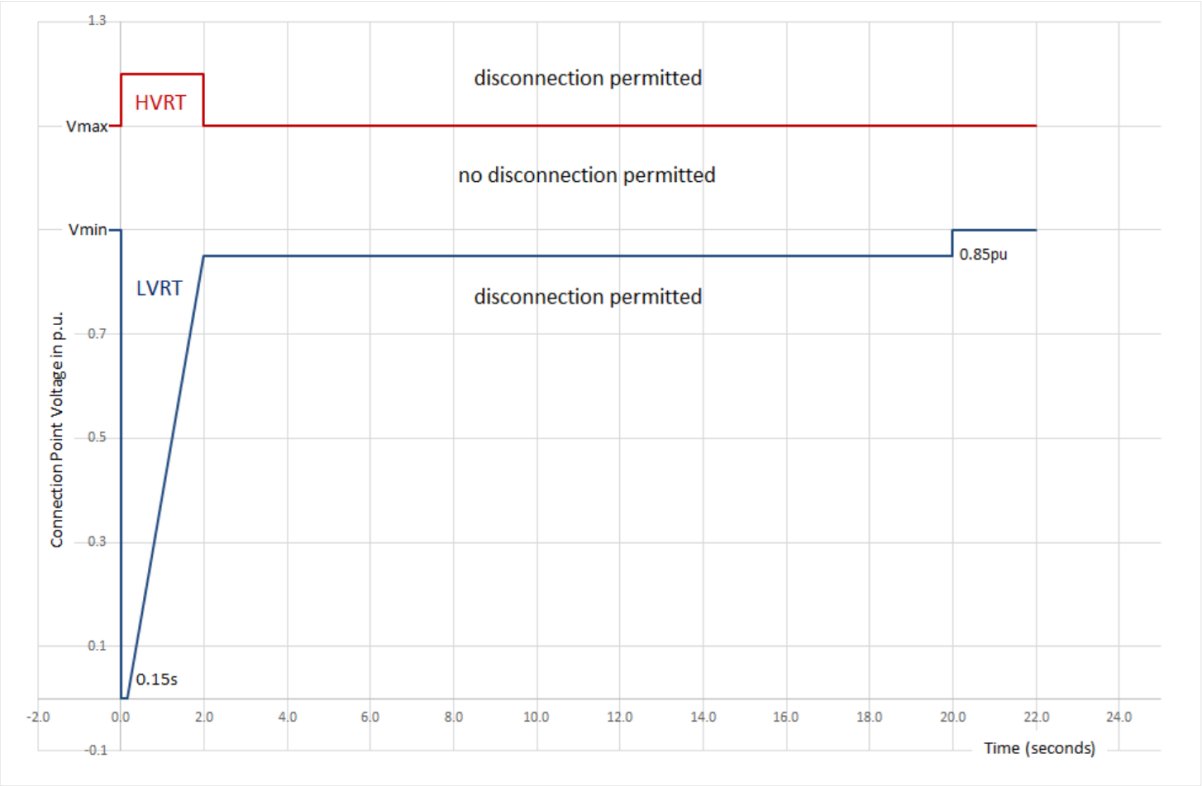


Figure 1: Voltage Fault Ride Through requirement for SWE Embedded Generators

(*This figure and those following in this section are standard internationally acceptable requirements that all major manufacturers comply with and are direct copies from the Grid Code*.)

f. If the Voltage (V) reverts to the normal operating range during a fault sequence, subsequent Voltage drops shall be regarded as a new fault condition. If several successive fault sequences occur and the Voltage remains outside of the normal Voltage operating range, the successive series of faults shall be considered to be one continuing fault condition. In addition, desynchronisation of the Power Station from the Distribution Network will be permitted if the operating point falls below the LVRT line to the 'desynchronisation permitted' area or above the HVRT line to the 'desynchronisation permitted' area, as illustrated in Figure 1.

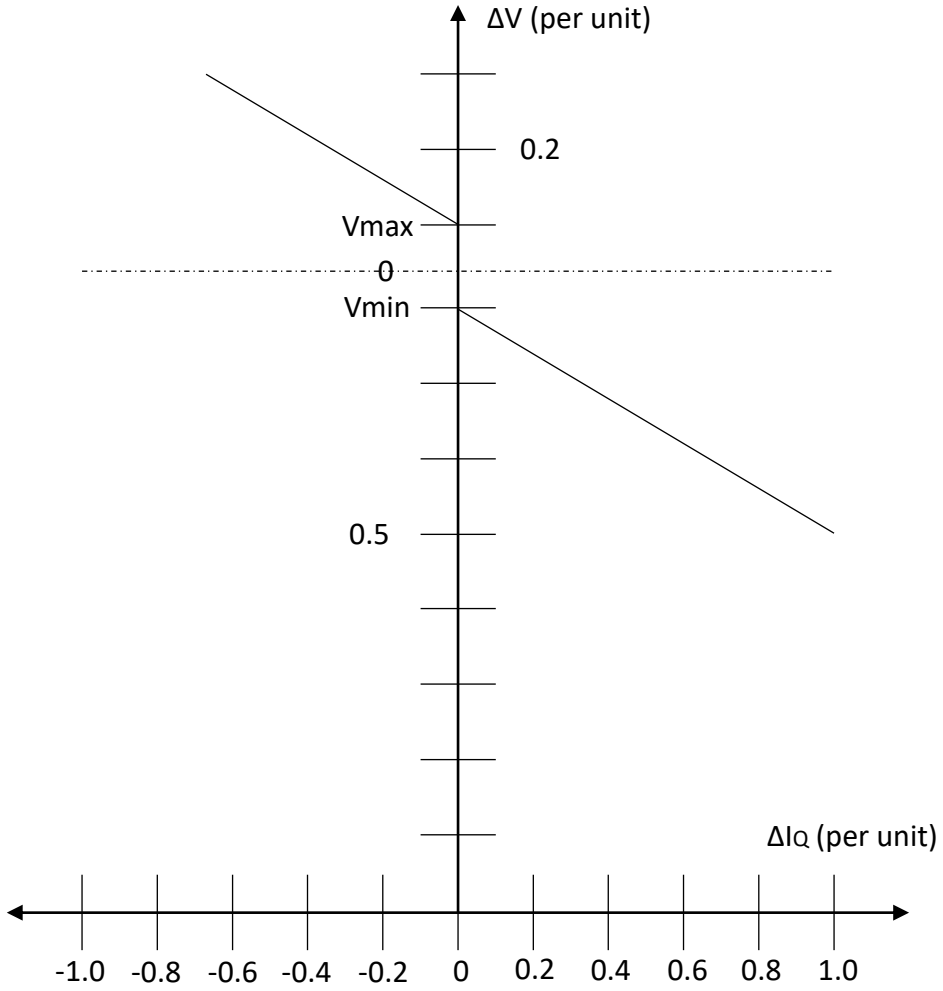


Figure 2: Requirements for Reactive Power support, □IQ, during Voltage drops or peaks at the DC Embedded Generating Unit terminals

CC 7.5.4 Voltage support during grid faults (see Figure 2).

Note that due to the timescales involved, this requirement is applied at the DC Embedded Generating Unit level. Therefore, this Subsection shall also apply at the terminals of any additional dynamic Reactive Power Equipment which may form part of the SWE Embedded Generator.

a. The DC Embedded Generating Unit shall have the capability of delivering an additional reactive current in proportion to the Voltage change ΔV at its terminals, as illustrated in Figure 2.

b. Vmin and Vmax in Figure 2 correspond to the appropriate ranges, based on the Connection Point rated Voltage but applied to the DC Embedded Generating Unit terminal Voltage.

c. The factor of proportionality between additional reactive current and Voltage deviation is named K (ΔIQ=K*ΔV). The factor K must be settable in the range of 0<K<4.

d. The default setting for the K factor shall be 2 as shown in Figure 2.

e. The additional reactive current ΔIQ according to Figure 2 shall be injected in addition to the pre-fault reactive current.

f. The Voltage deviation ΔV is defined as being the difference between the pre-fault Voltage and the Voltage during the fault.

g. Both pre-fault current and pre-fault Voltage are defined by the 1-minute average of the positive sequence component of the fundamental frequency value of current and Voltage, respectively.

h. The post-fault Voltage on which basis the Voltage deviation ΔV is calculated is the positive sequence component of the Voltage at the DC Embedded Generating Unit terminals.

i. The additional reactive current shall be injected as a positive sequence component.

j. 60ms after fault inception, the additional current shall remain within a tolerance band of ±20% around the value according to Figure 2.

k. The absolute value of the current in each phase that is injected into the grid can be limited to the rated current of the DC Embedded Generating Unit.

l. The reactive current requirement applies to retained Voltages (during the fault) greater than 10%. Below 10% the current of the DC Embedded Generating Unit can be set to zero.

m. As long as the DC Embedded Generating Unit operates below Vmin, reactive current will have priority over active current, and active current should therefore be reduced if required to meet the characteristic shown in Figure 2.

n. Upon the termination of a LVRT event, when Voltage is back into the normal operating range, each DC Embedded Generating Unit shall restore Active Power to it at least 90% of its pre-fault value within 1s.

o. During Voltage recovery, a DC Embedded Generating Unit must not absorb more Reactive Power than prior to the fault (reference for pre-fault Reactive Power: 1-minute average).

CC 7.5.5 Minimum requirements for Reactive Power capability for SWE Embedded Generators

a. A SWE Embedded Generator must have the capability of varying Reactive Power at the Connection Point within the reactive capability limits defined by Figure 3 when the Connection Point Voltage is at 1 per unit.

b. These Reactive Power limits will be reduced pro rata to the amount of Plant in service.

c. The SWE Embedded Generator shall be designed in such a way that the operating point can lie anywhere within its maximum and minimum capability according to Figure 3.

d. The Reactive Power capability defined in Figure 3 is modified depending on the Voltage at the Connection Point as per Figure 4. This requirement applies once automatic Tap Changer(s) of the grid transformer(s) and / or any switched shunts in the SWE Embedded Generator have operated. In the period(s) that the Automatic Tap Changer is not functional the SWE Embedded Generator is required to reduce Active Power export from the SWE Embedded Generator so that Reactive Power capability can be provided.

e. For Active Power levels below 5% of rated MW output (point C in Figure 3), there is no Reactive Power capability requirement. In this range, it is required that the SWE Embedded Generator operates within the tolerance range specified by point A and point B in Figure 3. Point A is equivalent (in MVAr) to –5% of Rated Output and point B is equivalent (in MVAr) to 5% of Rated Output. Note that if the SWE Embedded Generator can provide full or partial Reactive Power Control capability down to zero Active Power

then it may do so without limitation provided that this capability allows operation at zero MVAr exchange (unity power factor).

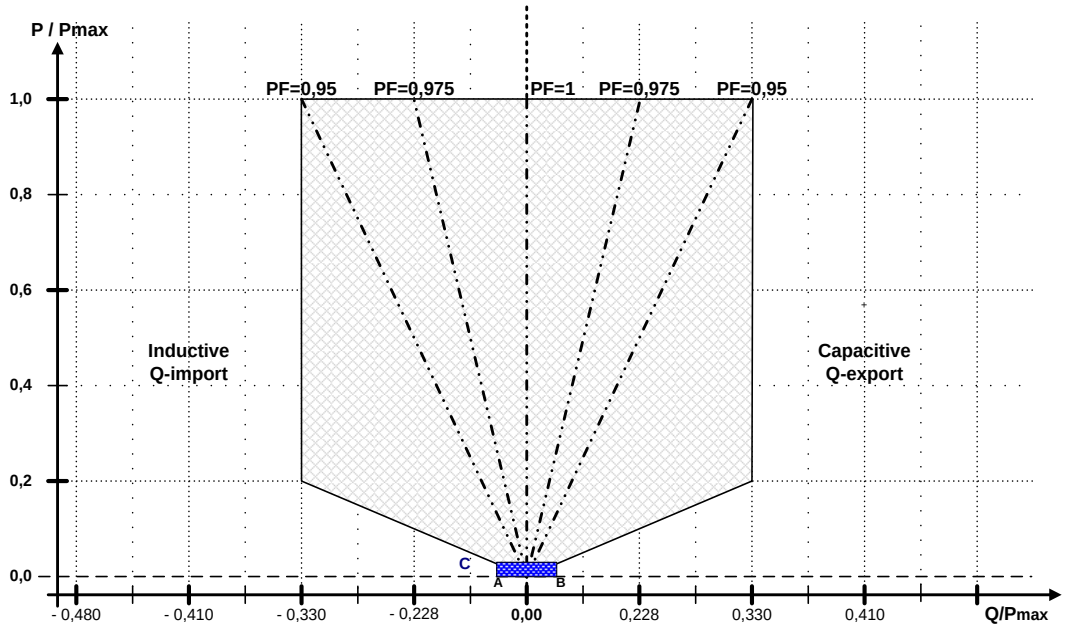


Figure 3: Reactive Power requirements at 1 per unit Voltage at the Connection Point for SWE Embedded Generators

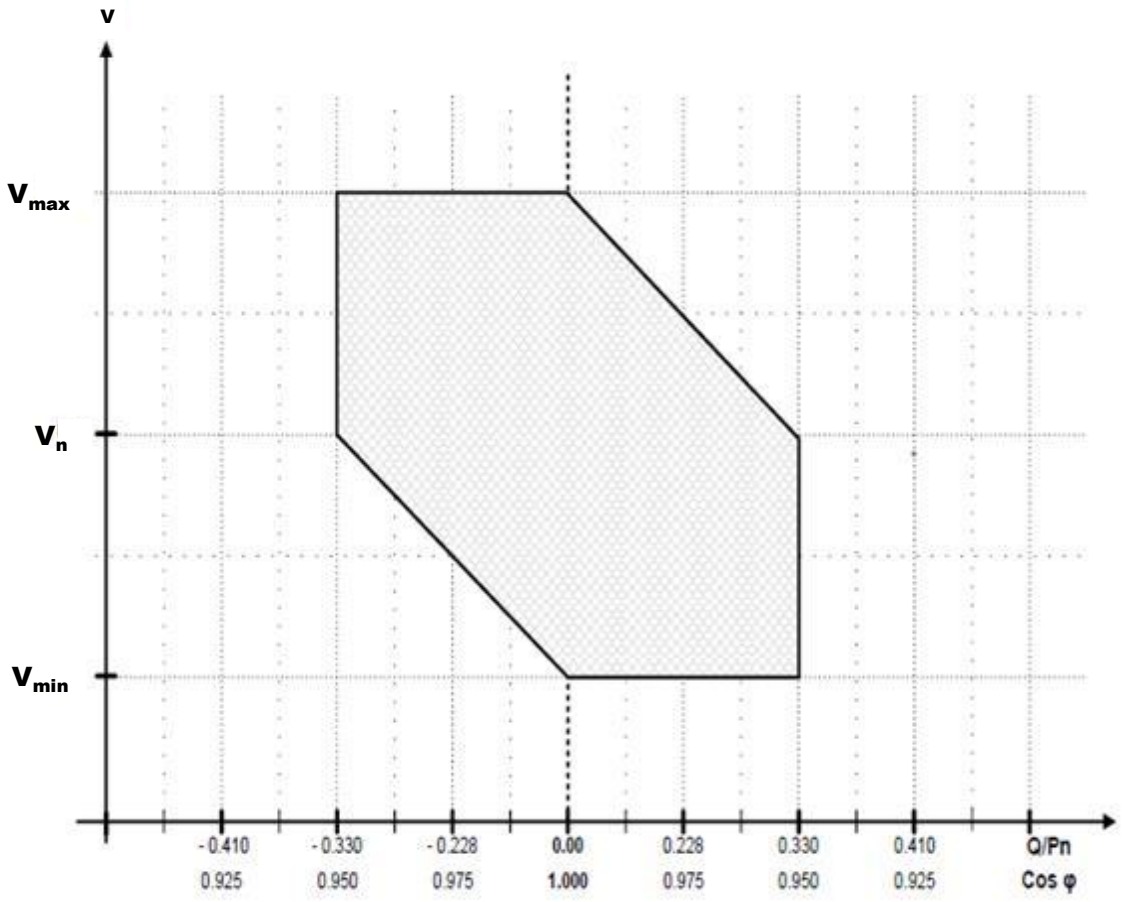


Figure 4: Variation of Reactive Power requirement for different Voltages at the Connection Point for SWE Embedded Generators

CC 7.5.6 Reactive Power Control and Voltage Control Requirements for SWE Embedded Generators

a. The SWE Embedded Generator shall be equipped with Reactive Power Control functions capable of controlling the Reactive Power supplied by the SWE Embedded Generator at the Connection Point as well as a Voltage Control function capable of contributing to Voltage support at the Connection Point via orders using set-points and gradients.

b. The Reactive Power and Voltage Control functions are mutually exclusive, which means that only one of the following three functions can be activated at a time:
   i. Voltage Control
   ii. Power Factor Control
   iii. Reactive Power (Q) Control, including Q(P) Control

c. The control function and applied parameter settings for Reactive Power and Voltage Control functions shall be determined by the DNO's Control Centre and implemented by the SWE Embedded Generator. The agreed control functions and initial parameters shall be documented in the Connection Agreement.

d. Reactive Power (Q) Control, including Q(P) Control:
   i. Q control is a control function controlling the Reactive Power supply and absorption at the Connection Point, either independently of the Active Power and the Voltage or in function of Active Power (Q(P) Control). This control function is

illustrated in Figure 5 as a vertical, red line (independent of Active Power) or as the green line (in function of Active Power). The indicated Q(P) characteristic is just an example. It is up to the DNO's Control Centre to define the actual settings of the Q(P) characteristic; however, it will always start with unity power factor (0 MVAr) at low power output.

ii. The SWE Embedded Generator shall be able to receive a Q setpoint with a discrimination of at least 1kVAr.

iii. If the operating point of the SWE Embedded Generator deviates from the characteristic in Figure 5 the automatic control system should act to restore the operating point onto the characteristic within the following timescales:

1. Response from inverter-based Plant should commence within 0.5 seconds
2. All transformer and shunt tapping (where applicable) should be completed, and the operating point should be settled onto the characteristic within 2 minutes.

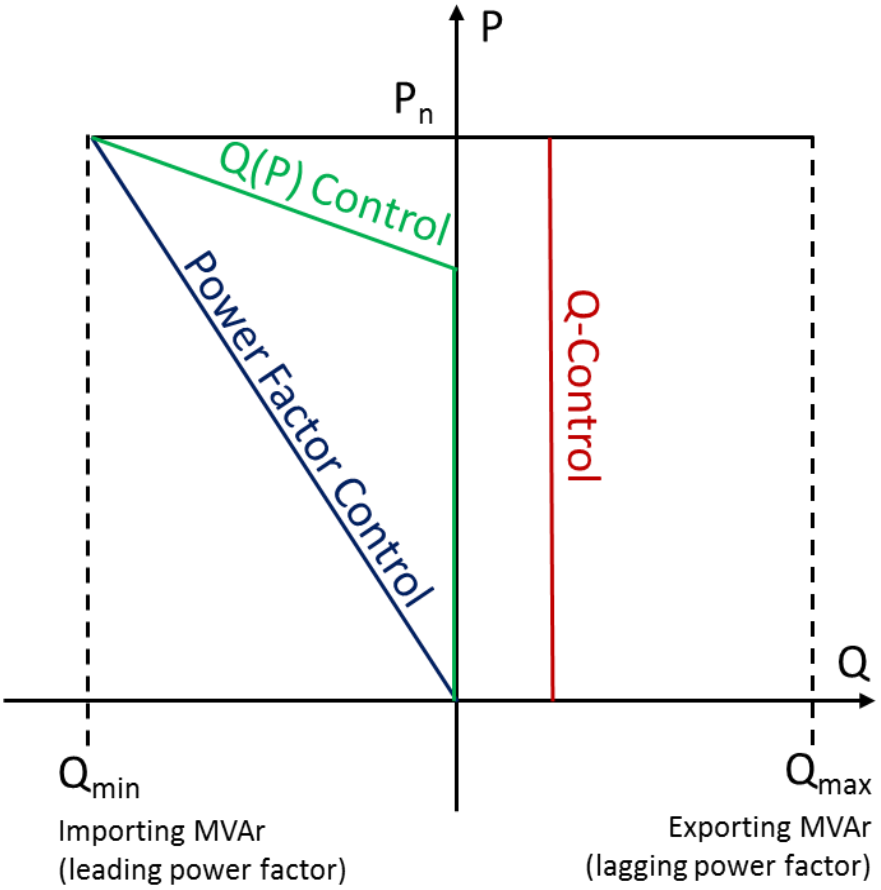


Figure 5: Reactive Power Control functions for the SWE Embedded Generator

e. Power Factor Control:

i. Power Factor Control is a control function controlling the Reactive Power to maintain a constant power factor at the Connection Point as shown by the blue line in Figure 5.

ii. If the operating point of the SWE Embedded Generator deviates from the characteristic in Figure 5 the automatic control system should act to restore the operating point onto the characteristic within the following timescales:

1. Response from inverter-based Plant should commence within 1 second
2. All transformer and shunt tapping (where applicable) should be completed, and

the operating point should be settled onto the characteristic within 2 minutes.

f. Voltage Droop Control:
   i. Voltage Droop Control is a control function which helps to control the Voltage at the Connection Point based on a target and slope (droop) approach.
   ii. The individual SWE Embedded Generator shall be able to perform the control within its dynamic range and Voltage limit with the droop configured as shown in Figure 6. In this context, droop is percentage change in Voltage from the Voltage setpoint which will cause a change in Reactive Power exchange from zero to Qmax or zero to Qmin as appropriate.
   iii. If the operating point of the SWE Embedded Generator deviates from the characteristic in Figure 6 the automatic control system should act to restore the operating point onto the characteristic within the following timescales:
      1. Response from inverter-based Plant should commence within 1 second
      2. All transformer and shunt tapping (where applicable) should be completed, and the operating point should be settled onto the characteristic within 2 minutes.

g. When the Voltage Control has reached the SWE Embedded Generator's dynamic design limits, the control function shall maintain this position (maximum or minimum reactive current) and await possible overall control from the tap changer or other Voltage Control functions.

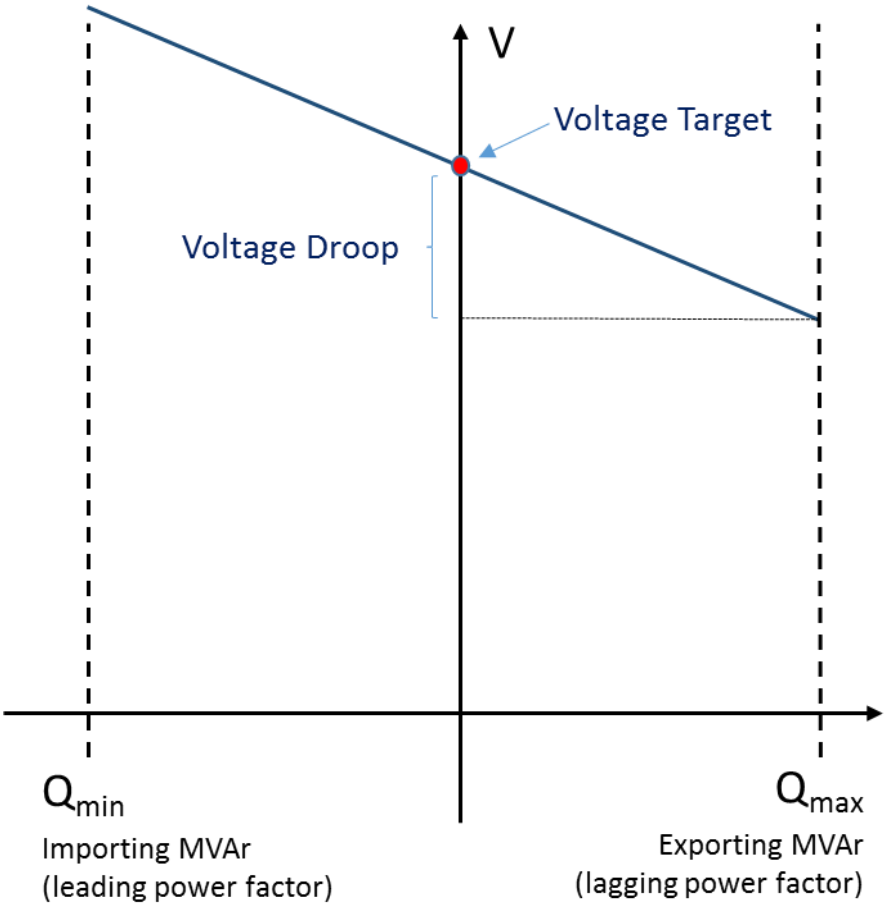


Figure 6: Voltage Droop Control for the SWE Embedded Generator

CC 7.5.7 Active Power Curtailment for SWE Embedded Generators:

a. All SWE Embedded Generators should be capable of setting an Active Power curtailment setpoint given in MW to limit Active Power following receipt of an instruction from the DNO's Control Centre.

b. Following an instruction to set an Active Power curtailment setpoint the SWE Embedded Generator should begin to respond to the new setpoint within 2 minutes.

c. The SWE Embedded Generator should ramp to the new Active Power curtailment setpoint at the ramp rate agreed with the DNO's Control Centre.

d. Any Active Power curtailment setpoint shall apply until such times as the DNO's Control Centre releases the Active Power curtailment setpoint. For the avoidance of doubt, should the Active Power of the SWE Embedded Generator decrease below the Active Power curtailment set point, the Active Power curtailment setpoint will still apply as a maximum limit until released by the DNO's Control Centre.

CC 7.5 8 <u>High Frequency Active Power reduction requirement for SWE Embedded Generators</u>

a. During excessive high frequency operating conditions, SWE Embedded Generators shall be able to provide the mandatory Active Power reduction requirement in accordance with Figure 7 in order to assist with stabilisation of the frequency.

b. When the frequency on the System exceeds 50.5 Hz, the SWE Embedded Generator shall reduce the Active Power as a function of the change in frequency as illustrated in Figure 7.

c. If the frequency reaches 51.75 Hz the SWE Embedded Generator output should reduce to zero.

d. The required reduction in Active Power output should commence within 2 seconds of the frequency exceeding 50.5 Hz and be continuously and linearly proportional, as far as is practicable to the characteristic in Figure 7.

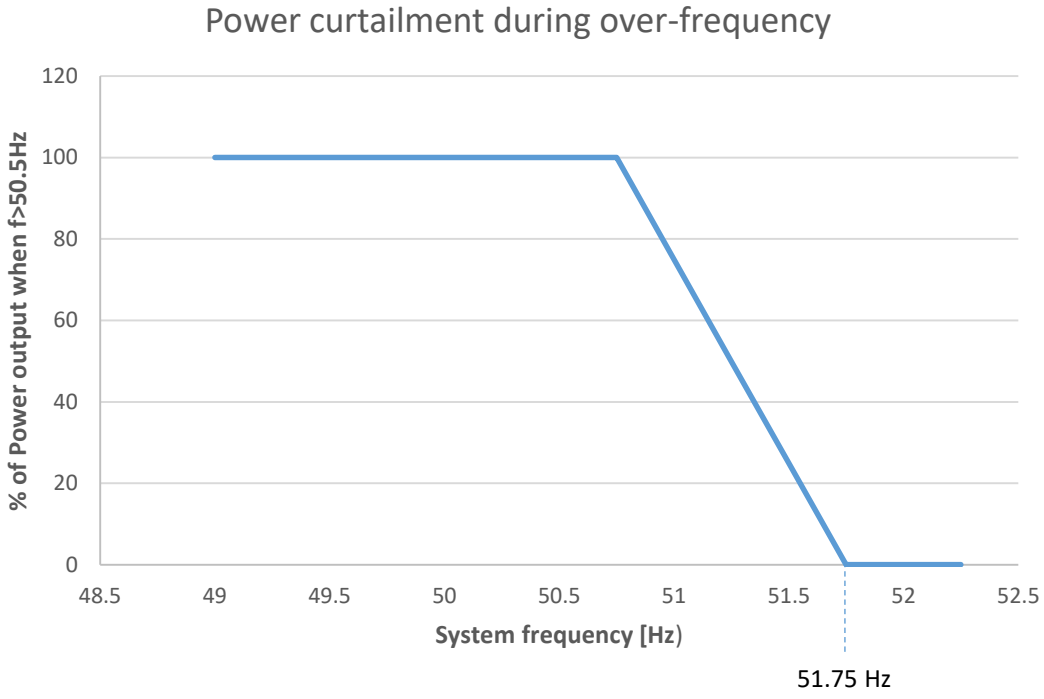


Figure 7: Power curtailment during over-Frequency for SWE Embedded Generators

CC 8 INSPECTION AND TESTING

Regarding inspection and testing of equipment and the facilities of the Users, the following procedures are to be followed:

CC 9 RIGHT OF ENTRY AND INSPECTION

The DNO, who is also party to the Connection Agreement, believes that another User is not operating its network in accordance with the technical limits set out for the Connection in the Grid/Distribution Code, and the Connection Agreement, and due to which negative impact is reflected to the DNO's or another User network, can enter into the premises of theconnection of the User and inspect the operating conditions of that Connection.

The DNO who intends to inspect premises of the Connection of a User under normal operating conditions shall give a three-business days' notice forthe same indicating the name of the representative who would conduct the inspection, and time and date of the inspection.

"However, detailed provision regarding DNO's right of entry to Consumer's premises to inspect connection and metering facilities are included in the Distribution Service Manual".

CC 10 REQUIREMENTS FOR EMBEDDED GENERATORS

CC 10.1 Distribution Connection Code is applicable to all existing and prospective Generators, including Consumers with Own Generation, having Plant operating or capable of operating in parallel with the DNO's System.

CC 10.2 In addition to meeting the requirements of this code, Embedded Generators shall need to meet the requirements of other relevant sections of the Distribution Code and relevant provisions of the Grid Code.

CC 10.3 Information Required from All Embedded Generators

It shall be necessary for each Generator to provide the DNO information on (a) the Generating Plant and (b) the proposed interface arrangements between the Generating Plant and the DNO's System. Any other relevant information provided in CC 7 of this sub-code may be required by the DNO before entering into an agreement to connect any GeneratingPlant onto the DNO's System:

CC 10.4 Obligations of Embedded Generators

The Obligations of Embedded Generators shall be as follows but not limited to:

a. Must Obtain License from NEPRA to operate as Generator unless it is a self-generator.

b. Must comply with the requirements and conditions of connections for Generators set out in the Connection Agreements made with the DNO and Grid/Distribution Code accordingly.

c. The Generators must submit an application for change for approval by the DNO of the existing or the installation of a new equipment at its facilities. Prior to installation of the proposed equipment, its specifications including any change in the layouts must be approved by the DNO

d. Must comply with the technical, functional, and operational

requirements set out for the connection by the DNO as per this sub-code or Connection Agreement.

e. Must provide generation availability forecast information including the amounts of output, partial shutdowns, any de-ratings, and outages (MW & MVAR both), to the relevant DNO.

f. The Generators must provide their development programs to the relevant DNO so that the transmission or distribution facilities can be upgraded in a timely manner, if required for, evacuation of power from the Generator's facilities.

g. Permit and participate in inspection and testing of facilities and equipment prior to commissioning.

h. Must participate in frequency and voltage control, stability requirements and short circuit requirements as specified in the Grid Code or Distribution Code.

i. Even if contractually permitted to self-dispatch the Generator must obey all instructions from the System Operator, given through the Power Control Centre of the DNO, in emergency circumstances.

j. Must maintain requisite functional protection facilities accurate metering facilities, testing, inspection, and repairs at all times.

CONNECTION PROCEDURE

for new connection or amendment
of existing connection

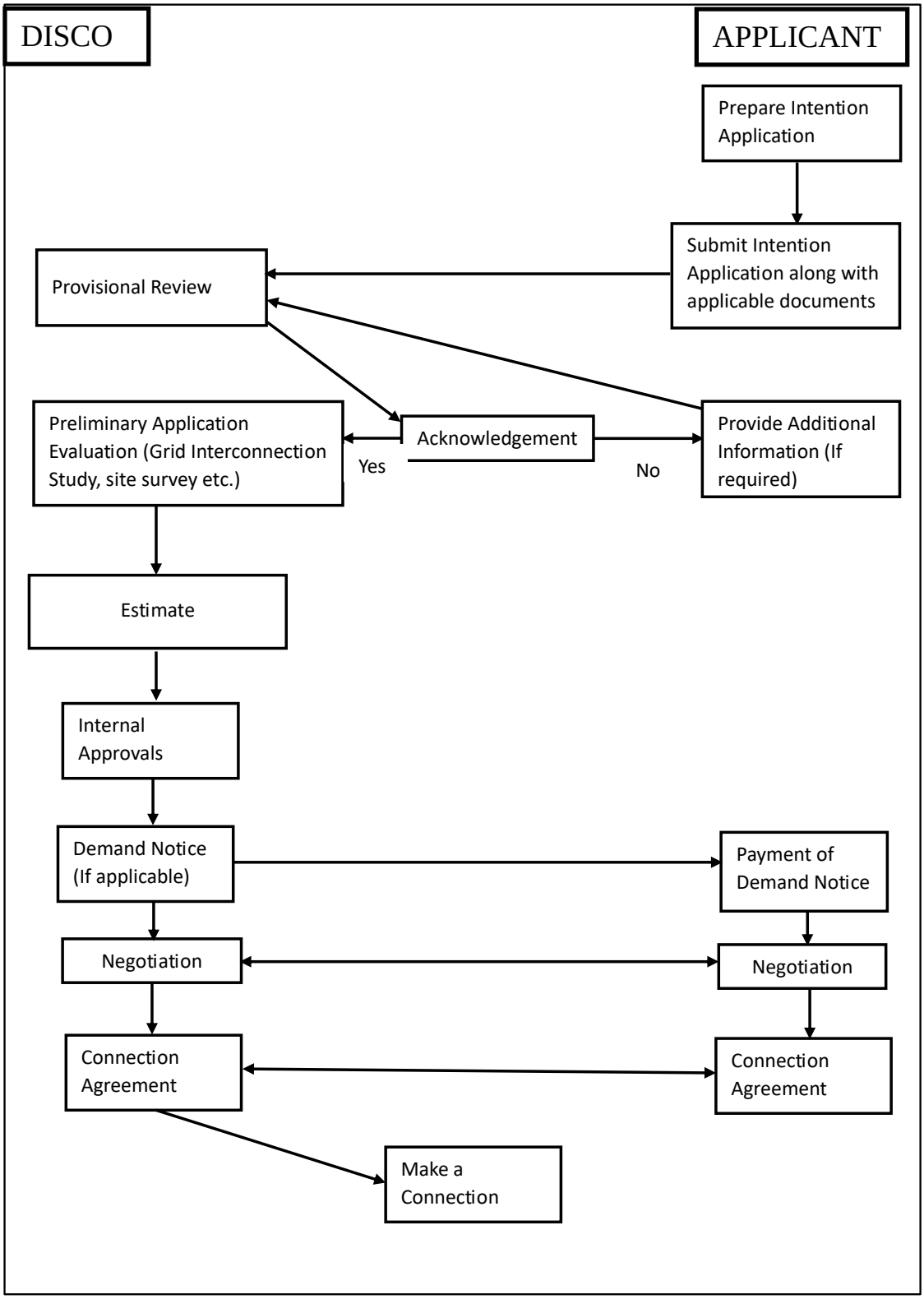


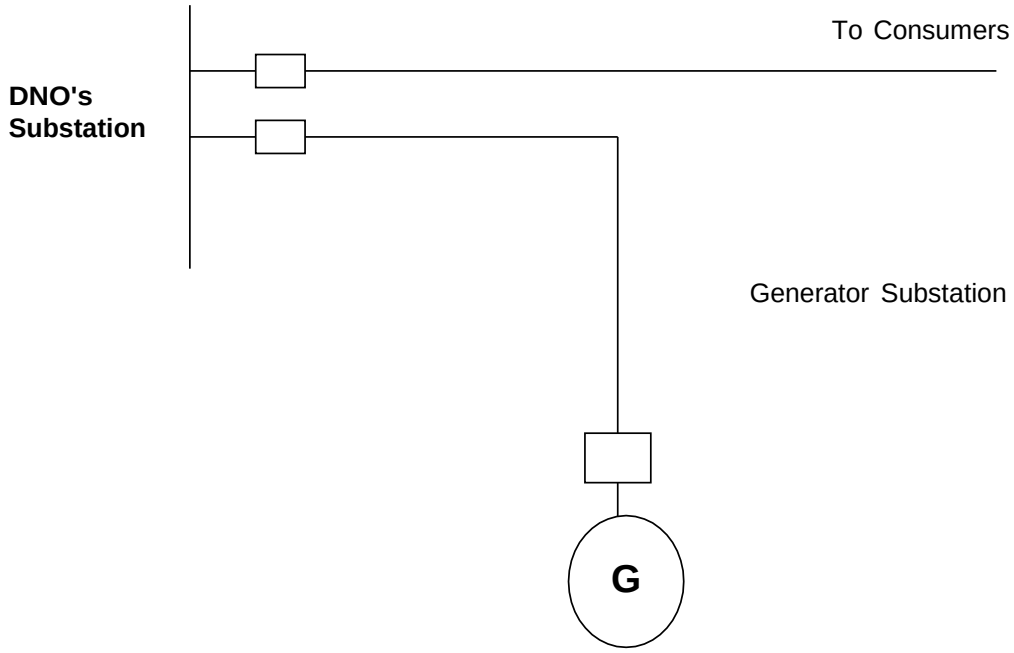
Figure 8 Connection Application Process

Interconnection Configurations for Generators

Connections at 11kV

Scheme 1

The generators may adopt any of the configurations depending on its location with reference to the substation and existing feeders and loading and operating condition of the feeders.



DISTRIBUTION CODE

SYSTEM CONSTRUCTION CODE

CONTENT

SYSTEM CONSTRUCTION CODE

SC 1 CONSTRUCTION MANUAL

Each DNO shall prepare a comprehensive and exhaustive Operating / Construction manual in accordance with DNOs approved standard based on relevant international standards like IEC, IEEE, and ANSI, Distribution Service Manual, Grid Code and Distribution Code dealing with all material aspects to the design specifications, safe constructing practices, and sound engineering technical principles for construction of Distribution System and connections to Consumer installation/system. In particular due regard shall be had for the following but not limited to: -

a. Standard clearance of all Distribution Voltage lines (vertical as well horizontal) from grounds, buildings, from each other, railway crossing, road crossing etc.

b. Maximum and minimum length of span of the lines of all Distribution Voltages at different locations and different areas.

c. List and use of standard overhead HT/LT conductors, and underground cables.

d. Proper procedure for laying HT/LT underground cables.

e. Procedures for proper erection of HT/LT structures.

f. Procedures for proper transportation, loading/unloading and erection of HT/LT PC poles.

g. Proper use of PG connectors for HT/LT jumpers.

h. Use of proper size of joints sleeves by using hand compression tools.

i. Preparation of site safety plan by in charge engineer**/**supervisor before starting the work.

j. Proper usage of PPEs, SPEs and Tools.

k. Proper foundation of structure and PC poles (in special cases) if required.

l. Procedures for proper earthing of structure and distribution transformers and other electrical equipment.

m. Procedures for proper installation of energy meters.

n. Procedure for proper installation of Consumer service wire.

o. Use of IPCs for LT ABC and Covered Conductor along with standard accessories

DNO's Construction Manual shall *not* be made available to the Users of the DNO. However, the distribution system and connection of the Consumer's installations to the DNO's system, when approved, shall be made available to the prospective User upon request.

SC 2 CONSTRUCTION GUIDELINES

Following instructions are provided on construction practices as guidelines to form contents and level of details required for the operating / construction manual to be prepared by the DNO's

SC 2.1 Overhead Distribution Lines

The overhead distribution lines shall be designed in accordance with applicable international standards, e.g. IEC.

SC 2.2 Wiring on Consumer's Premises

The service Wires to Consumers shall be installed in accordance with relevant Construction Standards for 230V/400V supply and in accordance with the Distribution Service Manual.

SC 2.3 Underground Installations

Direct buried cable or conduit or other raceways installed shall meet the minimum depth or height or clearances requirements of international standards e.g. NESC. All underground installations shall be grounded in accordance with the DNOs approved standards based on relevant international standards like IEC60364, BS7671, and NESC. Underground cable installed within a building like for example a consumer substation shall be routed through proper raceway/trench.

SC 2.3.1 Protection from Damage

All underground cables should be laid down in proper trenches up to required length or direct buried with standard depth and as per DNOs approved standard procedure based on relevant international standards like IEC 60364, BS 7671 etc.

SC 2.3.2 Backfill

Backfill containing large rock, paving materials, cinders, large or sharply angular substance, or corrosive material shall not be placed in an excavation where materials may damage cables or other substructures or prevent adequate compaction of fill or contribute to corrosion of such structures. When necessary to prevent physical damage to the cables, structures, protection should be provided in the form of appropriate means.

SC 2.3.3 Sealing of Entry Points

All the entry points of cables to a building or substation shall be properly sealed to avoid ingress of water or rodent entry.

SC 3 CONSTRUCTIONAL IMPROVEMENTS

The system can be improved by providing the following construction criteria by the DNO.

SC 3.1 Foundation of the Poles/Structure

Foundations shall be designed considering the nature of soil/salinity in the area. Concrete foundations of sulphate resistive cement shall be provided wherever necessary and required.

SC 3.2 Insulators

In areas where air borne dust/salts are deposited on insulators during fog and forms contamination double disc insulators shall be used in the construction design in such areas.

SC 3.3 Line Connectors

Line connectors must be installed properly so as not to result in loose joints or cause flashovers, broken conductors, and severe line losses. The DNO must use parallel grove type connectors (PG) and follow installation instructions to

assure proper installation. The instructions shall indicate wire brushing of the conductors, adding an oxide compound to conductor surface, and proper tightening of the bolts.

Use of compression type connectors shall be promoted. Hand Compression Tools shall be used to affix these connectors.

Insulation Piercing Connectors (IPCs) for covered conductor and LT ABC shall be used.

SC 3.4 Transformer Connections

a. DNO shall develop construction standards that provide for the best connections to primary and secondary conductors.

b. The DNO shall incorporate the following in its construction design standards:

   i. Use of Wasp conductor/copper conductor Jumpers for transformers up to capacity of 100 kVA.

   ii. Use of double WASP Conductor jumpers for 200 kVA Transformer.

   iii. Use of P.G. connectors for joining the jumpers to line.

   iv. Use of special compression lugs/Thimbles to join the jumpers to transformer bushings.

   v. Lead sizes shall be standardized by DISCO as per transformer rating.

   vi. Thumb clamp shall be used at transformer bushing for connection of leads with bushing instead of directly connecting lugs with bushing.

The DNO shall specify that distribution transformers are provided with lugs on transformers bushings.

Transformer shall be protected at its LT and HT side using overcurrent protection devices. Additional protections like pressure relief device may be added in specification of DNO.

SC 3.5 Proper Construction Techniques

Construction of Distribution network shall be conducted using proper construction techniques. Use of sag/span chart, tension meter, stay wire 45 deg angle, crimping machine, torque wrench and trolley for ABC pulling and electrical grease application are some of quality methods for construction.; Techniques includ.

The use of shovel for structure pit digging and auger for PCC poles.
The use of Rollers on every pole for Stringing of Conductors.
The use of Sag Charts and Tension Meters for proper sags.

Stay wire shall be affixed to the pole at a 45-degree angle to provide the maximum strength to the pole or at appropriate angle depending upon the site location, and condition.

SC 3.6 Affixing of Hardware

The pole framing to install Hardware, Cross arms, Insulators shall be affixed to the pole while it is still lying on ground and then erect it, so that labour time can be saved.

Pole shall be erected 1st adopting all the safety measures and subsequently

hardware installation may be carried out.

The DNO Engineer shall prepare a site plan, stating the requirement of shutdowns, transport, Tools and Plant, work force and the material needed for the job and shall arrange them before starting work atsite.

End of SC

SYSTEM PERFORMANCE, RELIABILITY AND CONSUMER SERVICE REQUIREMENTS

CONTENTS

SYSTEM PERFORMANCE, RELIABILITY AND CONSUMER SERVICE REQUIREMENTS

SPR 1 SYSTEM OPERATION

In order to ensure the performance standards, to achieve minimum standards of reliability and to improve the service to Consumer and to address the Consumers complaints promptly, the DNO shall comply with all the provisions, obligations, requirements, and responsibilities placed upon it with the prescription of Performance Standards (Distribution)-Rules in accordancewith Section 34 of NEPRA Act (XL of 1997). The system reliability, Consumer service and complaints and disputes resolution procedures shall be maintained in accordance with the provisions of prescribed Performance Standards (Distribution) and Distribution Service Manual of the DNO and applicable provisions of Grid/Distribution Codes. The DNO shall provide guidelines for smooth operation of the distribution system for a safe, efficient, and reliable electricity supply to meet the needs and expectations of the Consumers.

SPR 1.1 Operation Criteria and Principles

The operation criteria and principles shall comprise of:

a. Operate within specified capacity and design loading specifications

b. To maintain the voltage and frequency within specified limits as provided in the Grid and Distribution Codes.

c. Ensure safety, quality, and reliability of supply as per NEPRA Performance Standards (Distribution)

d. Provide adequate contingency supply arrangement at all times.

e. Restoration of supply as per NEPRA Performance Standards (Distribution)

SPR 1.1.2 Load Monitoring

DNO shall monitor the distribution system loads and ensure that the following system capacity and loading guidelines are followed:

SPR 1.1.2.1 Equipment Loading Criteria

a. Conductor Loading

The capacity of a feeder is a function of the feeder length and the distribution of the loads along the feeder. The purpose of establishing current carrying capacity criteria for planning is to initiate the planner to review a feeder that may be in violation based on existing as well as forecasted load.

b. The loading limits of all the distribution facilities of the lines and grid station should be in accordance with IEC Standard, manufacturer recommendation with due regard to ambient temperature conditions.

SPR 1.1.5 Voltage Monitoring and Control and Load Balancing

Voltage monitoring on the secondary side of 33/0.4kV and 11/0.4kV distribution transformers shall be carried out at least once in one year during Peak Load hours to cover at least two nos. of transformers on each 11KV feeder as follows:

a. One transformer towards the beginning of the feeder

b. One transformer towards the end of the feeder

The load on each phase shall be kept equal to the maximum possible extent.

- **Voltage Imbalance**
  - Unbalance caused by individual loads should be kept within a reasonable range.
- **Voltage Fluctuation**
  - A 3% general limit on the allowable magnitude of voltage changes, regardless of shape.
- **Harmonics**
  - IEEE 519 shall be used as the applicable standard.

Improvement to voltage conditions can be achieved by but not limited to the following action: -

a. Providing proper earthing of the transformer. Proper earth connection may result in proper voltage at Consumer premises.

b. The load on the LT feeders must be kept balanced as far as possible - unbalanced loads cause heavy voltage drops in the overloaded phases. The unbalanced load on the Low Voltage side of the Distribution transformers shall not exceed 10% of the peak load.

c. Adjusting/shifting Consumers on adjacent transformers to reduce the length of LT radial line from the transformer as for as possible.

d. To bring in circuit all fixed disconnected 11kV capacitors installed on the feeders.

e. By bifurcating the existing 11kV feeders.

f. By augmenting the existing 11kV conductor.

g. By providing 11kV voltage regulators on the feeders.

SPR 2 POWER-FREQUENCY AND VOLTAGE VARIATIONS

a. A DNO must ensure that all equipment, which is part of its network, is capable of continuous uninterrupted operation in the event that variations in supply voltage as described in DPC 3.4.

b. A DNO shall supply power to its Consumer within the frequency range of 50(±1%) Hz. The DNO shall supply electric power to its Consumers of the power quality in accordance with the IEEE Standards 519 (latest version available) – pertaining to Harmonics content.

c. As per IEEE Standard 1159, voltage variation sustained for more than 1 minute will be considered as under or overvoltage.

d. The Users shall ensure that any of their Apparatus, Equipment, or Plant connected to the Transmission System, shall not cause Power Quality issues such as flicker, harmonics, Voltage dips, or Voltage unbalance beyond the permissible limits stated in the relevant International Standards (IEC and/or IEEE). Where such limits are exceeded at the Connection Point, the Users shall install appropriate and specific compensation and/or power quality mitigation equipment within their premises/networks.

SPR 3 OPERATIONAL CONSTRAINTS

The DNO shall develop procedures and guidelines to overcome the operational constraints on the distribution system. These include but are not limited to; communication and control system constraints, distribution system replacements and improvements and the following guidelines: -

a. **Pre-arranged** shut down for maintenance of lines and grid stations should be avoided during the months of May to August as far as possible and to co-ordinate with other utility (telephone, cable, gas) officials.

b. Pre-arranged shut down must not be allowed during the peak load hours.

c. Communication between the system operator and grid station staff (especially power line carrier (PLC) system) must be maintained and kept in working order all the times.

d. Availability of transport in working order all the time with adequate maintenance and operation staff along with necessary tools and service equipment.

e. Availability of material and proper T & P with the maintenance and operation staff to attend emergency.

f. To properly schedule preventive maintenance of the lines and grid stations.

g. Availability of telephone attendant in complaint offices with the telephone in working order all the times.

h. To provide mobile telephones or wireless set to the complaints' attendant and maintenance staff.

i. Establishing the training centres in the field to train the line staff in operation, maintenance, and construction of distribution system.

SPR 4 HOTLINE WORKING TOOLS, TRAINING AND TESTING

The Licensee shall develop a training for line crews to be trained on Hot Line, Cold Line Maintenance and Equipment testing requirements. The use of special insulated gloves, shoes and tools shall be provided. The use of insulated bucket trucks shall be encouraged to assure Continuity of Supply and or prompt restoration.

SPR 5 MANAGEMENT OF OUTAGE PLANS

The DNO shall address and outline its proposed outage plans and submit them to its Users on a time schedule as given in the Grid Code and Distribution Code each year. The outage management plan shall containprocedures/guidelines on identification of electric lines and equipment of the distribution system that shall be taken out of service for maintenance or replacement, outage start date, expected duration of outage, number of Consumers effected, effected sub-stations and the quantum of load not to be drawn at any interconnection during outage.

The outage and restoration plans of the DNO must be co-ordinated with the System Operator and be in accordance with the plan and procedures established in the Grid Code, and Distribution Code.

The Disco shall set timelines for all User outage planning request submission and consequent PCC approval, so as to allow the PCC to fulfil its outage submission duties to the SO.

From time to time, but not less than once every three years, the System Operator shall schedule a test of the system restoration plan and DNO shall co-operate and participate in the exercise.

In the event of breakdown within its own System, the DNO shall restore/maintain supply by taking appropriate pre-specified measures within a pre-specified time.

SPR 6 POWER CONTROL CENTRE (PCC)

SPR 6.1 Each DNO shall establish a Power Control Centre to effectively communicate with the System Operator and the Generators and other DNOs, BPCs, TNOs for the necessary operation and maintenance of distribution network and transmission network.

SPR 6.2 Each DNO shall install AMI / AMR Meters at its 11 kV outgoing feeders along-with 11kV Incoming Panels for remote monitoring and load dispatch decisions. Further, the DNO shall establish a central database through these AMI / AMRs which shall be used for Short Term Load Forecast (STLF) / Day-a-head load forecast and coordination with SO as well as for improvisation of their Medium-Term Load Forecast (MTLF).

SPR 6.3 The DNO shall also work on integration of its all-available IT infrastructure including Power Control Centre (PCC) with SCADA, AMI/ AMR, GIS Enterprise to convert its system into Advanced Distribution Management System (ADMS) for operation, maintenance and planning purpose.

SPR 6.4 Customer payments shall be associated with the feeder supplying them so as to assess and monitor the commercial losses on each feeder.

SPR 7 UNPLANNED INTERRUPTIONS

SPR 7.1 In the case of an unplanned Interruption or an emergency, the DNO must:

a. inform its Users (or the System Operator, if applicable) as soon as possible by way of a 24-hour telephone service information on the nature of the interruption and an estimate of the time when supply shall be restored or when reliable information on restoration of supply shall be available.

SPR 7.2 Wherever reasonable and practicable, the DNO shall provide notice of planned interruption to its Consumers at least forty-eight hours in advance of any such planned outage excluding defence establishments when planned power interruptions shall only be taken through mutual agreement.

End of SPR

METERING AND DATA COLLECTION

CONTENT

METERING AND DATA COLLECTION

MDC 1 INTRODUCTION

This sub-code defines conditions/obligations and operational responsibilities for efficient commercial metering and data collection at the points of connection between DNO's network and User's system (including generators).

MDC 2 PURPOSE

This section specifies the minimum technical, design, operational and performance criteria for revenue metering, for the purpose of electricity sales and flow, which must be complied with by all the DNOs, and Users connected to or seeking connection with the network of the DNO.

For the purpose of settlement the electric energy (active and reactive) supplied and delivered at each defined connection point (Common Delivery Point) must be measured and recorded through metering equipment of the required specifications as described in this sub-code, Distribution Service Manual or Grid Code, which shall be installed, operated, and maintained according to this code.

MDC 3 LOCATION OF METERING POINT

a. Metering facilities shall be installed at the point of connection between the Applicant and DNO's network.

b. Metering between the generator and the DNO's network would be installed at the high voltage side of the outgoing bus bars of the generating stations or DNO side point of connection. Metering between the delivery point of the Consumer and the DNO's network would be installed as per relevant provision of Distribution Service Manual. In case of interconnection between the DNO and Transmission Licensee, the meter should always be on lower side of the interconnecting transformer.

c. In the case of inter-DNO tie line, the metering shall be provided at the outgoing terminal tower/pole of the exiting Grid Station of the DNO mostly exporting power to the other DNO.

d. Notwithstanding the above, the location of the metering point in each case shall be such that the cost of transformation losses shall be with the entity that owns the interconnecting transformer with the DNO.

e. Separate metering room with separate trench for metering cable shall be provided at the applicant's cost wherever possible.

f. The DNO shall provide data logging type metering for all important data such as voltage, current, power factor, kWh, and MDI metering.

MDC 4 COMMERCIAL METERING AND DATA COLLECTION

Where Commercial Metering for New Market purposes is at a Metering Point of a BPC or an Embedded Generator the following will apply:

- The measurement will be of half-hourly energy.
- The meter will be of high accuracy as given in the Grid Code.
- The data will be stored securely.

- The meter installation must be set up to allow remote access by standard protocols.
- Data collection will be by secure means.

MDC 5 METERING SERVICE PROVIDER

A Metering Service Provider (MSP) will collect commercial meter data from all CDPs in accordance with the Grid Code and the Commercial Code.

MDC 6 ADVANCED METERING INFRASTRUCTURE (AMI)

This section shall apply to all Metering Points that are under the purview of the MSP. It shall not apply to Metering Points that are the DNO's responsibility.

MDC 6.1 MSP shall establish Advanced Metering Infrastructure (AMI) system to facilitate measurement, recording and communication of Metering Data. The minimum parameters of this Metering Data shall include following:

a. Active energy import and export registers

b. Reactive energy import and export registers

c. Active import and export billing maximum demand registers (with datetime)

d. 30 minutes (or less-than) timestamped Load Profile data for channels including:

- Active energy import
- Active energy export
- Reactive energy import
- Reactive energy export
- Power-factor each phase
- Voltage each phase
- Current each phase

e. Meter local time

f. Maximum Demand reset counter

g. Meter event log

MDC 6.2. MSP shall maintain MDM server with database of all metering devices installed at Metering Points to store the Metering Data along with meter information, required for billing and settlement in accordance with the Market Commercial Code.

MDC 6.3. MSP shall formulate operating procedures for operation and maintenance of the AMI System to achieve uninterrupted and complete Metering Data retrieval which shall cover the following:

a. Metering Data Reading remotely by MDM/by locally attached device/by hand-held data collection device as required. In the event of failure of communications facilities, Metering Data shall be read locally from the meter and transferred to the Meter Data Management (MDM) Server.

b. Metering Data Validation, Estimation & Editing (VEE), as per the

requirements of the MCC and/or any other applicable regulation.

c. Time synchronization of meters

d. Meter display parameters

e. Sign conventions

MDC 6.4. **Data Communications**

MDC 6.4.1 Meters shall be equipped with standard communications ports/modules for local and remote downloading of Load Profile and other Metering Data.

MDC 6.4.2 Both the Primary and Back-up Energy meters shall be integrated in the AMI System of MSP. The relevant User shall be provided with read-only indirect access of Metering Data for its Primary and Back-up Meters.

MDC 6.4.3 The communication protocol for transmitting Metering Data shall be in accordance with IEC 61107, IEC 62056 (DLMS/COSEM/UDIL specifications), or IEC 61850.

MDC 6.4.4 Provided energy meter shall be capable of integration with the MDM Server of MSP. All the necessary communication modules required for this integration shall be provided by User.

MDC 6.4.5 Remote communication option shall be provided by means of suitable communication medium as deemed appropriate by MSP while adhering to security guidelines as set out in MC 4.6.

MDC 6.5. **Metering Data Storage**

MDC 6.5.1 MSP shall maintain record of Metering Data in MDM server for three (3) years. Metering Data shall be maintained with a back-up arrangement.

MDC 6.5.2 The stored Metering Data values shall be in kilowatt (kW) and kilowatt-hour (kWh) for power and energy respectively.

MDC 6.5.3 In the event of a power supply failure, the meters shall protect all data stored up to the time of the failure and maintain the time accuracy. To cater for continuous supply failures, the clock, calendar and all data shall be retained in meters for a period of at least twenty-four (24) months without an external supply connected.

MDC 6.5.4 Uninterrupted auxiliary supply should be provided to meters and communication devices for metering and continuous transmission of data.

MDC 6.5.5 A “read” action shall not delete or alter any stored Metering Data in the meter and MDM.

MDC 6.6 **Meter Time Synchronization**

MDC 6.6.1 Time of Metering System shall be kept synchronized as per Pakistan Standard Time (PST).

MDC 6.6.2 Time synchronization of meters shall be performed as per MSP operating procedures and consequently, appropriate measures shall be taken to ensure the accuracy of the time-stamped Metering Data.

MDC 6.7 **Sharing of Metering Data**

MDC 6.7.1 The MSP shall share relevant Metering Data with the following:

a. The MO for performing billing and settlement activities;

b. The SO, required for operational monitoring;

c. The involved User, to fulfil their own obligations.

MDC 6.7.2 MSP shall keep the Metering Data confidential to avoid unauthorized access by any entity.

MDC 6.8 **Metering Data Validation, Estimation, and Editing (VEE)**

The Metering Data – that will be transferred to the MO – shall be complete, correct and its type, format and Frequency shall be in accordance with the Market Commercial Code. For such purpose, the MSP shall follow the provisions of the Market Commercial Code and its associated CCOPs.

MDC 6.9 **Technical Disputes in Metering Data**

MDC 6.9.1 MSP shall resolve errors/omissions in Metering Data (as a result of metering system error or malfunction), if any, in collaboration with the relevant Users and the adjusted/corrected Metering Data shall be reported to the MO and the relevant Users.

MDC 6.9.2 In case MSP and the relevant Users do not reach an agreement, the Dispute Resolution Procedure provided in the Market Commercial Code shall be followed.

MDC 7 TAMPER AND REVENUE PROTECTION

For Metering Points under the purview of the MSP, an authorized representative of the MSP, DNO and User shall supervise meter installation. After completing the installation the DNO representative and User as observers shall lock and seal the meter and metering equipment.

MDC 7.1 **Security and Sealing**

MDC 7.1.1 All components of Metering Systems (energy meters, meter communication devices, instrument transformers and their secondary circuits) shall be installed in such a manner that they cannot be tampered with.

MDC 7.1.2 The MSP shall make arrangement to seal and secure all Primary & Back-up Metering Systems with unique serial number seals.

MDC 7.1.3 The MSP shall be responsible for record-keeping and supervision of sealing/desealing activities of Metering System. The authorized representatives of the relevant User and MSP shall be present during the said sealing/de-sealing activities.

MDC 7.1.4 All wiring between Instrument Transformers outside the metering compartment shall be installed in rigid galvanized steel conduits.

MDC 7.1.5 Primary and Back-up metering rooms shall be locked and sealed under supervision and control of authorized representative nominated by MSP.

MDC 7.1.6 To prevent unauthorized access to the data in the Metering System, a security scheme, as described below, shall be incorporated for both direct local and remote electronic access:

a. Level 1 security, with or without password for read-only access of the Metering Data including meter time, data registers and Load Profile.

b. Level 2 security with password for programming of CT and VT ratios, and other parameters including Load Profile configuration, display sequences, Maximum Demand period, MDI reset.

c. Level 3 security with password for corrections to the time and date

MC 7.1.7 In case of tampering with Metering System, MSP shall perform audit/enquiry of User's Metering System to ascertain if the tampering is deliberate or inadvertent and the duration of such tampering. If the tampering of Metering System is proven to be deliberate, a complaint will be lodged by MSP with the Authority and the appropriate law enforcement agency for investigation and/or punitive actions as per law of the country, if any.

If the MSP detects any anomaly, including maintenance defects, inappropriate equipment, or evidence of tampering, thereof, it shall prepare a Metering Incident Report, informing this situation to the Market Operator as per the provisions of the Market Commercial Code.

MDC 8 APPLICATION

Metering shall provide accurate measurement of electrical quantitiesdelivered to or received from the electric transmission, transmission, anddistribution network. Metering devices including all instrument transformers shall be revenue class with facilities for measuring, active and reactive energies, peak load, power factor, etc. that are required for billing, planning, and engineering purposes. Metered quantities shall be remotely transmitted and recorded in the metering database at DNO computer centre and MSP (if applicable).

Metering facility shall be provided at the connection points between Users and DNO to record energy (kWh) delivered or consumedfor the purpose of billing, engineering studies and planning. Metering shall provide measurements of energy delivered at the point of connections between the Generators and other Users. Metering data shall be made available to each User.

The DNO or MSP shall make all meter data available to the User.

MDC 9 SUBSTATION METERING REQUIREMENTS

For regulated customers the following paragraphs shall apply:

Metering shall be installed at a secured location in the substation where connection between the Users with DNO is made. Meter and instrument transformers shall be installed in such a manner that they cannot be tampered with.

The DNO shall provide the meter at the cost of the User and install the revenue meter at the connection location. Meter shall be the type approved as per specification of IEC and approved DNO standards and model. Prior to installation meter and instrument transformers shall be tested and calibrated and DNO approved instrument transformers shall be used by the DNO. The DNO shall replace meters not meeting the minimum accuracy requirements specified in MR 10 (standards).

The DNO shall always provide, install, test, calibrate, repair, and replace the meter at the User's premises according to the pre-specified standard as contained in the Commercial Code, Grid Code, Distribution Code, Distribution Service Manual, and Performance Standards (Distribution).

DNO shall have test and calibration facility, with necessary tools and instruments, for testing and calibration of meters and shall be responsible for periodic testing and maintenance of the metering and ancillary equipment. The DNO shall replace meter or other metering component that is found to be defective in accordance with the provisions of the Distribution Service Manual.

MDC 10 STANDARDS

All metering devices and instrument transformers for metering shall comply with the latest applicable international and local standards. Accuracy (energy and demand). Reference “applicable IEC specifications” (Class 0.5, 1 and 2 Alternating Current watt-hour meters) No. I85 (Current transformers), No. 186 (Voltage Transformers), “applicable IEC specifications” (Measuring Relays and Protection Equipment).

Metering devices and instrument transformers for revenue metering must comply with the latest applicable international and local standards, including but are not limited to the following.

- IEC 62053-61 Electricity metering equipment (ac) – particular requirements – Part 61: power consumption and voltage requirements.
- IEC 62056-31 Electricity metering – Data exchange for meter reading, tariff, and load control – Part 31: Use of local area networks on twisted pair with carriersignalling.
- IEC 62056-41 Electricity metering – Data exchange for meter reading, tariff, and load control – Part 41: Data exchange using wide area networks: Public Switched Telephone Network with LINK+ protocol.
- IEC 62056-51 Electricity metering – Data exchange for meter reading, tariff, and load control – Part 51: Application layer protocol.
- IEC 60186 Voltage transformers
- IEC 62052-11 Electricity metering equipment - General requirements, tests and test conditions - Part 11: Metering equipment
- IEC 62053-21 Electricity metering equipment - Particular requirements - Part 21: Static meters for AC active energy (classes 0,5, 1 and 2
- IEC 62053-22 Electricity metering equipment - Particular requirements - Part 22: Static meters for AC active energy (classes 0,1S, 0,2S and 0,5S)

MDC 11 PERFORMANCE REQUIREMENTS

Revenue metering and ancillary equipment shall read energy delivered to or received from the electric transmission with an appropriate degree of accuracy, but not less than +/- 0.2* %. Revenue class metering shall have the following characteristics

- Three phase four-wire and three phase three wire configuration, electronic, digital, with accuracy class of 0.2 from 0% to 100% of full scale is standard.
- Meters shall be capable of measuring and recording active and reactive energy, phase currents and phase voltages at 30minute intervals for a period of 70 days, with intervals programmable from 1 minute to 2 hours.
- The meter shall have the capability of recording active and reactive energy and maximum demand for the entire billing period. The meter billing period shall be programmable and can be programmed to automatically store the accumulated value and reset the counter for the next billing period.

- Multiplier corresponding to the combination of CT and PT ratios shall be programmable in the meter. Accuracy class of CT and PT shall be in accordance with applicable DNOs technical specifications.
- Meters shall be capable of time of use and seasonal applications. Meters shall have internal time clock for time and date stamping of data. Time clock shall have high accuracy and shall synchronize to GPS time signals.
- Meters shall have provisions for remote meter reading by telemetering. Communication ports shall be provided for optical and serial data communication with industry standard protocol support.
- Meter shall have self-diagnostic capability and includes an alarm to indicate failure and/or tampering.

a) Installation

Installation of revenue meter and ancillary equipment at the substation for the point of connection shall be the Generator and other Users' responsibility. The Generators and other User connecting to the DNO's network shall submit to the DNO for approval theengineering design for revenue metering, proposed location of metering equipment and ancillaries complete with wiring and installation drawings and bill of materials. The proposed metering location shall be adjacent to any telemetering, communication, and datalogging equipment.

Revenue metering and ancillary devices shall be provided in secured metal enclosure. Enclosure shall have doors with locks for easy access. Glass window shall be provided on the door to allow visual reading of the meter inside the enclosure. Instrument transformers shall be installed in secured location and shall be dedicated and not be shared with protection or other metering devices, to prevent tampering. All wiring between the instrument transformer outside the metering compartment shall be installed in rigid galvanized steel conduits. Meter shall be located where it is accessible for reading the registers and for testing and maintenance.

b) Access

Each User shall grant the DNO and the MSP right to enter upon and pass through and remain upon any part of such User's property to the extent necessary for the purpose of performance of obligation under this Code.

The right of access provided for under this code includes the right to bring on to such User property such vehicles, plant machinery and maintenance or other materials as shall be necessary for the purpose of performance of obligation under this Code.

Each User shall procure that all reasonable arrangements and provisions are made and/or revised from time to time as when necessary or desirable to facilitate the safe exercise of his right of access.

c) Telemetering (Data Collection System)

Facilities are to be provided by the User for remote transmission of metering information to the DNO to be recorded in the metering

database. Transmission of telemetered data information must be secure and reliable and not prone to tempering. All metered quantities including times and date of acquisition must be telemetered. Quantities that are to be metered shall include:

- Apparent energy
- Real energy
- Energy (kWh or MWh) delivered to load
- Energy (kWh or MWh) received from supply
- Reactive energy (kVArh or MVArh)
- Peak load MW or kW
- Peak MVAr or kVAr load
- Power Factor.

Metering database is to be provided at the DNO Headquarters. Database will have metered quantities, meter information, metering constants, instrument transformer ratios, etc. Information in the data base computer will be accessible to for billing, engineering studies and planning.

The communication protocol for transmitting metering information shall be in accordance with IEC 61107.

MDC 12 TESTING AND CALIBRATION

Testing and calibration of meters shall be in accordance with applicable IEC Standard listed in MR 10 of this sub-code. All test equipment for testing meters shall conform to IEC Standard.

Note: All matters of energy metering requirements of the Consumers of different categories as categorized in the Performance Standards (Distribution) clause 4 part III have been detailed and discussed in Distribution Service Manual approved by the Authority which shall be followed by each DNO.

MDC 13 METER OWNERSHIP

Meters at 11kV on the CDP points shall be owned by the entity owning the feeder and responsible for losses.

End of Metering and Data Collection

PROTECTION REQUIREMENTS

CONTENT

PROTECTION REQUIREMENTS

PR 1 PROTECTION SYSTEM PRACTICES AND SYSTEM CO-ORDINATION

The DNO shall follow suitable and necessary provisions regarding protection system practices and co-ordination such as the following but not limited to achieve the aims of proper functioning of the distribution system of the DNO at all times:

a. Protection co-ordination of distribution system and system up to the metering point of the User (wherever applicable).

b. Intentions to protect the DNOs lines, sub-station facility and equipment against the effects of faults.

c. Achievement of co-ordination with protection systems at the NGC Transmission level, with other TNOs, and other Distribution Companies.

d. Provision for the disconnection of all faulted items from the power system in a timely manner as specified in PCC 2.2 of the Grid Code.

e. Protection schemes designed to cope with single element failure or stuck breaker condition and to maintain proper equipment protection.

f. Minimization of loss of power supply of distribution system following protection operation and chances of inadvertent operation.

g. Supply the distribution system protection scheme data of DNO to the User and NGC or connected TNO upon request.

h. Provide protective earthing devices including portable earth devices. Recommended grounding resistance limits should be as follows:

- System Ground: 5 ohms
- All Distribution S/S: 5 ohms
- Surge Arrestors: 5 ohms
- LV Distribution Panel: 10 ohms

i. Replace the mechanical relays with digital equipment over a period of time, co-ordinated with the NGC or connected TNO.

j. The DNO shall conduct loadflow and short circuit studies of the network for planning, designing and operation of Power System. Short circuit levels shall be calculated as per IEC 60909.

The protection relays shall be in accordance with the IEC Standard No. 255**,** and IEC 60255 (Protective Relays)

PR 2 SYSTEM PROTECTION OPERATION

The DNO shall plan, design, co-ordinate with the NGC or connected TNO, procure, install, operate, and maintain its requisite protection systems as per the hierarchy of standards provided in the Grid Code and submit the pertinent information to the NGC or connected TNO in the form and manner as determined by the Grid Code at least once a year.

A DNO shall use the protection systems for its network, in coordination with

NGC and connected TNOs, which shall cover the following types of protection at Distribution Voltage sub-stations.

(i) Bus bar protection (differential relay)

(ii) Power transformer protection (differential relay, Buchholz relay, low oil relay, winding temperature rise relays, over-current relay, earth fault,and pressure relief on HV/LV sides.

(iii) Transmission line protection (over current relay, distance relay, earth fault relay)

(iv) Over and under voltage relay

(v) under frequency relay

(vi) Breaker failure relay

(vii) Lightning protection

For the Distribution Voltage network, the above shall be used as applicable also:

(i) All the feeders shall be protected with a minimum of overcurrent and earth fault relays as follows: non-directional time lag overcurrent and earth fault relay with suitable settings.

PR 3 POWER-FREQUENCY AND VOLTAGE VARIATIONS

A DNO must ensure that all equipment, which is part of its network, is capable of continuous uninterrupted operation within the specified limits of voltage, frequency, loading as provided in the grid code/distribution code.

PR 3.1 Proper Earthing

To assure proper protection relay operation the DNO/DNO must ensure that the neutrals of its substation transformers are securely connected to the earth mesh through at least two independent earthing conductors from each transformer to an earth mass in the substation switchyard. The resistance of the earth mass shall be or less than 2Ω. The DNO shall strictly follow the codes as approved by NEPRA and IEC standards in respect of neutral earthing and equipment grounding of substation transformers to earth mass and in respect of neutral earthing andequipment grounding at Consumers' premises consistent with the latest practice adopted by DNO and IEC Standards.

PR 4 STANDARDS AND PRACTICES

Protection devices shall conform to the applicable IEC standards based on the approved Grid Code. The protection relays shall be in accordance with IEC Standard No. 255, and IEC Standard No. 60255 (Protective Relays) and others as given in PR Appendix-1, whichever is applicable.

a. Clearance: for 33kV and above if the fault clearance times are not met as a result of a failure to operate the primary or main protection system, a back-up or secondary protection system shall be provided. Back-up protection shall be coordinated with the primary protection so as to provide discrimination. Back-up protection features shall include over-reach of adjacent item protection and delayed inter-tripping of alternative breakers.

b. The target performance of the system fault dependability index shall not be less than 99%. This is a measure of the ability of the protection

system to initiate successful tripping of circuit breakers that are associated with the fault in the system. Fault dependability index is the ratio of the number of successful operations divided by the total number of operations.

PR 5 SUBSTATION PROTECTION

The time setting for clearing a fault by any relay operating a breaker should be provided by the DNO and coordinated with NGC or connected TNO.

Connections between the DNO and the transmission network of NGC or a connected TNO system, and other Users (Distribution Companies, BPC, TNOs, generators (Embedded and Consumer's-owned) substations must meet the minimum requirements delineated below:

a. For faults on the User's substation equipment directly connected to the network of the DNO and for faults on the network of the DNO directly connected to the User's substation equipment, fault clearance period from fault inception to circuit breaker arc extinction duly co-ordinated with the NGC or connected TNO shall be set out in the Transmission Service or Connection Agreement duly coordinated with the System Operator.

b. All fault clearing times shall be specified by the DNO and approved by NGC or connected TNO except for the transmission connection point where NGC or connected TNO is required to specify.

c. In the event the primary or main protection system fails to meet the fault clearance times listed above, a backup or secondary protection system shall be provided. Back-up protection shall be coordinated with the primary protection so as to provide discrimination.

d. Circuit breakers provided at the point of connection between the User's substation and the transmission network shall be provided with breaker failure protection. In the event the breaker fails to operate, the breaker failure protection will initiate tripping of all the electrically adjacent circuit breakers within the time limit approved bythe System Operator.

Additional protection may be required by NGC or connected TNO as per the provisions of the Grid Code.

PR 6 TESTING, CALIBRATION AND MAINTENANCE

Testing, calibration, and maintenance of the protection systems installed within the grid stations such as 500/220/132/66/11kV not owned by the DNO shall be the responsibility of other DNOs, TNOs or NGC as the casemay be depending on the ownership and control.

Calibration, Maintenance and Testing shall be scheduled annually or according to manufacturer's recommendations and shall be performed as per the standard procedures.

PR 7 CONTROL AND SWITCHING COORDINATION

PR 7.1 <u>General</u>

For the purpose of connecting and disconnecting a generating unit and/or User's substation from the DNO network it is essential that the necessary equipment be provided. This equipment shall include, but not limited to the following:

a. In conjunction with the protection system, circuit breakers shall be provided at the connection point between the User and the transmission network. The circuit breaker shall have the proper voltage ratings, short circuit current rating and continuous current rating. Rating shall be submitted to NGC or connected TNO for approval.

b. Control panels for circuit breakers, disconnecting switches and protection system shall be provided at the connection point. SCADA connections for monitoring and control of circuit breakers, disconnecting switches, metering, and protection devices.

c. Disconnecting switches shall be provided for isolating circuit breaker for maintenance. Disconnecting switches shall be no-load break type and have the same voltage, continuous current and fault closing current capability as the circuit breaker.

d. Disconnecting switches shall be provided for isolating transformers in the substation for maintenance. Disconnecting switches shall have wiper to prevent arcing when energizing the transformer. Disconnecting switches shall be no-load break type and have the same voltage, continuous current and fault closing current capability as the circuit breaker.

e. Grounding switches shall be furnished to ground the bus bars and transmission line for maintenance.

Disconnecting and grounding switches shall be motor-operated and shall permit remote operation and interlocking with other switching devices. Control and electrical interlock for disconnecting and grounding switches shall be provided in the control panel. Control shall have interface with SCADA for remote control and monitoring of the disconnecting and grounding switches.

a. Switching Procedures

All switching activities performed at the connection point between the DNO and User system shall be performed under the direction of the DNO (system operator). All other switching activities in the Users system shall be coordinated with the DNO. Proper communication and tagging procedure shall be observed to prevent accidents and damage to equipment involved in the switching operation.

b. Testing and Maintenance of Control Facilities

Control and switching shall be scheduled once a year or as per manufacturer's recommendations for testing and maintenance. Adjustments in protection system and control will be made at this time if necessary. Equipment found to be defective shall be repaired or replaced, accordingly. Testing and maintenance will be coordinated with DNO and NGC. Tests, calibration, repair, and replacement of equipment shall be recorded and distributed to all concerned parties.

PR 8 INSULATION CO-ORDINATION REQUIREMENTS

The protection system shall be developed with the co-ordination of NGC or connected TNO and in accordance with relevant design and equipment standards.

End of PR

DISTRIBUTION CODE

SYSTEM MAINTENANCE AND TESTING

CONTENT

SYSTEM MAINTENANCE AND TESTING

SMT 1 MAINTENANCE REQUIREMENTS

DNO shall establish and follow maintenance and testing procedures to maintain the apparatus, equipment sub-stations and lines in a functioning condition to be operatable at its rated capacity at all times and ensure that the same can be connected to Distribution System in a safe and reliable manner.

Necessary maintenance schedules shall be developed for equipment maintenance and preventive maintenance. The established schedules shall be in compliance with good industry practices and as per recommendations of the manufacturers.

The need to maintain appropriate level of the maintenance schedule is necessitated to meet the licence obligations of the DNO and comply with NEPRA prescribed Performance Standards (Distribution)-Regulations.

The DNO shall provide means of appropriate communications such as radio, mobile phone, wireless etc. and transport facility for maintenance crew.

Maintenance of the inter-DNO Distribution Voltage lines shall be the responsibility of the DNO mostly exporting power to other DNO's distribution and transmission system.

The DNO must notify the System Operator of any required maintenance activities and the System Operator will schedule an outage for the necessary maintenance activities to be performed.

Any operation and maintenance of the interconnecting facilities and substation equipment must be authorized and coordinated with the System Operator. Maintenance of the interconnecting facility and maintenance and operation of lines and sub-station serving more than one DNO which shall be coordinated by the System Operator.

SMT 1.1 Binding Obligations

The DNO shall ensure that proper tools and spares are available at all workplaces for carrying out maintenance and testing.

There shall be a national training centre for imparting training to DNO's workmen corresponding to the following categories/aspects.

a. Maintenance Strategies

b. On-line testing and preventive maintenance where applicable.

c. Off-line testing and preventive maintenance where applicable.

d. Testing and Maintenance of Grid Station equipment, and use of T&P.

e. Construction of Distribution Voltage lines and installation of distributiontransformers

f. Safety

The training shall incorporate but not limited to the following procedures and techniques.

a. Lines

- 132kV line feeding the DISCOs should be looked after by the DISCO to the fed by the line.

b. Grid Stations

- Operating mechanism of different types of circuit breakers i.e. (ACB, VCB and OCB)
- Testing of circuit breakers with respect to contact resistance, opening/closing timings, oil testing, insulation testing of vacuum interrupter in case of VCB.
- Testing of the power transformers current transformers with respect to capacitance and dissipation factor (C & DF), oil testing.
- Grid station battery operation and maintenance with respect to specific gravity, voltage, float charge volt/cell, boost charge volt/cell, end of discharge voltage cell at 10 Hrs. rate.
- Procedure and use of different types of protective relays, used on transmission lines and grid stations.
- Distribution Transformers
    - Oil Dielectric Testing
    - Insulation Testing
    - These should be done at least every five years.
- Maintenance and testing of Smart meters or related devices.

c. Construction

- Distribution transformer installation.
- Consumer's overhead and underground service connection.
- Installation and connection of different types of energy meters.
- Grounding of electrical equipment.
- Construction techniques including;
    (i) Use of shovel and auger for pit digging
    (ii) Use of rollers on every pole for stringing of conductor
    (iii) Use of sag charts for proper sag
    (iv) Fixing of stay wire to the pole
    (v) Erection and foundation of pole/structure
    (vi) Fixing of hardware to the pole/structure

d. Use of Testing Equipment and Tools

Procedure and use of different types of testing equipment and tools used in the maintenance of the system.

e. Safety

Awareness and implementation of safety code management.

SMT 2 MAINTENANCE STRATEGIES

To properly discharge its responsibilities in respect of safe, reliable, and economic operation of the Distribution System and in accordance with its licence provisions, the DNO shall develop, organize, and carry out monitoring, testing, and investigation of the effect of Users electrical apparatus or electrical installation on the distribution system.

The User shall install the necessary protection equipment at the point of connection, as advised by the DNO at the time of connection.

SMT 3 ON-LINE TESTING AND PREVENTATIVE MAINTENANCE

Responsibilities and procedures for arranging and carrying out System Tests, which may have an effect on other Transmission and Distribution Systems, have been laid down in DOC 8, which should be strictly followed where applicable.

SMT 4 OFFLINE PREVENTIVE MAINTENANCE AND TESTING

The DNO shall arrange off-line preventative maintenance and testing of its system. An annual plan of maintenance and testing including lines and sub-stations shall be prepared by the DNO which should further be broken down into monthly schedules. The plan should layout the procedures and schedules for lines, and sub-stations which must cover the following points: -

a. the procedure and schedule of patrolling the transmission and distribution lines, patrolling of lines should be applicable for above 11kV network;

b. preparation and submission of patrolling reports by the field staff;

c. the points which need to be noted during patrolling of lines at 33kV and above;

d. scheduling shut-down to attend the major problems, if any encountered during the patrolling report;

e. in case of sub-station the schedule of maintenance and testing should be prepared on the basis of manufacturer's recommendation for different equipment which may be on daily basis, monthly basis, half yearly basis, yearly basis and five yearly basis;

f. the detail of maintenance and testing which is required to be carried out on each equipment should be prescribed with schedule;

g. oil dielectric tests for transformers, breakers and other oil filled distribution apparatus;

h. test equipment to perform insulation resistance tests, C & DF test, voltage withstand tests opening/closing timings of the breakers, contact resistance of the breakers etc. should be arranged and provided;

i. earthing test equipment and meggers shall be provided for field testing

of earthing systems at substations, structures, poles, distribution transformers, and at Consumer connections; and

j. cleaning/washing of insulators on the lines and sub-stations, especially in polluted area.

SMT 4.1 Listing Tools, SPEs and PPEs

The plan should also prescribe the list of required standard testing equipment and tools which are to be used by the DNO during maintenance, and breakdowns.

End of SMT

SAFETY REQUIREMENTS

CONTENTS

SAFETY REQUIREMENTS

SR 1 INTRODUCTION

The DNO shall abide by the Safety Requirements of NEPRA HSE Code for Licensees, 2021". (Currently Draft 2nd Edition published). This code presents safety instructions for the electrical works concerningconstruction, installation, operation and maintenance of electric supply lines and grid station facilities. The DNO shall also abide by the Safety requirements as per NEPRA Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997), and safety standards established in the Distribution Service Manual, Consumer Eligibility Criteria andDistribution Performance Standards Rules.

SR 2 OBJECTIVES

To lay down the safety management criteria to be applied to ensure safety of persons working on the Distribution System and at or across operational and Ownership Boundaries, general public and animals.

SR 3 SCOPE

Each DNO shall develop its Safety Manual in accordance with the requirements of the NEPRA HSE Code for Licensees, 2021". (Currently Draft 2nd Edition published).

Similar Criteria and Standards of Safety Management Systems shall be provided by other Users of the Distribution System and approved by the DNO when carrying out work or tests at the operational interface with the DNO. If these are not provided the DNO standards shall apply.

SR 4 SAFETY MANAGEMENT CRITERIA

a. All distribution facilities of a DNO shall be constructed, operated, controlled, and maintained in a manner consistent with the Distribution Code, "NEPRA HSE Code for Licensees, 2021" Code, Distribution Service Manual, Performance Standards (Distribution) Rules, 2005 and other applicable documents.

b. A DNO shall ensure that its distribution facilities do not cause any leakage of Electrical Current or Step Potential beyond a level that can cause harm to human life, as laid down in the relevant IEEE/IEC Standards; prevent accessibility of live conductors or equipment; and prevent development of a situation due to breakdown of equipment which results in voltage or leakage current that can cause harm to human life, property and general public including without limitation, employees and property of the DNO.

c. A DNO shall implement suitable, necessary, and appropriate rules, regulations and working practices, as outlined in its Distribution Code or applicable documents, to ensure the safety of its staff and members of the public. This shall also include suitable training for familiarity and understanding of the rules, regulations, practices, and training to use any special equipment that may be required for such purposes including without limitation basic first aid training.

The Safety Management criteria that apply to the DNO and the followingUsers of the Distribution System:

a. Embedded Generators.

b. Bulk Power Consumers

c. Other DNOs

d. SHYDO

e. Any other party reasonably specified by the DNO including Users connected at Distribution Voltages for appropriate sections when necessary.

f. Agents of the DNO or Users working on the Distribution System or at or across operational boundaries.

SR 5 PROCEDURES

The Safety Manual will present the principles, guidelines, and procedures (Safety Management System) for ensuring safety of all relevant personnel of the DNO and Users for work on their respective Systems or Plant or Apparatus connected to them.

There shall be joint agreement by the DNO and Users on which Safety Management System is to be used for sites or locations where an Operational Boundary exists and proper documentation of the safety precautions to be taken shall be maintained.

There shall be written authorization of personnel who do the work of control, operation, work or testing of Plant or Apparatus forming part of or connected to the Distribution System of the DNO.

There shall be joint agreement between the DNO and Users which specifies responsibility for system or control equipment which shall ensure that only one party is responsible for any item of plant or apparatus at any one time.

The DNO and each User shall at all times have nominated a person or persons responsible for the co-ordination of safety on the respective systems.

The DNO and each User shall maintain a suitable system of documentation which records all relevant operational events that have taken place on the Distribution System or other System connected to it and the co- ordination of relevant safety precautions for work.

System diagrams which show sufficient information for control personnel to carry out their duties shall be exchanged between the DNO and User as required.

SR 6 SAFETY AT THE DNO / USER INTERFACE

The following procedure set down the basic safety requirements at the operator and the DNO interfaces. These procedures are necessary to ensure the safety of all who may have to work at either side of the interface oron the interface (boundary).

a. Written Rules for Safe Working and Communicating Procedures shall be available and used by all persons who may have to work at or use the facilities provided at the Interface.

b. Electrical equipment at the interface points of the DNO shall only be controlled by designated authorized person of the DNO or other DNO/the System Operator/User.

c. Each item of equipment shall be controlled by only one identifiable

person at any one time.

d. Adequate means of isolation shall be provided at the interface to allow work to be carried out safely at either side of the interface.

e. Where necessary to prevent danger adequate facilities for earthing shall be provided at either side of the interface to allow work to be carried out safely at the interface or at either side of the interface.

f. Adequate working space, adequate means of access where necessary, adequate lighting shall be provided at all electrical equipment on or near which work is being done in circumstances, which may cause danger.

g. All electrical equipment shall be suitably identified and tagged where necessary to prevent danger.

h. Electrical installations and equipment shall comply with the relevant requirements as set down in the Power Safety Code.

i. safety protocols to be followed while working at height.

j. Communication plan to be established to avoid incorrect / inadequate information and to communicate right and clear information to right people at right time to control and monitor operational and HSE critical activities.

k. Risk assessment of each activity to be conducted to reduce risk to as low as reasonably practicable.

l. Personal protective equipment (PPE) shall be provided in accordance to Hazard/Risk category to provide protection.

m. Permit to work system to be adopted while carrying out maintenance activities.

n. Minimum safety requirement for scaffolds to be followed.

o. Entry of unauthorized visitor and vehicle to the restricted/operational area to be controlled.

SR 7 PUBLIC AND PROPERTY SAFEGUARD

The DNO shall make every effort to protect the public at all times when work is in progress by the use of signs, barricades, or personal warnings in thefollowing cases:

a. When work is conducted along public streets or highways, pedestrian and vehicular traffic shall be warned in compliance with applicable standards.

b. Where necessary, open manholes, ditches and excavations shall be barricaded or be substantially covered to prevent pedestrians, animals, or vehicles from falling into them.

c. During the night and in all dark locations, lights or torches should be in place at any obstruction, excavation or opening which is likely to cause injury to workers or public.

d. When working on Consumers' premises or public property, every effort shall be made by DNO staff to avoid hazards to Consumers or public and their property. Tools, excess material, and scrap shall be removed when the job is completed.

e. No DNO's employee shall smoke or use matches or open flames on

Consumers' premises unless it is positively known 'that such action does not conflict with the Consumers' rules, wishes and safety.

f. Walks, aisles, stairways, fire escapes and all other passageways shall be kept clear of all obstructions.

g. Any floor or wall opening shall be guarded with standard railings and toe boards. Other means of temporary protection may be used only with an observer present.

h. Tools and plant shall not be placed where they may cause tripping or stumbling hazards, or where they may fall and strike anyone below.

i. Adequate measures shall be taken as per hierarchy of controls to overcome slipping hazards,which may exist.

j. Nails in boards, such as those removed from scaffolds, forms and packing boxes shall be removed. The boards shall be carefully stacked or stored.

k. Nails that have been driven into barrels or tins to secure the head shall be removed when the head is removed.

l. Work areas and vehicles shall be neat and orderly at all times.

m. Separate dust bins shall be provided and used for broken glass, insulators, sheet metal scraps, used pressurized containers and other waste material for segregation of waste at source end.

n. HSE signs to be pasted at work areas & prominent locations as an administrative control to give awareness to staff & public regarding specific hazards.

o. Hierarchy of controls to be adopted to reduce risk at an ALARP level.

End of Safety Requirements

PUBLIC LIGHTING

CONTENT

PUBLIC LIGHTING

PL 1.1 The DNO shall provide distribution facilities for public lighting within its distribution territory. Maintenance/operation and replacement of lamps/fixtures shall be carried out by the DNO at mutually agreed terms and conditions with the relevant local body desirous of establishing a public lighting system.

PL 1.2 Construction of the public lighting in the territory of the DNO shall also be governed under a mutual agreement between the DNO and the relevant local body. Civic agencies to ensure intimation to DNO for such development in due time.

End of PL

EMERGENCY PLANS AND LOAD SHEDDING

CONTENTS

EMERGENCY PLAN AND LOAD SHEDDING

General Comments

It is important to lay down the principles and priorities of load shedding and detailed procedures as to how the load shedding shall be carried by the DNO under the instructions of the System Operator. This section needs to be consistent with Performance Standards (Distribution), Grid Code, and TransmissionPerformance Standards.

The Network Load Management actions should treat all Consumers equally independent of who supplies them. Where Commercial Load Management is in place it should always be preferred, noting that large Consumers are more likely to be interested in delivering this service and would often have an independent supplier.

EPL 1 BREAKDOWNS AND EMERGENCY PROCEDURES

The DNO shall formulate necessary procedures and guidelines for emergency response plans and restoration procedures in coordination with relevant organizations and its Users for compliance purposes. These procedures shall be tested /checked at specified periods.

The principals and procedures are required to be laid down by DNO consistent with the relevant provisions of the Grid Code and Distribution Code and Performance Standards (Distribution) as to how to restore and maintain power supply to its Consumers in an efficient and prompt manner under emergency and breakdown system conditions.

As far as practicable, the DNO shall provide separate circuits for Urban Supply (Non-Industrial) and Rural Supply and shall so arrange the feeder/loads in such a manner so as to create discrete load blocks to facilitate load management during emergency operations.

EPL 2 LOAD SHEDDING

A DNO shall have plans and schedules available to shed up to a maximum of 30% of its connected load at any time upon instruction from the System Operator. However, the amount of load that may be shed by the DNO under particular emergency system conditions shall be equal to its allocation, as determined by the System Operator, based on the DNO's peak load in relation to the Total System Peak Load of the System Operator. This 30% load must be made up from separate blocks of switchable load, which can be immediately either automatically or manually disconnected in turn at the instruction from the System Operator. A DNO shall provide copies of these plans to the System Operator as per the requirements of Performance Standards (Distribution).

Wherever possible the System Operator shall give DNO advance warning of impending need for load shedding to maintain system voltage and/or frequency in accordance with the Grid Code.

As per the provisions of the Grid Code, and Performance Standards (Distribution) the System Operator shall maintain an overview and as required instruct each DNO the quantum of load to be disconnected and the time of such disconnection. This instruction shall be given in clear, unambiguous terms and related to prepared plans.

When instructed by the System Operator, the distribution companies shall

shed the load in the following order:

a. Supply to Consumers in rural areas; and residential Consumers inurban areas where separate feeders exist.

b. Supply to Consumers, other than industrial, in urban areas.

c. Supply to agriculture Consumers where there is a dedicated powersupply.

d. Supply to industrial Consumers.

e. Supply to schools and hospitals.

f. Supply to defence/strategic installations.

A DNO shall prepare schedules of load disconnection, which demonstratethis priority order, and which rotate load disconnection within the above groupsin a non-discriminatory manner. The principle of proportionality shall be kept in mind so as not to excessively burden a particular Consumer class.

EPL 3 DNO'S OBLIGATIONS

The DNO shall establish procedures for restoring the supply after emergency breakdowns consistent with Grid and Distribution Code.

DNO shall interact with the System Operator, in case of black start and shall follow the System Operator instructions for restoration of supply.

Each DNO shall abide by the requirements of the system restoration plan prepared by the System Operator and shall ensure that its personnel are familiar with and are trained and experienced in their standing instructions and obligations to implement the required emergency restorations procedure.

The power supply in a post emergency state is to be restored under the instructions of the System Operator in reverse sequence that outlined in the clause 7 of the Performance Standards (Distribution) approved by NEPRA.

End of EPL

PROVISION OF INFORMATION

CONTENTS

PROVISION OF INFORMATION

PI 1 PROVISION OF INFORMATION

The DNO shall fulfil requirements related to but not limited to the following:

a. DNO’s obligation to provide information on quality and tests made or and when required by Consumer.

b. DNO’s obligation in providing technical information

PI 2 DNO'S OBLIGATIONS

DNO shall provide all necessary information to NEPRA as required under current regulations and legislation.

PI 2.1 As a requirement of Distribution Licensing Rules - 1999 and the distribution licence developed under such rules a DNO must provide a summary of the DNO's and Consumers' rights and obligations in the form of Distribution Service Manual and make such available to each of its Consumer:

a. at the time the Consumer is connected;

b. on request; at least once every two years.

PI 2.2 When requested by a Consumer, the DNO must:

a. provide information on the reliability or quality of supply provided to that Consumer as per the requirements of Performance Standards (Distribution); and

b. provide a copy of the NEPRA Performance Standards (Distribution) to the Consumer.

PI 3 ANNUAL SYSTEM PERFORMANCE REPORT

Each DNO shall submit each year annual performance report of its distribution and transmission system network as requiredunder clause 11 of the Performance Standards (Distribution)-Rules approved by the Authority.

PI 4 CONFIDENTIALITY

A DNO must use all reasonable endeavours to keep confidential any confidential information which comes into the possession or control of the DNO or of which the DNO become aware of.

PI 5 NEW MARKET - CTBCM

The provision of information to the New Market should cover at least:

1) Registration of each CDP with a Supplier.

2) Hence registration of the CDP meter(s) with that Supplier.

3) Commercial metered energy data from CDPs.

4) Commercial metered energy data from generators connected directly to its network.

5) Capacity contribution of each generator connected directly to its network.

6) Distribution loss factor for each BPC CDP and generator CDP.

End of PI

DISTRIBUTION CODE

DISTRIBUTION DATA REGISTRATION CODE

CONTENTS

DISTRIBUTION DATA REGISTRATION CODE

DDRC 1 INTRODUCTION, OBJECTIVE & SCOPE

DDRC 1.1 The various sections of the Distribution Code require Users to submit data to the DNO.

DDRC 1.2 The Distribution Data Registration Code ("DDRC") provides a set of schedules summarising 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.

DDRC 1.3 The DDRC 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 DDRC.

DDRC 1.4 In the case of a Generator seeking a connection to the DNO's System then discussions on connection shall be with the DNO concerned with the connection.

DDRC 1.5 The Users to which this DDRC applies are;

a. All the DNOs of NEPRA

b. NGC

c. Embedded Generators

d. SHYDO

e. BPCs

f. SPPs

g. AJK

h. Any other entity connected to the distribution network of DNOs as appropriate.

DDRC 2 DATA CATEGORIES

DDRC 2.1 The data required by the DNO is divided into two categories, System Planning Data ("SPD") and Operational Data ("OD").

DDRC 2.2 In order to assess the implications for making a connection the DNO shall require SPD and OD information, the precise requirements being decided by the DNO and dependent upon circumstances. Following an agreement to connect and not less than 6 weeks before the proposed date of connection the User must supply data as requested by the DNO, which shall be referred to as Registered Data.

DDRC 3 PROCEDURES AND RESPONSIBILITIES

DDRC 3.1 Unless otherwise specified or agreed by the DNO each User is required to submit data as defined in DDRC 4.7 below and the attached schedules.

DDRC 3.2 It is a requirement of the DDRC that data changes are advised as soon as practicable to the DNO and in any case reviewed annually to ensure continued

accuracy or relevance. The DNO shall initiate this review in writing and the User shall respond in writing.

DDRC 3.3 Where possible data shall be submitted on standard forms forwarded to the User by the DNO.

DDRC 3.4 If a User wishes to change any data item, then this must first be discussed with the DNO concerned in order for the implications to be considered and the change if agreed (such agreement not to be unreasonably withheld), be confirmed by the submission of a revised data form or by verbal means with confirmation by telex or similar if short timescales are involved.

DDRC 3.5 From time to time the DNO may change its data requirements, appropriate Users shall be advised of these changes as they occur and shall be provided with a reasonable timescale by which to reply.

DDRC 3.6 Users and Distribution Companies are obliged to supply data as set out in the individual sub codes of the Distribution Code and repeated in the DDRC. If a User fails to supply data when required by any sub-code of the Distribution Code, DNO concerned shall make an estimation of such data if and when in the DNO's view it is necessary to do so. If DNO fails to supply data when required by any sub-code of the Distribution Code, the User to whom that data ought to have been supplied shall estimate of such data if and when, in that User's view it is necessary to do so. Such estimates shall, in each case, be based upon data supplied previously for the same facility or upon such other information as DNO or that User, as the case may be, deems appropriate.

DDRC 3.6.1 DNO shall advise a User in writing of any estimated data it intends to use pursuant to DDRC 3.6 relating directly to that User's facility in the event of data not being supplied.

DDRC 3.6.2 Where estimation by the DNO or the User occurs the DCRP shall be informed.

DDRC 3.6.3 A User shall advise DNO in writing of any estimated data it intends to use pursuant to DDRC 3.6 in the event of data not being supplied.

DDRC 3.6.4 In the event the required data is not supplied or is incomplete or in-accurate by the User, the DNO shall refer the matter to the "Review Panel" which shall issue necessary instructions to the defaulted party in writing.

Failure to obtain/supply the required data within the specified timeframe from/by the defaulted party, the DNO shall consider the matter as a violation of the Distribution Code provision. Suitable measures regarding Distribution code non-compliance are covered in CM 16 of this Distribution Code.

DDRC 4 DATA TO BE REGISTERED

Schedule 1	–	All generating units' technical data
Schedule 2	–	System design information comprising system technical data.
Schedule 3	–	Load characteristics - comprising the forecast data for load points indicating the maximum load, the equipment that comprises the load, and the harmonics content of the load.
Schedule 4-6	–	Load forecasts - as described in DOC 1

time varying output/generation forecast for the Users defined in the scope.

Schedule 7-10 – Operational planning as described in DOC 2 outage planning information.

Schedule 11 – Event information exchange as described in DOC 5

Schedule 12 – Annual Performance Data

Schedule 1 to Schedule 12 are attached as DDRC Schedule No. 1 to DDRC Schedule No. 12.

DDRC 4.1 The data applicable to each class of User is as follows:

Schedule Number	Title	Applicable to	Data Category
1	Generating Unit Data	♦ All Generators including Embedded Generators ♦ Consumer with own generation	System Planning Data
2-3	System Design Information and Load Characteristics	♦ Embedded Generators ♦ Other DNO Connected to the DNO System ♦ BPC	System Planning Data
4-6	Load, and Generation Forecast	♦ All Generators ♦ other Distribution Companies Connected to the DNO System ♦ All Users have load of 1MW and above	Operational Data
7-10	Outage Data	♦ Embedded Generators ♦ All Users and all Consumers havinga connection load of 1MW and above	Operational Data
11	Event Information Exchange	♦ All Generators ♦ DNOs ♦	Operational Data
		♦ AJK Own generating Consumers who are partly supplying to DNOs	
12	Annual Performance Data	♦ All DNOs	Operational Data

End of DDRC

SCHEDULE AND APPENDIX

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DISTRIBUTION CODE

DDRC	**Schedule No. 3** LOAD CHARACTERISTICS	S&A-172
DDRC	**Schedule No. 4** Forecast information (8 weeks to 1 year ahead inclusive)	S&A-173
DDRC	**Schedule No. 5** OPERATIONAL PLANNING PROGRAMMING PHASE (24 hours to 8 weeks ahead inclusive)	S&A-174
DDRC	**Schedule No. 6** OPERATIONAL PLANNING CONTROL PHASE (0 to 24 hours ahead)	S&A-175
DDRC	**Schedule No. 7** OUTAGE PLANNING OPERATIONAL PLANNING PHASE MEDIUM TERM PROGRAMME	S&A-176
DDRC	**Schedule No. 8** OUTAGE PLANNING OPERATIONAL PLANNING PHASE SHORT TERM PROGRAMME	S&A-177
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DOC-1
APPENDIX-1

LOAD FORECASTS – OPERATIONAL PLANNING PHASE
(8 weeks to 1 year ahead inclusive)

Forecast information for each of the next 1 year of:

(a) Date and Time of Annual the System Operator System Maximum and Minimum Power Demand as notified by the System Operator.

(b) Hourly Maximum and Minimum Annual Power usage of DNO with reference to Maximum and Minimum System Operator System demand at a specified date and time at each transmission connection point.

(c) Annual energy Forecast load at annual average conditions of all the different categories of Consumers connected to the DNO's system.

(d) Maximum generation output in MW by all the embedded generating plants at a specified date and time of annual Peak Hours on the System Operator's system.

Where reference is made to ‘specified’ or ‘the System Operator Demand’, the information shall be provided by the DNO following the receipt of information provided by the System Operator in accordance with OC2 of the Grid Code.

DOC-1
APPENDIX-2

LOAD FORECASTS – PROGRAMMING PHASE
(24 hours to 8 weeks ahead inclusive)

The following information shall be provided to the DNO in the time scales specified in DOC1:

(a) Hourly operational schedule of each Embedded Generator whose output is more than 1 MW.

(b) All the Bulk Power Consumers and other distribution companies connected to the DNO's system shall intimate to the DNO the specific date and time where the aggregate change in their load due to their operation is expected to be more than 1 MW.

(c) Any other relevant Load forecast information reasonably required by the DNO.

DOC-1
APPENDIX-3

LOAD FORECASTS – CONTROL PHASE
(0 to 24 hours ahead)

The following information shall be supplied to the DNO at reasonable times to be specified by the DNO for the un-expired period covered by the Control Phase.

(a) Intimation by all the embedded generating plants to the licencein case the difference of their hourly output is more than 1 MW as compared to their schedule of generation already notified under DOC 1.3.3.3.

(a) Intimation by all the Bulk Power Consumer to the DNO the detail of changes in the load if such changes are more than1 MW.

DOC-2
APPENDIX-1

OUTAGE PLANNING

OPERATIONAL PLANNING PHASE

MEDIUM TERM PROGRAMME – Calendar Year – 1 – 2 Year ahead

This appendix should be completed by DNO in consultation with Users and Embedded Generators (not subject to central dispatch)

DOC-2
APPENDIX-2

OUTAGE PLANNING

OPERATIONAL PLANNING PHASE

SHORT TERM PROGRAMME – Current Calendar year down to Programming Phase (8 Weeks)

This appendix should be completed by DNO in consultation with Users and Embedded Generators (not subject to central dispatch)

DOC-5
APPENDIX-I

MATTERS, IF APPLICABLE TO THE SIGNIFICANT INCIDENT, TO BE INCLUDED IN A WRITTEN REPORT GIVEN IN ACCORDANCE WITH DOC 5.2.2

Applicable to DNO and Embedded Generator

1 Time and date of Significant Incident;
2 Location;
3 Facility involved;
4 Brief description of the Significant Incident; and
5 Details of any Demand Control undertaken.

Applicable to DNO:

(a) duration of incident and corrective actions taken;
(b) estimated date and time of return to normal service.

Applicable to Embedded Generator:

6 Effect on generation including, where appropriate:
(a) MW of generation interrupted;
(b) frequency response achieved;
(c) MVAr performance achieved;
(d) estimated date and time of return to normal service; and
(e) Withstand capabilities limits and other technical and performance requirement achieved during the event as per G Code and Distribution Code.

DPC
APPENDIX-I

SHUNT CAPACITOR INSTALLATION
(Useful Formulae)

1. CAPACITOR REQUIRED

KVAR = KVA1 (Sin ∅1 – [Cos ∅ 1 / Cos ∅ 2] Sin ∅ 2)

Where KVAR is: Amount of capacitance to be added to improve the Power Factor from Cos ∅1 to Cos ∅2.

KVA1 is: Original kVA.

2. OPTIMUM LOCATION OF CAPACITORS

L = [1– (KVARC / 2 KVARL) x (2n–1)]

Where,

L	=	distance in per unit along the line from sub-station
KVARC	=	Size of capacitor bank
KVARL	=	KVAR loading of line
n	=	relative position of capacitor bank along the feeder from sub-station if the total capacitance is to be divided into more than one Bank along the line. If all capacitance is put in one Bank, then values of n=1.

3. VOLTAGE RISE DUE TO CAPACITOR INSTALLATION

% Rise = (KVARC.X) / 10V2

Where,

X = Reactance per phase
V = Phase to phase voltage in kilovolts

DDC
APPENDIX-1

KVA-KM LOADING
(Sample Calculations)

1. CONDUCTOR DATA

Conductor Size …… (6/3.35mm+1/3.35mm)

ACSR Gross Area of Aluminium.....52.95mm2

Copper Equivalent.....32.26mm2

Resistance in Ω per KM (at 20°C).....0.5449*

Inductive reactance at 50 Hz in Ω per KM. 0.421*
(For equivalent spacing of 1000mm)

* Appropriate values may be taken for any other temperature and equivalent spacing.

2. ASSUMPTIONS

Length of Line …… 1 KM

kVA Loading …….. 1000 kVA

3 Phase Voltage …… 11,000 V

3. REGULATION

Percent Regulation (approx.) = {I (R Cos ∅ + X sine ∅)/E}x100

Where

I = Current per phase in amp
R = Resistance per phase in ΩX = Reactance per phase in Ω Cos ∅ = Power Factor
E = Phase-Neutral voltage in volts

$$\text{Percent Regulation} = \left\{ \frac{\mathbf{416.2 \times (0.5449 \times 0.8 + 0.421 \times 0.60}}{\mathbf{6451}} \right\} \mathbf{\times 100 = 4.44\%}$$

For 1% Voltage Regulation the KVA-KM loading for the selected conductor size at **0.8** PF will be 1912 KVA-KM. For any other Power Factor, voltage, and conductor temperature the Voltage Regulation may be calculated by substituting appropriate values of current, Resistance Cos ∅ and Sine ∅ in the formula.

DISTRIBUTION CODE

PR

APPENDIX-I

Publications found with ICS code:
29.060.01 Electrical wires and cables in general

29.060.01 IEC 60344 (1980-01)
Guide to the calculation of resistance of plain and coated copper conductors of low-frequency cables and wires

29.060.01 IEC 60364-5-52 (1998-11) Ed. 1.1 Consolidated Edition
Electrical installations of buildings - Part 5: Selection and erection of electrical equipment - Chapter 52: Wiring systems

29.060.01 IEC 60364-5-523 (1999-02)
Electrical installations of buildings - Part 5: Selection and erection of electrical equipment - Section 523: Current-carrying capacities in wiring systems

29.060.01 IEC 61084-1 (1991-07)
Cable trunking and ducting systems for electrical installations - Part 1: General requirements

29.060.01 IEC 61084-1-am1 (1993-10)
Amendment No. 1

29.060.01 IEC/TR2 61200-52 (1993-03)
Electrical installation guide - Part 52: Selection and erection of electrical equipment - Wiring systems

Publications found with ICS code:
29.120.50 Fuses and other overcurrent protection devices

29.120.50 IEC 60050-441 (1984-01)
International Electrotechnical Vocabulary. Switchgear, controlgear and fuses

29.120.50 IEC 60050-441-am1 (2000-07)
Amendment 1

29.120.50 IEC 60050-448 (1995-12)
International Electrotechnical Vocabulary - Chapter 448: Power system protection

29.120.50 IEC 60099-1 (1999-12) Ed. 3.1 Consolidated Edition
Surge arresters - Part 1: Non-linear resistor type gapped surge arresters for a.c. systems

29.120.50 IEC 60099-4 (1998-08) Ed. 1.1 Consolidated Edition
Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems

29.120.50 IEC 60099-5 (2000-03) Ed. 1.1 Consolidated Edition
Surge arresters - Part 5: Selection and application recommendations

DISTRIBUTION CODE

29.120.50 IEC 60127-4 (1996-08)
Miniatures fuses - Part 4: Universal Modular Fuse-Links (UMF)

29.120.50 IEC 60255-6 (1988-12)
Electrical relays - Part 6: Measuring relays and protection equipment

29.120.50 IEC/TR 60255-20 (1984-01)
Electrical relays. Part 20: Protection (protective) systems

29.120.50 IEC 60269-2 (1986-09)
Low-voltage fuses. Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)

29.120.50 IEC 60269-2-1 (2000-03) Ed. 3.1 Consolidated Edition
Low-voltage fuses - Part 2-1: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) - Sections I to V: Examples of types of standardized fuses

29.120.50 IEC 60269-3 (1987-06)
Low-voltage fuses. Part 3: Supplementary requirements for fuses for use by unskilledpersons (fuses mainly for household and similar applications)

29.120.50 IEC 60282-1 (1994-12)
High-voltage fuses - Part 1: Current-limiting fuses

29.120.50 IEC 60282-1 (1998-01) Ed. 4.2 Consolidated Edition
High-voltage fuses - Part 1: Current-limiting fuses

29.120.50 IEC 60282-2 (1997-12) Ed. 2.1 Consolidated Edition
High-voltage fuses - Part 2: Expulsion fuses

29.120.50 IEC 60282-3 (1976-01)
High-voltage fuses. Part 3: Determination of short-circuit power factor for testing current-limiting fuses and expulsion and similar fuses

29.120.50 IEC 60291 (1969-01)
Fuse definitions

29.120.50 IEC 60364-4-42 (1980-01)
Electrical installations of buildings. Part 4: Protection for safety. Chapter 42: Protection against thermal effects

29.120.50 IEC 60364-4-43 (1977-01)
Electrical installations of buildings. Part 4: Protection for safety. Chapter 43: Protection against overcurrent

29.120.50 IEC 60364-4-45 (1984-12)
Electrical installations of buildings. Part 4: Protection for safety. Chapter 45: Protection against undervoltage

29.120.50 IEC 60364-4-46 (1981-01)
Electrical installations of buildings. Part 4: Protection for safety. Chapter 46: Isolation and switching

DISTRIBUTION CODE

29.120.50 IEC 60364-4-473 (1999-03) Ed. 1.1 Consolidated Edition
Electrical installations of buildings - Part 4: Protection for safety - Chapter 47: Application of protective measures for safety - Section 473: Measures of protection against overcurrent

29.120.50 IEC 60549 (1976-01)
High-voltage fuses for the external protection of shunt power capacitors

29.120.50 IEC 60644 (1979-01)
Specification for high-voltage fuse-links for motor circuit applications

29.120.50 IEC/TR 60755 (1983-01)
General requirements for residual current operated protective devices

29.120.50 IEC 60787 (1983-01)
Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit application

29.120.50 IEC 60931-3 (1996-08)
Shunt capacitors of the non-self-healing type for AC power systems having a rated voltage up to and including 1000 V - Part 3: Internal fuses

29.120.50 IEC 60934 (2000-10)
Circuit-breakers for equipment (CBE)

29.120.50 IEC/TR3 61459 (1996-08)
Coordination between fuses and contactors/motor-starters - Application guide

Publications found with ICS code:
29.120.70 Relays

29.120.70 IEC 60050-446 (1983-01)
International Electrotechnical Vocabulary. Electrical relays

29.120.70 IEC 60255-3 (1989-06)
Electrical relays - Part 3: Single input energizing quantity measuring relays with dependent or independent time

29.120.70 IEC 60255-5 (2000-12)
Electrical Relays - Part 5: Insulation coordination for measuring relays and protection equipment - Requirements and tests

29.120.70 IEC 60255-6 (1988-12)
Electrical relays - Part 6: Measuring relays and protection equipment

29.120.70 IEC 60255-8 (1990-10)
Electrical relays - Part 8: Thermal electrical relays

29.120.70 IEC 60255-9 (1979-01)
Electrical relays. Part 9: Dry reed make contact units

29.120.70 IEC 60255-11 (1979-01)
Electrical relays - Part 11: Interruptions to and alternating component (ripple) in d.c. auxiliary energizing quantity of measuring relays

DISTRIBUTION CODE

29.120.70 IEC 60255-12 (1980-01)
Electrical relays - Part 12: Directional relays and power relays with two input energizing quantities

29.120.70 IEC 60255-13 (1980-01)
Electrical relays - Part 13: Biased (percentage) differential relays

29.120.70 IEC 60255-14 (1981-01)
Electrical relays. Part 14: Endurance tests for electrical relay contacts - Preferred values for contact loads

29.120.70 IEC 60255-15 (1981-01)
Electrical relays. Part 15: Endurance tests for electrical relay contacts - Specification for the characteristics of test equipment

29.120.70 IEC 60255-16 (1982-01)
Electrical relays - Part 16: Impedance measuring relays

29.120.70 IEC 60255-19 (1983-01)
Electrical relays. Part 19: Sectional specification: Electromechanical all-or-nothing relays of assessed quality

29.120.70 IEC 60255-19-1 (1983-01)
Electrical relays. Part 19: Blank detail specification: Electromechanical all-or-nothing relays of assessed quality - Test schedules 1, 2 and 3

29.120.70 IEC/TR 60255-20 (1984-01)
Electrical relays. Part 20: Protection (protective) systems

29.120.70 IEC 60255-21-1 (1988-09)
Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section One: Vibration tests (sinusoidal)

29.120.70 IEC 60255-21-2 (1988-10)
Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section Two: Shock and bump tests

29.120.70 IEC 60255-21-3 (1993-09)
Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section 3: Seismic tests

29.120.70 IEC 60255-22-1 (1988-05)
Electrical relays - Part 22: Electrical disturbance tests for measuring relays and protection equipment - Part 1: 1 MHz burst disturbance tests

29.120.70 IEC 60255-22-2 (1996-09)
Electrical relays - Part 22: Electrical disturbance tests for measuring relays and protection equipment - Section 2: Electrostatic discharge tests

29.120.70 IEC 60255-22-3 (2000-07)
Electrical relays - Part 22-3: Electrical disturbance tests for measuring relays and protection equipment - Radiated electromagnetic field disturbance tests

DISTRIBUTION CODE

29.120.70 IEC 60255-22-4 (1992-03)
Electrical relays - Part 22: Electrical disturbance tests for measuring relays and protection equipment - Section 4: Fast transient disturbance test

29.120.70 IEC 60255-23 (1994-10)
Electrical relays - Part 23: Contact performance

29.120.70 IEC 60255-25 (2000-03)
Electrical relays - Part 25: Electromagnetic emission tests for measuring relays and protection equipment

29.120.70 IEC 61733-1 (1995-12)
Measuring relays and protection equipment - Protection communication interfacing - Part 1: General

29.120.70 IEC 61811-1 (1999-03)
Electromechanical non-specified time all-or-nothing relays of assessed quality - Part 1: Generic specification

29.120.70 IEC 61811-50 (1997-09)
Electromechanical all-or-nothing relays - Part 50: Sectional specification: Electromechanical all-or-nothing telecom relays of assessed quality

29.120.70 IEC 61811-51 (1997-10)
Electromechanical all-or-nothing relays - Part 51: Blank detail specification - Electromechanical all-or-nothing telecom relays of assessed quality - Non-standardized types and construction

29.120.70 IEC 61811-52 (1997-10)
Electromechanical all-or-nothing relays - Part 52: Blank detail specification - Electromechanical all-or-nothing telecom relays of assessed quality - Two change-over contacts, 20 mm x 10 mm base

29.120.70 IEC 61811-53 (1997-10)
Electromechanical all-or-nothing relays - Part 53: Blank detail specification - Electromechanical all-or-nothing telecom relays of assessed quality - Two change-over contacts, 14 mm x 9 mm base

29.120.70 IEC 61811-54 (1997-10)
Electromechanical all-or-nothing relays - Part 54: Blank detail specification - Electromechanical all-or-nothing telecom relays of assessed quality - Two change-over contacts, 15 mm x 7,5 mm base

29.120.70 IEC 61812-1 (1996-10)
Specified time relays for industrial use - Part 1: Requirements and tests

Publications found with ICS code:
29.130.10 High voltage switchgear and control gear

29.130.10 IEC 60056 (1987-03)
High-voltage alternating-current circuit-breakers

29.130.10 IEC 60129 (1984-01)

Alternating current disconnectors and earthing switches

29.130.10 IEC 60265-1 (1998-01)
High-voltage switches - Part 1: Switches for rated voltages above 1 kV and less than 52 kV

29.130.10 IEC 60265-2 (1988-03)
High-voltage switches. Part 2: High-voltage switches for rated voltages of 52 kV and above

29.130.10 IEC 60298 (1990-12)
A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

29.130.10 IEC 60420 (1990-10)
High-voltage alternating current switch-fuse combinations

29.130.10 IEC 60466 (1987-01)
A.C. insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 38 kV

29.130.10 IEC 60470 (2000-05)
High-voltage alternating current contactors and contactor-based motor-starters

29.130.10 IEC 60517 (1990-10)
Gas-insulated metal-enclosed switchgear for rated voltages of 72.5 kV and above

29.130.10 IEC/TR 60518 (1975-01)
Dimensional standardization of terminals for high-voltage switchgear and controlgear

29.130.10 IEC 60694 (1996-05)
Common specifications for high-voltage switchgear and controlgear standards

29.130.10 IEC/TS 60859 (1999-07)
Cable connections for gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above - Fluid-filled and extruded insulation cables - Fluid-filled and dry type cable-terminations

29.130.10 IEC/TR 60932 (1988-01)
Additional requirements for enclosed switchgear and controlgear from 1 kV to 72.5 kV to be used in severe climatic conditions

29.130.10 IEC 61128 (1992-02)
Alternating current disconnectors - Bus-transfer current switching by disconnectors

29.130.10 IEC 61129 (1992-02)
Alternating current earthing switches - Induced current switching

29.130.10 IEC 61166 (1993-04)
High-voltage alternating current circuit-breakers - Guide for seismic qualification of high-voltage alternating current circuit-breakers

29.130.10 IEC/TR2 61233 (1994-07)
High-voltage alternating current circuit-breakers - Inductive load switching

29.130.10 IEC 61259 (1994-04)

Gas-insulated metal-enclosed switchgear for rated voltages 72,5 kV and above - Requirements for switching of bus-charging currents by disconnectors

29.130.10 IEC 61330 (1995-12)
High-voltage/low voltage prefabricated substations

29.130.10 IEC/TR2 61633 (1995-04)
High-voltage alternating current circuit-breakers - Guide for short-circuit and switching test procedures for metal-enclosed and dead tank circuit-breakers

29.130.10 IEC/TR2 61634 (1995-05)
High-voltage switchgear and controlgear - Use and handling of sulphur hexafluoride (SF6) in high-voltage switchgear and controlgear

29.130.10 IEC/TR2 61639 (1996-12)
Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages of 72,5 kV and above

29.130.10 IEC/TR2 61640 (1998-07)
Rigid high-voltage, gas-insulated transmission lines for rated voltage of 72,5 kV and above

29.130.10 IEC 61958 (2000-11)
High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems

29.130.10 IEC/TR 62063 (1999-08)
High-voltage switchgear and controlgear - The use of electronic and associated technologies in auxiliary equipment of switchgear and controlgear

Publications found with ICS code:
29.130.20 Low voltage switchgear and controlgear

29.130.20 IEC 60439-1 (1999-09)
Low-voltage switchgear and controlgear assemblies - Part 1: Type-tested and partially type-tested assemblies

29.130.20 IEC 60439-2 (2000-03)
Low-voltage switchgear and controlgear assemblies - Part 2: Particular requirements for busbar trunking systems (busways)

29.130.20 IEC 60439-3 (1990-12)
Low-voltage switchgear and controlgear assemblies. Part 3: Particular requirements for low-voltage switchgear and controlgear assemblies intended to be installed in places where unskilled persons have access for their use - Distribution boards

29.130.20 IEC 60439-4 (1990-12)
Low-voltage switchgear and controlgear assemblies. Part 4: Particular requirements for assemblies for construction sites (ACS)

29.130.20 IEC 60439-4 (1999-07) Ed. 1.2 Consolidated Edition

Low-voltage switchgear and controlgear assemblies - Part 4: Particular requirements for assemblies for construction sites (ACS)

29.130.20 IEC 60439-5 (1998-10) Ed. 1.1 Consolidated Edition
Low-voltage switchgear and controlgear assemblies - Part 5: Particular requirements for assemblies intended to be installed outdoors in public places - Cable distribution cabinets (CDCs) for power distribution in networks

29.130.20 IEC 60715 (1981-01)
Dimensions of low-voltage switchgear and controlgear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations

29.130.20 IEC 60947-1 (2000-10) Ed. 3.1 Consolidated Edition
Low-voltage switchgear and controlgear - Part 1: General rules

29.130.20 IEC 60947-2 (1998-03) Ed. 2.1 Consolidated Edition
Low-voltage switchgear and controlgear - Part 2: Circuit-breakers

29.130.20 IEC 60947-3 (1999-01)
Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units

29.130.20 IEC 60947-4-1 (2000-11)
Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters

29.130.20 IEC 60947-4-2 (1999-12)
Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters - AC semiconductor motor controllers and starters

29.130.20 IEC 60947-4-3 (1999-09)
Low-voltage switchgear and controlgear - Part 4-3: Contactors and motor-starters - AC semiconductor controllers and contactors for non-motor loads

29.130.20 IEC 60947-5-1 (1997-10)
Low-voltage switchgear and controlgear. Part 5: Control circuit devices and switching elements - Section One: Electromechanical control circuit devices

29.130.20 IEC 60947-5-1 (2000-03) Ed. 2.2 Consolidated Edition
Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices

29.130.20 IEC 60947-6-1 (1989-07)
Low-voltage switchgear and controlgear. Part 6: Multiple function equipment - Section One: Automatic transfer switching equipment

29.130.20 IEC 60947-6-1 (1998-01) Ed. 1.2 Consolidated Edition
Low-voltage switchgear and controlgear - Part 6-1: Multiple function equipment - Automatic transfer switching equipment

29.130.20 IEC 60947-6-2 (1992-09)

Low-voltage switchgear and controlgear - Part 6: Multiple function equipment - Section 2: Control and protective switching devices (or equipment) (CPS)

29.130.20 IEC 60947-6-2 (1999-03) Ed. 1.2 Consolidated Edition
Low-voltage switchgear and controlgear - Part 6-2: Multiple function equipment - Control and protective switching devices (or equipment) (CPS)

29.130.20 IEC 60947-7-1 (1999-08) Ed. 1.1 Consolidated Edition
Low-voltage switchgear and controlgear - Part 7: Ancillary equipment - Section 1: Terminal blocks for copper conductors

29.130.20 IEC/TR3 61117 (1992-02)
A method for assessing the short-circuit withstand strength of partially type-tested assemblies (PTTA)

29.130.20 IEC/TR3 61641 (1996-01)
Enclosed low-voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to an internal fault

29.130.20 IEC 62026-1 (2000-07)
Low-voltage switchgear and controlgear - Controller-device interfaces (CDIs) - Part 1: General rules

29.130.20 IEC 62026-2 (2000-07)
Low-voltage switchgear and controlgear - Controller-device interfaces (CDIs) - Part 2: Actuator sensor interface (AS-i)

29.130.20 IEC 62026-3 (2000-07)
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29.130.20 IEC 62026-5 (2000-07)
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29.180 IEC 60044-2 (2000-11) Ed. 1.1 Consolidated Edition
Instrument transformers - Part 2: Inductive voltage transformers

29.180 IEC 60050-421 (1990-10)
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29.180 IEC 60076-1 (2000-04) Ed. 2.1 Consolidated Edition
Power transformers - Part 1: General

29.180 IEC 60076-2 (1993-04)
Power transformers - Part 2: Temperature rise

29.180 IEC 60076-3 (2000-03)
Power transformers - Part 3: Insulation levels, dielectric tests, and external clearances in air

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29.180 IEC 60076-5 (2000-07)
Power transformers - Part 5: Ability to withstand short circuit

29.180 IEC 60076-8 (1997-11)
Power transformers - Part 8: Application guide

29.180 IEC 60296 (1982-01)
Specification for unused mineral insulating oils for transformers and switchgear

29.180 IEC 60354 (1991-10)
Loading guide for oil-immersed power transformers

29.180 IEC 60542 (1976-01)
Application guide for on-load tap-changers

29.180 IEC 60551 (1987-12)
Determination of transformer and reactor sound levels

29.180 IEC 60599 (1999-03)
Mineral oil-impregnated electrical equipment in service - Guide to the interpretation of dissolved and free gases analysis

29.180 IEC/TR 60616 (1978-01)
Terminal and tapping markings for power transformers

29.180 IEC 60722 (1982-01)
Guide to the lightning impulse and switching impulse testing of power transformers and reactors

29.180 IEC 60726 (1982-01)
Dry-type power transformers

29.180 IEC 60905 (1987-12)
Loading guide for dry-type power transformers

29.180 IEC 61181 (1993-06)
Impregnated insulating materials - Application of dissolved gas analysis (DGA) to factory tests on electrical equipment

29.180 IEC 61203 (1992-12)
Synthetic organic esters for electrical purposes - Guide for maintenance of transformer esters in equipment

29.180 IEC 61378-1 (1997-09)
Convertor transformers - Part 1: Transformers for industrial applications

29.180 IEC 61378-2 (2001-02)
Converter transformers - Part 2: Transformers for HVDC applications

29.180 IEC 61558-1 (1998-07) Ed. 1.1 Consolidated Edition
Safety of power transformers, power supply units and similar - Part 1: General requirements and tests

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29.180 IEC 61558-2-1 (1997-03)
Safety of power transformers, power supply units and similar - Part 2: Particular requirementsfor separating transformers for general use

29.180 IEC 61558-2-2 (1997-10)
Safety of power transformers, power supply units and similar - Part 2-2: Particular requirements for control transformers

29.180 IEC 61558-2-3 (1999-10)
Safety of power transformers, power supply units and similar devices - Part 2-3: Particular requirements for ignition transformers for gas and oil burners

29.180 IEC 61558-2-4 (1997-03)
Safety of power transformers, power supply units and similar - Part 2: Particular requirements for isolating transformers for general use

29.180 IEC 61558-2-5 (1997-12)
Safety of power transformers, power supply units and similar - Part 2-5: Particular requirements for shaver transformers and shaver supply units

29.180 IEC 61558-2-6 (1997-03)
Safety of power transformers, power supply units and similar - Part 2: Particular requirements for safety isolating transformers for general use

29.180 IEC 61558-2-23 (2000-05)
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29.180 IEC 61596 (1995-05)
Magnetic oxide EP-cores and associated parts for use in inductors and transformers.

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29.240 IEC 60050-601 (1985-10)
International Electrotechnical Vocabulary. Chapter 601: Generation, transmission, and distribution of electricity - General

29.240 IEC 60050-602 (1983-01)
International Electrotechnical Vocabulary. Chapter 602: Generation, transmission, and distribution of electricity - Generation

29.240 IEC 60050-603 (1986-08)
International Electrotechnical Vocabulary. Chapter 603: Generation, transmission, and distribution of electricity - Power systems planning and management

29.240 IEC 60050-604 (1987-03)
International Electrotechnical Vocabulary. Chapter 604: Generation, transmission, and distribution of electricity - Operation

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29.240 IEC 60050-605 (1983-01)
International Electrotechnical Vocabulary. Chapter 605: Generation, transmission, and distribution of electricity - Substations

29.240.10 IEC 61643-1 (1998-02)
Surge protective devices connected to low-voltage power distribution systems - Part 1: Performance requirements and testing methods

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29.240.10 Substations. Surge arresters

29.240.10 IEC 60099-1 (1999-12) Ed. 3.1 Consolidated Edition
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29.240.10 IEC 60099-4 (1998-08) Ed. 1.1 Consolidated Edition
Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems

29.240.10 IEC 60099-5 (2000-03) Ed. 1.1 Consolidated Edition
Surge arresters - Part 5: Selection and application recommendations

29.240.10 IEC 61330 (1995-12)
High-voltage/low voltage prefabricated substations

29.240.10 IEC 61643-1 (1998-02)
Surge protective devices connected to low-voltage power distribution systems - Part 1: Performance requirements and testing methods

29.240.10 IEC 61643-21 (2000-09)
Low voltage surge protective devices - Part 21: Surge protective devices connected to telecommunications and signalling networks - Performance requirements and testing methods

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29.240.20 Power transmission and distribution lines

29.240.20 IEC 60050-466 (1990-10)
International Electrotechnical Vocabulary. Chapter 466: Overhead lines

29.240.20 IEC 60055-1 (1997-05)
Paper-insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors and excluding gas-pressure and oil-filled cables) - Part 1: Tests on cables and their accessories

29.240.20 IEC 60105 (1958-01)
Recommendation for commercial-purity aluminium busbar material

29.240.20 IEC 60121 (1960-01)
Recommendation for commercial annealed aluminium electrical conductor wire

29.240.20 IEC 60305 (1995-12)

Insulators for overhead lines with a nominal voltage above 1000 V - Ceramic or glass insulator units for a.c. systems - Characteristics of insulator units of the cap and pin type

29.240.20 IEC 60353 (1989-11)
Line traps for a.c. power systems

29.240.20 IEC 60383-1 (1993-04)
Insulators for overhead lines with a nominal voltage above 1000 V - Part 1: Ceramic or glass insulator units for a.c. systems - Definitions, test methods and acceptance criteria

29.240.20 IEC 60383-2 (1993-04)
Insulators for overhead lines with a nominal voltage above 1000 V - Part 2: Insulator strings and insulator sets for a.c. systems - Definitions, test methods and acceptance criteria

29.240.20 IEC 60433 (1998-08)
Insulators for overhead lines with a nominal voltage above 1 000 V - Ceramic insulators for a.c. systems - Characteristics of insulator units of the long rod type

29.240.20 IEC 60468 (1974-01)
Method of measurement of resistivity of metallic materials

29.240.20 IEC 60471 (1977-01)
Dimensions of clevis and tongue couplings of string insulator units

29.240.20 IEC 60481 (1974-01)
Coupling devices for power line carrier systems

29.240.20 IEC 60652 (1979-01)
Loading tests on overhead line towers

29.240.20 IEC 60720 (1981-01)
Characteristics of line post insulators

29.240.20 IEC 60743 (1983-01)
Terminology for tools and equipment to be used in live working

29.240.20 IEC 60781 (1989-01)
Application guide for calculation of short-circuit currents in low-voltage radial systems

29.240.20 IEC/TR 60826 (1991-06)
Loading and strength of overhead transmission lines

29.240.20 IEC 60832 (1988-04)
Insulating poles (insulating sticks) and universal tool attachments (fittings) for live working

29.240.20 IEC 60865-1 (1993-10)
Short-circuit currents - Calculation of effects - Part 1: Definitions and calculation methods

29.240.20 IEC/TR2 60865-2 (1994-06)
Short-circuit currents - Calculation of effects - Part 2: Examples of calculation

29.240.20 IEC 60888 (1987-12)
Zinc-coated steel wires for stranded conductors

29.240.20 IEC 60889 (1987-11)
Hard-drawn aluminium wire for overhead line conductors

29.240.20 IEC 60900 (1987-12)
Hand tools for live working up to 1000 V a.c. and 1500 V d.c.

29.240.20 IEC 60903 (1988-03)
Specification for gloves and mitts of insulating material for live working

29.240.20 IEC 60909 (1988-05)
Short-circuit current calculation in three-phase a.c. systems

29.240.20 IEC/TR3 60909-2 (1992-09)
Electrical equipment - Data for short-circuit current calculations in accordance with IEC 909 (1988)

29.240.20 IEC 60909-3 (1995-09)
Short-circuit current calculation in three-phase a.c. systems - Part 3: Currents during two separate simultaneous single-phase line-to-earth short circuits and partial short-circuit currents flowing through earth

29.240.20 IEC/TR 60909-4 (2000-07)
Short-circuit currents in three-phase a.c. systems - Part 4: Examples for the calculation of short-circuit currents

29.240.20 IEC 61057 (1991-06)
Aerial devices with insulating boom used for live working

29.240.20 IEC/TR2 61085 (1992-04)
General considerations for telecommunication services for electric power systems

29.240.20 IEC 61089 (1991-06)
Round wire concentric lay overhead electrical stranded conductors

29.240.20 IEC 61112 (1992-12)
Blankets of insulating material for electrical purposes

29.240.20 IEC/TR2 61211 (1994-06)
Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000 V - Puncture testing

29.240.20 IEC 61219 (1993-10)
Live working - Earthing or earthing and short-circuiting equipment using lances as a short-circuiting device - Lance earthing

29.240.20 IEC 61229 (1993-07)
Rigid protective covers for live working on a.c. installations

29.240.20 IEC 61230 (1993-09)
Live working - Portable equipment for earthing or earthing and short-circuiting

29.240.20 IEC 61232 (1993-06)
Aluminium-clad steel wires for electrical purposes

29.240.20 IEC 61234-2 (1997-09)
Electrical insulating materials - Methods of test for the hydrolytic stability - Part 2: Moulded thermosets

29.240.20 IEC 61235 (1993-09)
Live working - Insulating hollow tubes for electrical purposes

29.240.20 IEC 61236 (1993-08)
Saddles, pole clamps (stick clamps) and accessories for live working

29.240.20 IEC 61243-1 (1993-11)
Live working - Voltage detectors - Part 1: Capacitive type to be used for voltages exceeding 1 kV a.c.

29.240.20 IEC 61243-2 (2000-03) Ed. 1.1 Consolidated Edition
Live working - Voltage detectors - Part 2: Resistive type to be used for voltages of 1 kV to 36 kV a.c.

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Live working - Voltage detectors - Part 3: Two-pole low-voltage type

29.240.20 IEC 61243-5 (1997-06)
Live working - Voltage detectors - Part 5: Voltage detecting systems (VDS)

29.240.20 IEC/TR2 61278 (1997-01)
Live working - Guidelines for dielectric testing of tools and equipment

29.240.20 IEC 61284 (1997-09)
Overhead lines - Requirements and tests for fittings

29.240.20 IEC/TR2 61318 (1994-08)
Live working - Guidelines for quality assurance plans

29.240.20 IEC 61325 (1995-03)
Insulators for overhead lines with a nominal voltage above 1000 V - Ceramic or glass insulator units for d.c. systems - Definitions, test methods and acceptance criteria

29.240.20 IEC/TR2 61328 (1995-08)
Live working - Installation of transmission line conductors and earth wires - Stringing equipment and accessory items

29.240.20 IEC/TR3 61334-1-1 (1995-11)
Distribution automation using distribution line carrier systems - Part 1: General considerations - Section 1: Distribution automation system architecture

29.240.20 IEC/TR3 61334-1-4 (1995-11)
Distribution automation using distribution line carrier systems - Part 1: General considerations - Section 4: Identification of data transmission parameters concerning medium and low-voltage distribution mains

29.240.20 IEC 61334-3-1 (1998-11)
Distribution automation using distribution line carrier systems - Part 3-1: Mains signalling requirements - Frequency bands and output levels

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Distribution automation using distribution line carrier systems - Part 3: Mains signalling requirements - Section 21: MV phase-to-phase isolated capacitive coupling device

29.240.20 IEC 61334-3-22 (2001-01)
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29.240.20 IEC 61334-4-1 (1996-07)
Distribution automation using distribution line carrier systems - Part 4: Data communication protocols - Section 1: Reference model of the communication system

29.240.20 IEC 61334-4-32 (1996-09)
Distribution automation using distribution line carrier systems - Part 4: Data communication protocols - Section 32: Data link layer - Logical link control (LLC)

29.240.20 IEC 61334-4-33 (1998-07)
Distribution automation using distribution line carrier systems - Part 4-33: Data communication protocols - Data link layer - Connection oriented protocol

29.240.20 IEC 61334-4-41 (1996-08)
Distribution automation using distribution line carrier systems - Part 4: Data communication protocols - Section 41: Application protocol - Distribution line message specification

29.240.20 IEC 61334-4-42 (1996-10)
Distribution automation using distribution line carrier systems - Part 4: Data communication protocols - Section 42: Application protocols - Application layer

29.240.20 IEC 61334-4-61 (1998-07)
Distribution automation using distribution line carrier systems - Part 4-61: Data communication protocols - Network layer - Connectionless protocol

29.240.20 IEC/TR2 61334-5-1 (1996-08)
Distribution automation using distribution line carrier systems - Part 5: Lower layer profiles - Section 1: Spread frequency shift keying (S-FSK) profile

29.240.20 IEC/TR2 61334-5-2 (1998-05)
Distribution automation using distribution line carrier systems - Part 5-2: Lower layer profiles - Frequency shift keying (FSK) profile

29.240.20 IEC 61334-6 (2000-06)
Distribution automation using distribution line carrier systems - Part 6: A-XDR encoding rule

29.240.20 IEC 61395 (1998-03)
Overhead electrical conductors - Creep test procedures for stranded conductors

29.240.20 IEC 61466-1 (1997-02)
Composite string insulator units for overhead lines with a nominal voltage greater than 1000 V - Part 1: Standard strength classes and end fittings

29.240.20 IEC 61466-2 (1998-08)
Composite string insulator units for overhead lines with a nominal voltage greater than 1 000 V - Part 2: Dimensional and electrical characteristics

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29.240.20 IEC/TR2 61467 (1997-02)
Insulators for overhead lines with a nominal voltage above 1000 V - A.C. power arc tests on insulator sets

29.240.20 IEC 61472 (1998-11)
Live working - Minimum approach distances - Method of calculation

29.240.20 IEC 61477 (2001-02)
Live working - Minimum requirements for the utilization of tools, devices, and equipment

29.240.20 IEC 61481 (2001-02)
Live working - Portable phase comparators for use on voltages from 1 kV to 36 kV a.c.

29.240.20 IEC/TR3 61597 (1995-05)
Overhead electrical conductors - Calculation methods for stranded bare conductors

29.240.20 IEC 61773 (1996-11)
Overhead lines - Testing of foundations for structures

29.240.20 IEC/TR2 61774 (1997-08)
Overhead lines - Meteorological data for assessing climatic loads

29.240.20 IEC/TS 61813 (2000-10)
Live working - Care, maintenance, and in-service testing of aerial devices with insulating booms

29.240.20 IEC 61854 (1998-09)
Overhead lines - Requirements and tests for spacers

29.240.20 IEC 61897 (1998-09)
Overhead lines - Requirements and tests for Stockbridge type aeolian vibration dampers

29.240.20 IEC/TS 61911 (1998-12)
Live working - Installation of distribution line conductors - Stringing equipment and accessory items

29.240.20 IEC 61942 (1997-09)
Live working - Gloves and mitts with mechanical protection

DDRC
SCHEDULE NO. 1

GENERATING UNIT DATA

(a) Terminal Voltage

(b) Registered Capacity (MW)

- (i) Output Usable (MW)
- (ii) System constraint capacity (MW)
- (iii) Minimum generation (MW)
- (iv) MW in excess of registered capacity
- (v) Generation performance chart

(c) Rated Parameters Data

(d) Exciter and Power System Stabilizer Data

(e) Central System Data of Generation

(f) Generating Unit Parameters

(g) Generating Unit Step up Transformer Data

(h) Excitation Control System parameters

(i) Governor Parameters

(j) Type of Generating Plant

(k) Auxiliary Demand (MW) of the Power Station and each Unit

(l) Plant Flexibility Parameters and Performance

DDRC
SCHEDULE NO. 2

USERS SYSTEM DATA

- Reactive compensation equipment data
  (Shunt reactors, capacitor banks)
- Single line diagram of the User’s system.
- Switch gear data.
- Equivalent impedance of the User's system at his connection point.
- Maximum and minimum short circuit contribution to DNO system.
- Short circuit contribution of each embedded generator.
- Individual equipment fault current contribution of generator to the DNO system.
- Present capability in MW which a DNO can meet from other source of supply in caseof an unplanned and planned outages.

DDRC
SCHEDULE NO. 3

LOAD CHARACTERISTICS

General Demand Data

- Details of individual loads (sector wise).
- Maximum and minimum demand and active and reactive power requirements.
- User's maximum harmonics injection to DNO's system.
- Details of load causing short term and long-term fluctuations on the DNO's system.

DDRC
SCHEDULE NO. 4

OPERATIONAL PLANNING PHASE

(8 weeks to 1 year ahead inclusive)

Forecast information for each of the next 1 year of:

(e) Hourly Active and Reactive power usage at the specific time of DNO's Annual Peak and the System Operator's Annual Peak and minimum system load at each transmission connection point.

(f) Annual energy forecast demand at average conditions in respect of various Consumer's categories.

(g) MW output of embedded generating plant at specified the System Operator'sannual peak load hours.

Where reference is made to ‘specified’ or ‘the System Operator Demand’, the information shall beprovided by the DNO following the receipt of information provided by the System Operator in accordance with OC2 of the Grid Code.

DDRC
SCHEDULE NO. 5

OPERATIONAL PLANNING PROGRAMMING PHASE

(24 hours to 8 weeks ahead inclusive)

The following information shall be provided to the DNO in the time scales specified in DOC1:

(d) Operational hourly schedules for all Embedded Generators having an output greater than 1MW .

(e) Notification to the DNO by all its Bulk Power Consumers and other Distribution Companies connected to the DNO systemfor the specific time intervals where the aggregated change in the load due to their operations is expected to be greater than 1MW.

(f) Any other relevant Load forecast information reasonably required by the DNO.

DDRC
SCHEDULE NO. 6

OPERATIONAL PLANNING CONTROL PHASE

(0 to 24 hours ahead)

The following information shall be supplied to the DNO at reasonable times to be specified by the DNO for the un-expired period covered by the Control Phase.

(b) Hourly details of MW output by all embedded generating plants havinga difference of more than 1MW from the schedule of generations notified under DOC 1.3.3.3.

(b) Intimation of details of changes in aggregated MW demand (by more than 1MW) by all the Bulk Power Consumers connected to the DNO's distribution system.

DDRC
SCHEDULE NO. 7

OUTAGE PLANNING

OPERATIONAL PLANNING PHASE

MEDIUM TERM PROGRAMME – Calendar Year – 1 – 2 Year ahead

This appendix should be completed by DNO in consultation with Users

DDRC
SCHEDULE NO. 8

OUTAGE PLANNING

OPERATIONAL PLANNING PHASE

SHORT TERM PROGRAMME – Current Calendar year down to Programming Phase (8 Weeks)

This appendix should be completed by DNO in consultation with Users

DDRC
SCHEDULE NO. 9

GENERATING UNIT'S OUTAGES

Comprising information required by the DNO for outages on each generating unit effecting the DNO's system operation and demand.

DDRC
SCHEDULE NO. 10

USERS PLANT AND APPARATUS

Comprising information required by DNO for outages on the User's system plants and apparatus effecting the DNO's System.

EVENT INFORMATION EXCHANGE

DOC 5 Appendix 1

DDRC
SCHEDULE NO. 12

ANNUAL PERFORMANCE DATA

The DNO shall supply its Annual Performance Data as supplied to NEPRA under Performance Standards (Distribution).

GLOSSARY AND DEFINITIONS

The Terms Not included here have been Defined in Various Applicable Documents of NEPRA and Grid Code.

SR. #	ITEM	DEFINITION
1.	**Act**	Means the Regulation of Generation, Transmission & Distribution of Electric Power Act (XL of 1997) as amended vide 2018 Act.
2.	**Authority**	The National Electric Power Regulatory Authority established under the Regulation of Generation, Transmission & Distribution of (section 3) Electric Power Act (XL of 1997).
3.	**Active Load** **(Active Power)**	Means 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 1000 MW = 1 GW 1000 GW = 1 TW
4.	**Authorisation**	The formal sanction given in writing to undertake specified tasks that has a specific meaning in Safety Management System.
5.	**Automatic Load Shedding**	A load shedding scheme utilized by the System Operator to prevent frequency collapse or other problems, and to restore the balance between generation output and load on the Total System.
6.	**Automatic Voltage Regulator (AVR)**	A continuously acting automatic excitation control system to control the voltage of a Generator measured at the Generator terminals.
7.	**Average Conditions**	That combination of weather elements within a period of time chosen by the DNO to represent the average ofthe observed values of those weather elements during equivalent periods over a number of years (sometimes referred to as normal weather).
	Behind-the-Meter	This describes generation installed by ordinary Consumers who do not need to have a connection agreement. This is primarily for their own consumption although they may export.
8.	**Breakdown**	An occurrence relating to equipment which prevents that equipment from performing its correct function within the distribution system.
9.	**Bulk Power Consumer (BPC)**	means a large Consumer as defined in the Act.
10.	**Bulk Power Supply Agreement**	The commercial agreement between a Generator and Purchaser for the delivery and use of power.
11.	**Captive Generator**	means a power plant setup by any person to generate electricity primarily for his own use and includes a power plant setup by any co-operative society or association of persons for generating electricity primarily for use of members of such co-operative

		society or association.
12.	**Commercial Code**	The commercial code prepared and maintained by the market operator pursuant to sections 23A and 23B of the Act and approved by the Authority, from time to time.
13.	**Commercial Load Management**	Where a Supplier may offer discounts to Consumers who agree to be shed under specific, Supplier determined conditions.
14.	**Commercial Metering**	Has the meaning given in the Grid Code.
15.	**Common Delivery Points (CDP)**	Points at the boundary between commercial entities where there is Commercial Metering.
16.	**Connection Agreement**	An Agreement between a User and DNO setting out the terms and conditions relating to a Connection to the Distribution System.
17.	**Consumer**	a person or his successor-in-interest who purchases or receives electric power for consumption and not for delivery or re-sale to others, including a person who owns or occupies a premises where electric power is supplied.
18.	**Consumer with Own Generation**	A Consumer with one or more generating units connected to the Consumer's system, providing all or part of the Consumer's electricity requirements, and which may use the DNO's Distribution System for the transport of any surplus of electricity being exported.
19.	**Consumption**	Is the use of electrical energy by a DNO or Bulk Power Consumer, in a period of time previously established.
20.	**Continuity of Supply**	Means providing electrical power services in an uninterrupted manner.
21.	**Control**	The process of managing the System Operator Transmission System or a Distribution System or a User System in "real time" by means of instructions issued verbally using the control telephony or by means of SCADA systems. Control includes monitoring as well as operating the networks.

SR. #	ITEM	DEFINITION
22.	**Control Centre**	A site nominated by NGC or DNO as a place where control of the NGC Transmission System or a connected TNO system, or the DNO's System is exercised.
23.	**Control Person**	A person who has been nominated by a DNO,NGC or User to be responsible for controlling and coordinating system operations.
24.	**Control Phase**	The Control Phase follows on from the Programming Phase and starts with the issue of the Indicative Running Notification for the next Schedule Day and covers the period down to real time.
25.	**ΔIQ**	The change in reactive current.
26.	**DCRP Operating Procedure or DCRP-OP**	The operating procedure under the D-Code by which the DCRP operates, covering its constitution, duties, operations, and timescales.
27.	**Discrimination**	The minimum time by which events must be separated such that the sequence of their occurrence is determined correctly.
28.	**Distribution Code**	The distribution code prepared by the DNOs and approved by the Authority.
29.	**Distribution Licensee Financial Year**	"Financial Year" means a consecutive period of twelve calendar months commencing on the 1st day of July of any year and ending on the 30th day of June of the following year.
30.	**Distribution Network Operator (DNO)**	An entity, which owns, operates, and maintains Distribution Facilities.
31.	**Distribution Service Manual**	the manual of instructions developed by a DNO and approved by the Authority detailing instructions and guidance to the persons connected or to be connected to the distribution system of the licensee as more fully described in regulation 8 of the NEPRA distribution licensing regulations.
32.	**Distribution Use of System Charges (DUOS)**	the charges made or levied or to be made or levied by a DNO for the use of its distribution system for the purposes of the distribution services but shall not include connection charges.
33.	**Distribution Voltage(s)**	Voltages below 66kV.
	Effective Capacity	Maximum power that may be obtained from a generator.
34.	**Efficiency**	The ratio of active output power to active input power, expressed per unit or as a percentage.
35.	**Embedded**	Having a direct electrical connection to a Distribution System.
36.	**Embedded Generator**	Generating Units within a Power Station which are directly connected to a Distribution System and have no direct Connection to the Transmission System. For the avoidance of doubt this shall include Captive Generators.
37.	**Emergency Instructions**	An instruction issued by the System Operator in emergency circumstances to its Users.
38.	**Emergency Operation**	Operating condition outside of the Normal Operation.

39.	**Entity**	Entity means a Person involved in either the generation, transmission, distribution, acquiring, purchasing, supplying/delivery or consuming electrical power and energy.
40.	**Equipment**	Means Plant and/or Apparatus
41.	**Event**	An unscheduled or unplanned (although it may be anticipated) occurrence on or relating to a System including, without limiting that general description, faults, incidents and breakdowns and adverse weather conditions being experienced.
42.	**Excitation Control System**	The automatic control system that provides the field excitation current for the synchronous Generator including excitation limiting devices and power system stabilizer.
43.	**Exciter**	A Generator which supplies all or part of the power required for the excitation of the main Generator or alternator.
44.	**Externally Connected Consumers**	The "Consumer" outside the jurisdiction of NEPRA Act which is connected to the NGC/DNO's System through an External Interconnection operating and managing their own distribution or transmission or generating systems.
45.	**Externally-Connected Parties**	The Parties or Power Entities within the jurisdiction of NEPRA Act which is connected to the NGC System through an External Interconnection operating and managing their own distribution or transmission or generating systems.
46.	**Fault Level**	Prospective current that would flow into a short circuit at a stated point on the System and which may be expressed in kA or, if referred to a particular voltage, in MVA.
47.	**Force Majeure**	means any event or circumstance beyond the reasonable control of the User or DNO claiming the Force Majeure which it could not reasonably have avoided or overcome, and which makes it impossible for the Claiming Party to perform its obligations under this Distribution Code.
48.	**Generator or Generating Company**	a person engaged in the generation of electric power.
49.	**Governor**	A mechanical device used to automatically regulate the speed of a turbine of electric generator.
50.	**Isolation Device**	A device for achieving electrical Isolation.
51.	**Isolator**	A device which provides in the open position a means of disconnecting Apparatus from the Distribution System in accordance with specified requirements.
52.	**Load Dispatch Centre**	The control centre of the System Operator.
53	**Load Management**	is the orderly reduction of load in a prearranged manner when generation is insufficient to meet demand. When necessary, this should be performed on a publicised structured rota basis.
54.	**Load Shedding**	is an emergency response to problems on the network, particularly a severe drop in frequency, it will be done automatically or manually in prearranged circumstances to manage the frequency falling below the nominal.
55.	**Market Operator (MO)**	a person responsible for the organization and administration of trade in electricity and payment settlements among Generators, licensees, and Consumers;

56.	**Metering Service Provider (MSP)**	An entity enrolled with the MO (currently NTDC).to: a) to collect all metering information required by the Commercial Code and its operational procedures, for the Market Operator to perform the settlement functions; b) to assess the completeness and consistency of the metering information; and c) to transfer the metering information to the Market Operator through electronic means, at such intervals as specified in the relevant operational procedures.
57.	**Negative Phase Sequence**	A term used within the theory of symmetrical components, which is a method of analysing an AC multiphase System.
58.	**Network Load Management**	Load Management which is done on an equitable basis for the purposes of stabilising the system, be it shortage of generation or transmission outages.
59.	**New Market or CTBCM**	The electric power market established in accordance with the high-level and detailed designs approved by the Authority vide its determinations dated 5th day of December 2019 and 12th day of November 2020 as may be amended by the Authority from time to time.
60.	**Nominal Voltage**	A suitable approximate value of voltage used to designate or identify a system.
61.	**Normal Operating Frequency**	The number of Alternating Current cycles per second, expressed in Hertz at which the System normally operates, i.e. 50 Hertz.
62.	**Operational Effect**	Any effect on the operation of the relevant other System which causes the Systems of the DNO, NGC or otherUsers, as the case may be, to operate (or be at a materially increased risk of operating) differently from the way in which they would or may have operated in the absence of such effect.
63.	**Operational Boundary**	The equipment boundary one DNO or User and another where control of the equipment changes. If not explicitly defined it is the Ownership Boundary.
64.	**Output Usable or (OU)**	That portion of Registered Capacity, which is not unavailable due to a Planned Outage or breakdown.
65.	**Overloading**	The condition under which part of the System is subject to a Load in excess of the normal design rating of that part of the System and not due directly to System fault current.
66.	**Ownership Boundary**	The boundary between the equipment owned by one DNO or User and the Equipment owned by another.
67	**Power Control Centre**	The control centre of a DNO.
68	**Rated Voltage**	The voltage assigned generally by a manufacturer, for a specified operating condition of a component, device, or equipment.

SR. #	ITEM	DEFINITION
69.	**Real Time**	The process of controlling, operating, maintaining any System at the actual time of the day. All instructions issued will be time tagged with the actual time of issue and completion thereof.
70.	**Real Time Operation**	Operation performed by the System Operator through the SCADA MonitoringSystem.
71.	**Registered Capacity**	The normal full load capacity of a Generator in MW measured at the Generator Terminals.
72.	**Registered Data**	Data referred to in the schedule to the Data Distribution registration code.
73.	**Safety Management**	The procedure adopted by the DNO or a User toensure the safe Operation of its System and the safety of public,animals and its personnel required to work on that System and at or across operation and ownership boundaries.
74.	**Safety Procedures**	The procedures specified within a Safety Management System.
75.	**SCADA**	Supervisory Control and Data Acquisition – a System whereby System Operator is able to monitor and depending on the degree of sophistication of the SCADA System, can control local and remote circuit breakers and other devices on the NGC Transmission System, a connected TNO system, a User System or DNO's system.
76.	**Scheduling**	The process of compiling a Generating Schedule as set out in SDC1, and the term "Scheduled" and like terms shall be construed accordingly.
77.	**Significant Incident**	An event of external or internal origin, affecting equipment or the supply system, and which disturbs the normal operation of the System.
78.	**Single Line Diagram**	Schematic representations of a three-phase network in which the three phases are represented by single lines. The diagram shall include (but not necessarily be limited to) bus bars, overhead lines, underground. Cables, power transformers, and reactive compensation equipment. It shall also show where Generating Plant is connected, and the points at which Load is supplied.
79.	**Station Transformer**	A transformer supplying electrical power to the auxiliaries of a power plant, which is not directly connected to the generating unit terminals.
	Supplier	A person who has been granted a licence under this Act to undertake supply of electricity.
80.	**SWE Embedded Generator**	A solar, wind or energy storage Embedded Generator, where energy storage is not pumped storage.
81.	**System Operator**	A person licensed under the NEPRA act to administer system operation and dispatch.
82.	**System Stability**	The state of the System whereby predicted changes in load and generation can be accommodated without any detrimental effect on the System.
83.	**System Tests**	Those tests which involve simulating conditions or the controlled application of irregular, unusual or extreme conditions on the Total System or any part of it, but not including routine testing, commissioning or re-commissioning tests.

84.	**Telemetering**	A process in which measurements are made at some remote location and the results are transmitted by telecommunication. The transmission of the values of measured variables using telecommunication techniques.
85.	**Total System**	The NGC Transmission Systems, other TNO systems, and the Distribution Systems of all the DNOs in Pakistan.
86.	**User:**	The term used in various sections of the Distribution Code to refer to the person who is directly or indirectly connected with or using the Distribution system of the DNO to whom this code is applicable and includes other DNO and generator as identified in relevant sections of this code.

AMENDMENT HISTORY

Amendment History			
Version	**Date**	**Change**	**Reason**
1	2005	Original	Required under the Act
2	2022	Significant revision	The CTBCM