

DEP SPECIFICATION

ELECTRICAL SUPPLY AND GENERATION - DESIGN AND OPERATION

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DESIGN AND ENGINEERING PRACTICE



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TABLE OF CONTENTS

1.	INTRODUCTION	4
1.1	SCOPE.....	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	4
1.4	CROSS-REFERENCES	6
1.5	SUMMARY OF MAIN CHANGES.....	7
1.6	COMMENTS ON THIS DEP	7
2.	EXTERNAL NETWORK CLASSIFICATION	8
3.	POWER AND FREQUENCY CONTROL	9
4.	VOLTAGE AND REACTIVE POWER CONTROL	10
4.1	TYPES OF CONTROL.....	10
4.2	EQUIPMENT	12
5.	DESIGN AND OPERATION	14
5.1	GENERATOR AUXILIARIES	14
5.2	OPERATIONAL CONDITIONS.....	14
5.3	BLACK START FACILITIES	14
6.	TECHNICAL AGREEMENTS WITH PUBLIC ELECTRICITY AUTHORITIES	16
7.	REFERENCES	17
8.	BIBLIOGRAPHY	18

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design and operation of a plant network with partial or complete power supply from embedded generation units. It gives minimum technical requirements for the design, engineering, operation and installation. These requirements address subjects related to electrical infrastructure, voltage and frequency control, generating units, protection and operation during operational life after testing and commissioning.

This is a revision of the DEP of the same number dated January 1999; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

1.3.2.1 Terminology

Term	Definition
Availability (performance) IEC 60050 (191-02-05)	The ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided. This ability depends on the combined aspects of reliability performance, maintainability performance and maintenance support performance.
Availability, instantaneous IEC 60050 (191-11-01)	The probability that an item is in a state to perform a required function under given conditions at a given instant of time, assuming that the required external resources are provided.
Critical clearance time	The maximum allowable time period of a voltage drop caused by a three phase fault, without the occurrence of one or more pole slips at the synchronous generator or motor after fault clearance.
Electrical power network IEC 60050 (601-01-02)	Particular installation, substation, lines, cables for the transmission and distribution of electricity. The boundaries of the different parts of this network are defined by appropriate criteria, such as geographical situation, ownership, voltage, etc.
External network	Part of the <i>electrical power network</i> that is beyond the <i>point of common coupling</i> . In many cases the public network.
Interconnection IEC 60050 (601-01-11)	A single or multiple transmission link between transmission systems enabling electricity to be exchanged between these systems by means of circuits and/or transformers.
Isolation of a unit IEC 60050 (602-03-28)	The emergency measure consisting of the disconnection of a unit while preserving its ability to supply its own auxiliaries.
Point of common coupling	Point(s) in an <i>electrical power network</i> which represent(s) the boundaries of administration and/or ownership between the different parts of that <i>electrical power network</i> .
Reliability (performance) IEC 60050 (191-02-06)	The ability of an item to perform a required function under given conditions for a given time interval.
Reliability IEC 60050 (191-12-01)	The probability that an item can perform a required function under given conditions for a given time interval.
Small island	Electrical system consisting of a single generator and its auxiliaries with its primary and secondary circuits designed so that it is able to run on its own after <i>isolation of the unit</i> .
Spinning reserve IEC 60050 (602-03-15)	The difference between the total available capacity of all generating units already coupled to the system and their actual loading.

1.3.2.2 Control

The following definitions have been adapted for use in industrial plant grids and are slightly different to those in general use in public networks.

Term	Definition
Primary control	Control system that is directly related to the controlled device.
Secondary control	Control system that is related to parallel operating devices having the same primary control function.
Tertiary control	Control system that is related to the exchange of active or reactive power with an external network.

1.3.2.3 Operational conditions

The classification of operational conditions for a plant network or an external network is given in Table 1.

Table 1 Classification of operational conditions

Class.	Type	Voltage (per unit)	Frequency (per unit)	Description
OC1	Steady State	$0.95 \leq U \leq 1.05$	$0.98 \leq f \leq 1.02$	Normal operational conditions, equipment is able to perform all primary functions continuously
OC2	Sustained	$0.90 \leq U < 0.95$ $1.05 < U \leq 1.10$	$0.95 \leq f < 0.98$ $1.02 < f \leq 1.03$	Abnormal operational conditions without loss of generation or load
OC3	Deviated	$0.70 \leq U < 0.90$	$0.92 \leq f < 0.95$ $1.03 < f \leq 1.10$	Transient conditions to be operated for a limited time span
OC4	Degenerated	$U < 0.70$		Loss of generation and load if cause is not eliminated immediately

1.3.3 Abbreviations

Term	Definition
AVR	Automatic Voltage Regulator
EN	European Standard
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
CCT	Critical Clearance Time
OLTC	On Line Tap Changer
PSSs	Power System Stabilizers
PCC	Point of Common Coupling

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (7).