

DEP SPECIFICATION

**ELECTRICAL NETWORK MONITORING AND CONTROL
SYSTEM**

FOR GLOBAL APPLICATION

DEP 33.64.10.32-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations and options for an electrical network monitoring and control (ENMC) system, for global application.

An ENMC system comprises microprocessor-based systems, associated software and required peripherals for monitoring and controlling an electrical power network. The ENMC system can be a separate system with separate hardware such as data servers (stand alone), it can be a separate system running as a virtual machine using common data servers or it can be an embedded function with the plant control system (DCS).

A set of Requisition sheets (DEP 33.64.10.93-Gen.) is available to assist communication between the Principal and Manufacturer/supplier.

This DEP is a revision of the DEP with the same number dated September 2017; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

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 shall 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.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Alarm	The notification type used to notify operators of the exceedance of a Critical Limit or a Standard Limit. See notification. On the control system, an alarm is an audible and/or visible means of indicating to the operator that a critical or standard priority equipment malfunction, limit exceedance, or abnormal condition occurred requiring a response.
Alarm Management	Activities related to monitoring, storing, reporting, analysing and auditing alarm and alert notifications, with the intent to improve the effectiveness and performance of the alarm system.
Alert	The notification type used to notify operators and/or operations support personnel of the exceedance of a Target limit or other event that is not a Critical or Standard limit exceedance. See notification. On the control system, an alert is an audible and/or visible means of indicating to the operator a target priority equipment event or limit exceedance that requires awareness, that is indicated separately from alarm indications, and which does not meet the criteria for an alarm.
Availability	Fraction of time that a system or plant is able to perform its designated service. Calculated as the total operating period minus total down time, divided by total operating period (x100 %).
Distributed Control System (DCS)	Configurable microprocessor-based (process) control system.
Electrical Network	Complete electrical network consisting of generation, transmission and distribution.
Electrical Network Monitoring and Control (ENMC)	A computerised system that is dedicated to monitoring and controlling defined aspects of an electrical network.
Electro-magnetic Compatibility	Ability of an equipment or system to function satisfactorily in its electromagnetic environment without imparting intolerable electromagnetic disturbances to anything in that environment.
Emission Level	Amount of electromagnetic emission that is permitted.
Fail Safe	In the event of a fault, system breakdown or lack of power, the functions concerned pass into a defined state or are taken out of service safely.
Hold Point	A mandatory verification point beyond which work cannot proceed without approval by the Principal or Contractor.
Immunity Level	The electromagnetic disturbance that is permitted without degradation of the performance of an equipment or system.
Inputs / Outputs (I/O)	The actual interface of the ENMC system to other systems or equipment. It does not mean a 'serial link'.

Term	Definition
Intelligent Electronic Device (IED)	Numeric control and protection device, commonly referred to as a protection relay.
Maintainability	The probability that a given active maintenance action, for an item under given conditions of use, can be carried out within a stated time interval when the maintenance is performed under stated conditions and using stated procedures and resources.
Mean Time Between Failure (MTBF)	Total operating period divided by number of faults that have resulted in outages (hours).
Mean Time to Repair (MTTR)	Total time to repair and return to service divided by number of faults that have resulted in outages (hours).
Network Function	Function needed for electrical power network operational reasons, i.e., to operate the network in a safe and/or economical way.
Notification	Alarms and alerts, used to inform appropriate personnel of limit exceedances or the occurrence of events.
POSIX	The Portable Operating System Interface (POSIX) is a family of standards specified by the IEEE for maintaining compatibility between operating systems.
Reliability	The probability that an item can perform a required function under given conditions during a given time interval.
Supervisory Control and Data Acquisition (SCADA)	A set of functions responsible for the acquiring and processing of data and issuing of commands.
Support Functions	Functions not explicitly needed for the network but supporting the operation of the ENMC system or the operator.
System Functions	Control and monitoring functions, inherent to a computerised ENMC system.
Technical Lifetime	The design lifetime of the system given that normal maintenance has been carried out.
Witness Point	A mandatory verification point notified to the Principal or Contractor.

1.3.3 Abbreviations

Term	Definition
AVR	Automatic Voltage Regulator
CCR	Central Control Room
CER	Central Electrical Room

Term	Definition
CPU	Central Processing Unit
CSER	Central Service Electrical Room
DCS	Distributed Control System. Also referred to as BPCS (Basic Process Control System)
EDG	Emergency Diesel Generator
EMC	Electromagnetic Compatibility
ENMCS	Electrical Network Monitoring & Control System
FAR	Field Auxiliary Room
FAT	Factory Acceptance Test
FDDS	Functional Detailed Design Specification
FDS	Functional Design Specification
FMEA	Failure Mode and Effects Analysis
GPS	Global Positioning System
GTG	Gas Turbine Generator
HMI	Human-Machine Interface
HV	High Voltage
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
I/O	Input/Output
ISO	International Standards Organization
LAN	Local Area Network
LER	Local Equipment Room
LV	Low Voltage
MOC	Management of Change
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
OLTC	On Load Tap Changer
OPC	OLE (Object Linking and Embedding) for Process Control

Term	Definition
OS	Operating System
OSI	Open Systems Interconnect
PCAD	Process Control Access Domain
PCB	Printed Circuit Board
PCC	Point of Common Coupling
PID	Protocol Implementation Document
PLC	Programmable Logic Circuit
RTU	Remote Terminal Unit
SAFOP	Electrical Safety and Operability Review
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SIT	Site Integration Test
STG	Steam Turbine Generator
TAMAP	Technically Accepted Manufacturers And Products
TFT	Thin Film Transistor (monitor)
UPS	Uninterruptible Power Supply
VSDS	Variable Speed Drive System

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (10).

1.5 SUMMARY OF MAIN CHANGES

This is a revision of the DEP of the same number dated February 2018. This is an administrative update only to correct references to DEPs that have been involved in either a merge or a split.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

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	Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

1.9 DATA and I/O SHEETS

Requisition/data sheet DEP 33.64.10.93-Gen. is applicable to this DEP.

2. INTERFACES

2.1 PRE-AWARD MEETING

1. The Manufacturer/Supplier shall arrange the Pre-award meetings to clarify the scope and parameters of the order and the responsibilities of each party involved.
2. The pre-award meeting should involve attendees from the EPC Contractor, the Principal, and the Manufacturer/Supplier.

2.2 STUDIES

1. The Manufacturer/Supplier shall agree with the Principal prior to contract award which studies are required and the involvement of the Manufacturer/Supplier in those studies.

Typical studies are load flow, transient behaviour, loadshed, protection studies and SAFOP.

3. BASIS OF DESIGN

3.1 GENERAL

1. The scope of supply of the ENMC system should include the following:
 - a. Detailed design of the system and the interfaces with control systems of equipment and systems such as generators, switchgear, transformers, Distributed Control Systems (DCS) of utility and the plant process installations.
 - b. Hardware forming part of the ENMC system.
 - c. Software required for the functioning of the ENMC, including communication to other systems and the supply of the relevant software licences.
 - d. Factory tests during the fabrication process and final factory acceptance tests.
 - e. Communication interface tests with 3rd party equipment and systems.
 - f. Documentation and instructions as specified in this DEP.
 - g. Site inspections, testing, commissioning and start up assistance.

2. The following may be included in the scope of supply:

- a. Installation of the hardware at site.
- b. Training of the Principal's personnel.

3. The ENMC shall only use hardware and software from the Manufacturer/Supplier's standard range.

The functionality of commercially available ENMC systems allows users to make a selection of the functions required for a particular installation.

The Principal will define what is the required functionality of the system during the tender stage.

4. It shall be possible to incorporate additional functions at a later date during the lifetime of the ENMC system without a major upgrade of the system.
 - a. Unless otherwise specified in requisition 20% spare processing capacity should be maintained at end of the Execute phase.
5. The design and selection of equipment, components and functions shall enable the system to achieve a minimum technical lifetime of 20 years.
 - a. The Manufacturer/Supplier shall state in the quotation the expected technical lifetime of any components that might not achieve a minimum of 20 years.

- b. If a component cannot achieve a minimum service life of 10 years, the Manufacturer/Supplier shall indicate how the component can be replaced during normal operation.
 - c. The Manufacturer/Supplier shall confirm that replacement components will be available during the technical lifetime.
 - d. The Manufacturer/Supplier shall indicate an expected duration of the replacement of major components (e.g., server, control units, HMI, electronic cards).
 - e. In the quotation, the Manufacturer/Supplier shall give documented evidence that maintenance, including replacement, of single components (e.g., Level 1 IED, Level 2 substation controller, switch and router) will not affect operation of the ENMC system.
6. The Manufacturer/Supplier shall confirm how software support will be maintained for the ENMC system during the lifetime of the system.

3.2 CONFIGURATION OF THE ENMC SYSTEM

1. ENMC systems for industrial electrical networks shall be configured so that the following three levels of control can be distinguished:
 - a. Level 1
 - i. Equipment on this level controls and protects part of the electrical network with a specific function.
e.g., an IED associated with switchgear; a VSDS.
 - ii. All control and protection equipment can operate without communication to other levels.
e.g., an IED in a switchgear panel feeding a transformer.
 - b. Level 2 (if required)
 - i. Equipment on this level receives and transmits information to and from Level 1 and can interface to other systems (e.g., DCS).
 - c. Level 3 (if required)
 - i. Equipment on this level centrally collects and processes information from substations and can interface with other system e.g., DCS, PCAD.
 - ii. For specific time critical applications, information from Level 1 can be directly received and/or transmitted.
2. Provision for monitoring and control of the Level 1 systems shall be located at Level 2.
For example, a local control HMI in a (plant) substation.
3. Unless otherwise specified in the Requisition (e.g., for small systems with ≤ 5 substations), the ENMC system control functions in a particular substation (Level 2) shall be connected to controllers or switches dedicated to that particular substation.
4. The monitoring and control of the Levels 1 and 2 shall be located at Level 3.
Level 3 is the highest level of ENMC system control. It is generally located in a central control location.

3.3 RELIABILITY, AVAILABILITY AND MAINTAINABILITY

3.3.1 General

1. The ENMC system components shall have a Mean Time Between Failure (MTBF) of $\geq 100,000$ hours.