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**NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY**

NIOEC SP

NIOEC SPECIFICATION FOR POWER MANAGEMENT SYSTEM

SECOND EDITION

MARCH, 2017

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical Specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such Specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international Standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences.

However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant Specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the ongoing projects.

In response to the initiative of the Design and Engineering Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design and Engineering Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design and Engineering Director of NIOEC for evaluation and approval.

REVISION INDEX

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 3) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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1. SCOPE

- 1.1. This Specification defines the minimum requirements for the design, manufacture, materials, software, inspection and test of Power Management System (PMS).
- 1.2. An industrial power system mainly consists of power supply and power distribution systems. Required power may be supplied by means of an onsite power plant (consists of power generating units) or may be imported from external electrical networks. The combination of these two methods may also be used.
- 1.3. When onsite power plant exists, a PMS shall be provided for supervision and control of power generation system (including main switchgear). Control and monitoring of downstream power distribution system (process unit substations) is not included in this Specification and is covered by NIOEC-SP-60-22 (Electrical Network Control and Monitoring System (ENCMS)).
- 1.4. Deviations from this Specification will only be permitted on obtaining written approval from NIOEC. Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced IPS and the international standards, shall be made through written consent and approval of NIOEC.

2. REFERENCES

The following standards, codes, and specifications, to the extent specified hereinafter, shall constitute a part of this NIOEC Specification. Latest edition of the undated referenced documents and the cited edition of the dated references shall apply. The applicability of changes made to the dated references, after the cited date shall be mutually agreed upon between NIOEC and the Vendor/Contractor.

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 60300	“Dependability Management”
IEC 60364	“Low Voltage Electrical Installations”
IEC 60445	“Basic and Safety Principles for Man-Machine Interface, Marking and Identification - Identification of Equipment Terminals, Conductor Terminations and Conductors”
IEC 60529	“Degrees of Protection Provided by Enclosures (IP Code)”
IEC 60706	“Maintainability of Equipment”
IEC 61000	“Electromagnetic Compatibility (EMC)”
IEC 61131	“Programmable Controllers”
IEC 61850	“Communication Networks and Systems for Power Utility Automation”

NIOEC-SP (NIOEC SPECIFICATIONS)

NIOEC-SP-60-00	“NIOEC Specification for General Design Philosophy for Electrical System”
NIOEC-SP-00-10	“NIOEC Specification for Units”

NIOEC-SIP (NIOEC SHOP INSPECTION PROCEDURE)

NIOEC-SIP-60-00

“Shop Inspection Procedure for Electrical Equipment”

3. UNITS

Unless otherwise specified, international system of units (SI) shall be used in accordance with NIOEC-SP-00-10.

4. GENERAL REQUIREMENTS

- 4.1.** The vendor shall ensure all the required coordination with manufacturers of power generating units and shall be responsible for supplying the complete system.
- 4.2.** PMS and its components shall be designed in accordance with the applicable IEC publications.
- 4.3.** Design and selection of equipment, components and functions shall be based on a 20 years lifetime. The vendor shall confirm that replacement components and software support will be available during the lifetime of the system.
- 4.4.** Although hardware reliability is important, the availability of the whole system (hardware plus software) for critical functions shall be considered as the representative of reliability figures. The availability of the whole PMS shall be at least 99.99%.
- 4.5.** PMS including all critical components shall have a Mean Time Between Failure (MTBF) of not less than 200,000 hours.
- 4.6.** All subsystems shall be designed to achieve a Mean Time To Repair (MTTR) of not more than 4 hours.
- 4.7.** Availability, reliability and maintainability requirements shall be in accordance with the definitions of IEC60300 and IEC60706.
- 4.8.** System Electromagnetic Compatibility (EMC) shall comply with the requirements of IEC61000 and also shall be tested in accordance with it.
- 4.9.** In order to achieve the specified emission and immunity levels, the specific installation requirements (cabling, earthing, etc.) shall be stated by the vendor.
- 4.10.** PMS equipment shall be normally installed inside air conditioned electrical or control rooms with 20 ~ 25 °C normal temperature, nevertheless, the equipment shall be capable of operating at the following conditions unless otherwise specified:
 - Maximum ambient temperature: 40 °C
 - Minimum ambient temperature: 5 °C
 - Maximum relative humidity: 90 %
 - Maximum altitude: 1000 m
- 4.11.** Available supply voltage will be single phase 230VAC with the following variations:
 - Steady state voltage variation: ±10%
 - Transient voltage variation (max. 0.5 sec): -20%
 - Frequency variation: ±5%
- 4.12.** PMS shall be connected to two independent feeders of AC UPS that will be supplied by others.
- 4.13.** The vendor shall be responsible for the power distribution within the PMS (including AC/DC converters).

5. SYSTEM DESCRIPTION

- 5.1. Power generation system generally comprises power generating units (GTG, STG, etc.) operating in islanded configuration or coupled to an external grid through tie-line transformers.
- 5.2. The PMS is a microprocessor based control system including a Human Machine Interface (HMI) that is specifically designed for monitoring, control and management of overall power generation system and import/export power tie-lines.
- 5.3. Power generating units shall be capable of operating without help from the PMS. Only status, measurements, alarms, faults and required commands for changing operating mode and set-points shall be exchanged between the PMS and power generating units.
- 5.4. Startup and run-up to the rated speed of each power generating unit shall be performed by relevant unit HMI. After startup, the AVR and governor shall be set to droop mode and control of their set-points shall be transferred to the PMS. Normally, generator synchronization shall be performed by PMS.
- 5.5. For island power systems, PMS shall control overall system voltage and frequency and also perform active/reactive load sharing between generators by adjusting speed and voltage set-points of power generating units governors and AVRs.
- 5.6. For power systems that are paralleled to an external grid, overall system frequency will be enforced by the external grid and the PMS shall control system voltage and tie-lines active/reactive power and also perform active/reactive load sharing between generators by adjusting tie-line transformers on-load tap changer and speed and voltage set-points of power generating units governors and AVRs.
- 5.7. Whenever the voltage and frequency of the external grid are lost, the control mode shall be adapted to the new network configuration and the voltage and frequency shall be regulated by the PMS. In this case, the load shall be matched with the available generation capacity by load shedding (if required).
- 5.8. The load shedding function of the PMS shall protect the power generation system against failure or instability due to sudden overload following the loss of external grid connection and/or operating generators or sudden application of a large load.
- 5.9. In the event of a disturbance, load shedding shall be initiated immediately to avoid excessive changes in frequency and voltage. Load shedding shall initiate disconnection of low priority loads according to a predefined priority table. The load shedding system shall inhibit re-energization of the shed circuits until operator reset.
- 5.10. It shall be possible to display overall system and power generating units parameters and also status and required measurements of main switchgear feeders (including generators, tie-lines, bus couplers and outgoing feeders). Control of main switchgear circuit breakers shall also be possible.

6. SYSTEM ARCHITECTURE

- 6.1. PMS shall be interfaced with the following system/equipment for data acquisition and control purposes:
 - power generating units main controllers
 - tie-line transformers on-load tap changers
 - main switchgear
 - distribution switchgears and MCCs (for load shedding commands)
 - ENCMS (Electrical Network Control and Monitoring System)