



**Resalat Oil Field Development Project
Phase 1 (EPC-EPD)**



Contract No.

Specification for PMS

Class 1

5365

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REVISION RECORD SHEET

REV. NO.	PURPOSE	LIST OF UPDATED MODIFIED SECTIONS IF ANY
02	Modification based on the comments of client and agreement	According to highlighted parts



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1. INTRODUCTION

1.1. Development Overview

The Resalat Field previously known as Rakhsh Field, is located in the Persian Gulf, some 80 km to the South of Lavan Island, in water depth of 65-75 meters. The facilities which were originally developed in 1968 have sustained some damage due to the Iran/Iraq war and adverse climate conditions thereafter.

To increase oil production capacity from this field (adding 12,000 stock barrels per day to current production), Iranian Offshore Oil Company (IOOC) has defined new project which includes Engineering, Drilling, Procurement, Construction for following items:

- New satellite Wellhead Platform (WHP1) with totally nine (9) conductor slots.
- Development and renovation of Existing offshore complex consist of new power generation, control system, HVAC, Electrical /control room, electrical panels(LV &MV),process & utility piping, and all necessary activities which shall be done for connection to existing facilities(Tie in requirements)
- Drilling of two new production wells in R1 and three wells in WHP1 platform and Re-entry and work-over of one existing well in R1 platform.
- One 10” productions submarine pipeline from WHP1 to PP and a single submarine cable (power and data) from SP to WHP1
- Inspection, Strengthening, Modification and Repair of existing R1 complex Jackets and topsides and replacement of boat landing and Barge Bumpers.

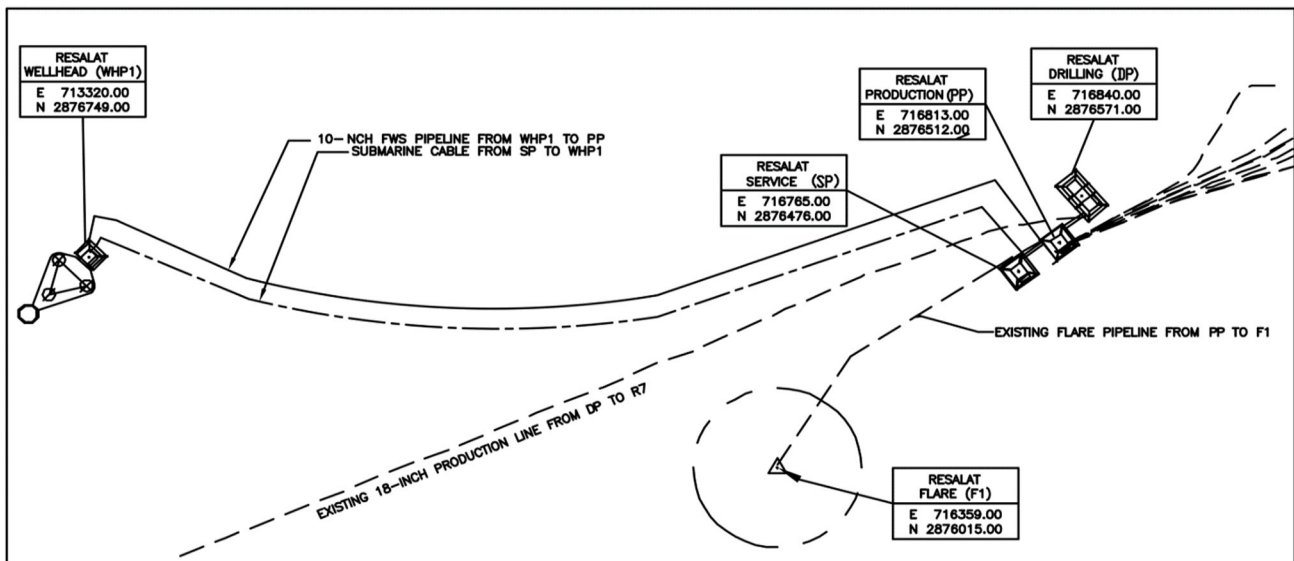


Figure 1: Resalat Development Field Layout (Datum ED 77, Zone 39, Cent. Meridian 51° East)



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1.2. Purpose of Scope

This document defines the Specification for the Power Management System (PMS) for the offshore Resalat Project.

This document defines the minimum functional requirements, design, manufacture and testing of the Power Management System for the project

1.3. Definitions

PROJECT	Resalat Oil Field Development – Phase 1
COMPANY	Iranian Offshore Oil Company (IOOC)
CONTRACTOR	Iranian Offshore Engineering and Construction Company (IOEC)
PURCHASER	Any firm who buy services, material and/or equipment for execution of the project within a dedicated contract.
SUPPLIER	Any vendor, manufacturer who supply any Service, Material or Equipment for the project
SHALL	Refer to a mandatory requirement
SHOULD	Refer to a recommendation
MAY	Refer to one acceptable course of action

2. CODES AND STANDARDS

The design and construction of the Power Management System shall be in accordance with the current edition of the following IEC standards:

IEC 60044	Instrument Transformers: Current Transformers Voltage transformers.
IEC 60051	Direct acting indicating analogue electrical measuring instruments and their accessories
IEC 60255	Electrical Relays
IEC 60269	Low voltage fuses for voltages up to and including 1000V ac and 1500V dc
IEC 60439	Low voltage switchgear and control gear assemblies
IEC 60445	Identification of equipment terminals and terminations of certain designated conductors including general rules for an alpha-numeric system.
IEC 60529	Degrees of protection provided by enclosures (IP Code)



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- IEC 60898 Miniature and moulded case circuit breakers
- IEC 61000 Electromagnetic Compatibility.
- ISO 9001 Quality System - Model for quality assurance in design / development, production, installation and servicing

3. REFERENCE DOCUMENTS

- LRSL-R1X-EL-SD-001 Overall Single Line Diagram
- LRSL-000-EL-DB-603 Electrical Design Criteria
- LRSL-000-EL-SP-619 Specification for Gas-Generator
- LRSL-R1X-EL-LI-001 Electrical Load List
- LRSL-R1X-EL-SM-001 Schematic diagram for MV Switchgear
- LRSL-R1X-EL-SM-002 Schematic diagram for LV Switchgear
- LRSL-R1X-EL-BD-001 Architectural block diagram for PMS
- LRSL-R1X-EL-LI-003 I/O list for PMS
- LRSL-000-MW-SP-673 Specification for Painting (Basic)

4. SCOPE OF EQUIPMENT SUPPLY

The Power Management System shall be complete with all accessories as defined in the material requisition, this specification and associated documents.

The VENDOR shall offer standard equipment to perform the duty stated in this specification and the material requisition. Any variations of the VENDORS standard package must be stated by the VENDOR, otherwise it will be assumed that all equipment offered is in accordance with this specification.

The VENDOR shall incorporate in his tender, details of previous contracts of similar design with proven reliability in service.

Equipment Manufacturing Record Books, Equipment Data Books, Operating and Maintenance Manuals are required.

With reference to the “Architectural block diagram for PMS” the general scope of hardware supply (but not limited to) shall be as follows:

- On Central Technical room of Service Platform (SP): Central control cabinet, including Main PMS controller with integral Human Machine Interface (HMI) unit and Remote IO with appropriate Analogue/Digital Input/output cards and communication link.
- On switchgear room of Service Platform (SP), Technical Building of Production Platform (PP), WHP1 and Drilling platform (DP): Local control cabinet, including Remote IO with appropriate Analogue/Digital Input/output cards and communication link.
- Any required FO, Serial link and Ethernet cable.



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- All required devices for load shedding, especially under frequency load shedding relay.
- Industrial Laptop.
- Any required modification on the existing switchgears to connect to PMS.

The VENDOR shall provide a separate price for installation, pre-commissioning, commissioning and start up the PMS in the field, including simulation tests to confirm satisfactory performance, and dynamic tests to demonstrate stability of the system on loss of generation in the absence of a short circuit.

5. SERVICE CONDITIONS

The Power Management System will be installed offshore, in non-hazardous, air conditioned and ventilated room.

The VENDOR shall recognize that service conditions specified could prevail during site storage and a HVAC failure.

Min. and Max. Temperature of site is 7°C and 45°C and Humidity is 100%. The atmosphere is to be considered saliferous as commonly encountered in offshore installations. The possibility of condensation, as experienced during large temperature fluctuations in a humid atmosphere, shall be taken into account.

Unless specified otherwise the environmental design conditions shall be as given in the project specification entitled.

Additional considerations are as follows:

- Rapid changes of air temperature and pressure shall be taken into account
- Equipment will be placed in a saline and corrosive atmosphere

6. DOCUMENT PRECEDENCE

It shall be the VENDORS responsibility to be, or to become, knowledgeable of the requirements of the referenced Codes and Standards.

The VENDOR shall notify the CONTRACTOR of any apparent conflict between this specification, the related data sheets, the Codes and Standards and any other specifications noted herein. Resolution and/or interpretation shall be obtained from the CONTRACTOR in writing before proceeding with the design/manufacture.

In case of conflict, the order of precedence shall be:

- Statutory Requirements
- Equipment Data Sheet(s)/Requisition
- This Specification
- IEC Codes and Standards
- VENDORS Quality Plan



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7. SPECIFICATION DEVIATION / CONCESSION CONTROL

Deviations from this specification are only acceptable where the VENDOR has listed in his quotation the requirements he cannot, or does not wish to comply with, and which the COMPANY/CONTRACTOR has accepted in writing before the order is placed.

In the absence of a list of deviations, it will be assumed that the VENDOR complies fully with this specification.

Any technical deviations to the Purchase Order and its attachments including, but not limited to, the Data Sheets and Narrative Specifications shall be sought by the VENDOR only through Concession Request format. Concession requests require CONTRACTORS and COMPANY'S review/approval prior to the proposed technical changes being implemented. Technical changes implemented prior to COMPANY approval are subject to rejection.

8. DESIGN REQUIREMENTS

8.1. General Description

The purpose of this document is to define the functional and construction requirements for a power management system (PMS). The PMS is required primarily to perform the function of load shedding in the event of gradual overload, under frequency or sudden loss of generating capacity.

Regarding load shedding, the PMS shall ensure that in any circumstances involving loss of generating capacity, there will be a rapid disconnection of loads on a pre-determined priority basis to result in continued stable operation of the power system on an optimum basis.

The PMS shall also ensure that optimum sharing of active and reactive load is achieved, covering all turbine generator normal operating conditions. At the same time, it is recognized that more accurate control of system frequency and voltage will be maintained by virtue of close control of the turbine governors and generator automatic voltage regulators (AVR's). The load sharing facility shall also, upon receipt of an appropriate initiating signal, automatically load or unload incoming or outgoing generators.

The main PMS controllers shall be complete with integral workstations (HMI) to aid programming, control, indication, annunciation and review of graphics.

8.2. Cubicle construction

Controllers shall be of sheet steel construction with a minimum thickness of 2mm, free standing, upright, naturally ventilated and designed for an IP42 degree of protection. The cubicles will be located indoors but the VENDOR shall design for the extreme environmental conditions specified.



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Cubicles shall be designed for front access. Rear access is not accepted for cubicles due to limitation of space. Access to terminals shall be made without shutting down. Warning labels shall be provided in prominent positions advising care to be taken when gaining access to live equipment.

Access doors shall be lockable from a common key. All doors and panels shall have gasket.

Cable access shall be provided for bottom entry only. Suitable undrilled, detachable gland plates of minimum thickness 5mm shall be provided.

All detachable sections, including gland plates, access panels, doors and mounting plates shall be electrically bonded to the cubicle main earth bar with SHF2 insulated green/yellow earth conductors of 6mm minimum cross-sectional area.

The VENDOR shall follow "Specification for Painting (Basic)" to method of panel work treatment and paint application. Also, color of panel shall be RAL7032

Space for the installation of future control relays, fuses, lamps and control switches etc. shall be provided to accommodate spare feeders of switchgears.

All cubicles shall be fitted with anti-condensation heaters suitable for operation at 230V, 1 phase, 50Hz and shall be individually protected and controlled by means of MCB's and RCDs.

The controller shall be supplied as one complete unit unless it is required to be sectioned for shipping and access. Lifting eye bolts (minimum 4) shall be provided to facilitate lifting and transportation.

8.3. Cubicle wiring

Internal wiring shall comprise copper conductors of minimum size 1.5 mm² and 600/1000V grade insulation.

All power and control cabling shall be numbered with ferrules for ease of identification.

Terminal blocks shall be arranged and positioned to afford ease of access for external cable terminations, testing, inspection and maintenance.

Internal wiring passing between sections shall be adequately protected against mechanical damage.

Terminals shall be clamp type mounted on DIN rails and shall be fully numbered in accordance with VENDOR schematic and interconnection drawings. 10% spare terminals and 10% additional spare space shall be provided. Spring pressure type terminals are not acceptable. For all wires and conductors, individual terminals shall be provided unless terminals are designed for more than one conductor. (No more than two conductors per terminal shall be allowed). All terminals shall be readily accessible.

Terminals for different A.C. voltages shall be barriered from each and completely segregated from DC. circuits. Terminals operating in excess of 50V shall be fitted with a protective cover and identified by a suitable protective warning label.



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Shorting links shall be provided for all incoming C.T. secondary circuits.

All outgoing terminals associated with digital alarms, status and analogue signals to the PCS shall be installed at a common point.

Signal wiring shall be screened and/or segregated, within the cabinet, where interference may affect accuracy.

Wiring shall be routed in vent flame retardant plastic trunking with adequate separation and sized so that no more than 50% of the cross sectional area is filled with conductors. Trunking shall be located so as not to interfere with access to any equipment and shall not encroach on space allotted to any future equipment. Trunking and terminals shall not be fitted in the area up to 150mm from gland plates.

8.4. Power Supply System

The following supplies will be available:

- Redundant 230VAC UPS, 1 phase, 50Hz, unearthed for technical room of Service platform.
- Redundant 230VAC UPS, 1 phase, 50Hz, unearthed for technical room of Production platform.
- Redundant 110VDC UPS, unearthed, for switchgear room of Service Platform.
- Redundant 110VDC UPS, unearthed, for switchgear room of Drilling platform.
- Redundant 230VAC UPS, 1 phase, 50Hz, unearthed, for WHP1.
- Single 230VAC Non UPS, 1 phase, for heater, lighting and socket of panels.

8.5. PMS Basic I/O Signals

I/O list of PMS is specified in document "I/O list for PMS". VENDOR shall consider IO list with 20% spare for built-in memory and terminal extension for future.

8.6. General Power Management Functions

The primary purpose of the Power Management System is to provide, by means of microprocessor-based technology, Supervisory Control and Monitoring for Gas Turbine Generators and Diesel-Generators and Control and Monitoring functions for Load Management (Power distribution of whole plant).

PMS system shall consist of a Master Station linked to various Slave Stations.

Supplier shall provide furniture for the operator stations.

The specific primary functions required are:

- Graphical Display with mimic of the electrical system status and measured parameters.
- Supervisory Control and Monitoring of the Generators through Unit Control panel of generators.
- Load Shedding.



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- Automatic Load Reconnection.
- Indication of Electrical Analog parameters.
- Status Indication.
- Alarm handling and processing.
- Trending of Measured parameters.
- Control of Switching devices and communications

The synchronizing is not in scope of PMS.

8.6.1. Graphical Display and Operator station

Continuous display of the following information shall be provided.

- Mimic consist of Gas Turbine Generators, 6.6kV & 2.2kV switchgears, LV incomers, LV bus ties and Diesel Generator parameters.
- Analog parameters of Gas Turbine Generators/Emergency Diesel generator Control systems.
- Switchgear Tag No. for R1 and WHP1 Platforms are shown in PMS VDU.

Operator station shall consist of an up to date Industrial PC with the following as a minimum.

- Industrial 19" Display VDU.
- Dot matrix printer and color printer.
- CD/DVD ROM drive.
- CD/DVD writer.
- Industrial Mouse and Keyboard
- All necessary system Software along with backup.
- All necessary Communication hardware and Software along with backup.

8.6.2. Supervisory Control of Generators

The PMS system shall be provided with facility to emulate the controls of the Gas Turbine Generator and Emergency Diesel Generator Control Systems. The Controls shall include as a minimum Start and Stop of Generator.

All relevant analogue, status, data required for Control and shedding shall be obtained from the Generators Control Systems through communication link or hardwire (as applicable).

8.6.3. Load Shedding

The PMS shall perform the function of load shedding. All 6.6kV & 2.2 kV circuit breakers shall be made available for load shedding. Any one of the following conditions shall initiate load shedding:

- Failure of one generator
- Under frequency
- Overload of a generator



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The principle of load shedding shall be that the PMS shall compute the available (spinning) power generating capacity on a continuous basis. At the same time, the PMS shall monitor the load on each 6.6kV feeder.

During all load shedding operations, the PMS shall recognize the mode of operation, and act accordingly. The amount of load shed shall always be the optimum number of loads, of highest trip priority, to prevent cascade failure of the remaining generation system.

Electrical power system studies shall be performed during Detail Design and these will confirm the amount of load to be shed for each scenario. The amount of load shed shall be adjusted to reflect the results of the power system studies and operating conditions.

Minimum 5 step load shedding shall be defined in PMS system. The sequence of load shedding steps shall be easily changeable. The load shedding facility shall ignore load that is not connected.

Load shedding of a running drive or switchboard incomer shall inhibit the start-up of standby drive or switchboard auto transfer scheme. The load shedding system shall recognize a momentary overload (such as during large motor starting). It shall compare the overload capabilities of the connected generator sets and the margin of the overload. If the amount does not exceed the connected generator set capability and is within the preset time interval, no action shall be taken.

On detection of the closure of a load circuit breaker, the load management system shall increase generation capacity to allow for transient starting inrush current (permitting momentary overload for a preset percentage overload for a preset time-if necessary) thus avoiding initiation of load shedding during this transient period.

8.6.3.1. Failure (Tripping) of one generator

The load shedding system shall continuously monitor the circuit breaker trip relay for each generator for the first indication of the generator set fault. The memory within the load shedding system shall be continuously updated with the reserve capacity and the magnitude and distribution of the load.

On detecting a fault, the system loading prior to the disturbance shall be compared with the remaining compensated peak generating capacity (after the removal of the faulted set) to determine the size of the excessive overload which could result. (The data required to perform this calculation shall be in the memory of the microprocessor).

The system shall then decide the number of loads, which need to be tripped, to prevent excessive overloading on the healthy generators, and output signals shall be given accordingly (Subject to priorities which will be given to maintain process integrity and safety).

The time elapsed from the initiation of trip relay to the opening of circuit breakers (up to the end of arcing) shall not exceed 175 ms.



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8.6.3.2. Under Frequency

If the frequency falls below the desired value for more than a short period (adjustable) the system shall respond by tripping load at intervals until the frequency recovers. In this regard, under frequency relays shall be provided in PMS system. The time elapsed from the occurrence of under frequency initiation (including under frequency relay operation) to the opening of circuit breakers (up to the end of arcing) shall not exceed 175 ms.

8.6.3.3. Overload of generator

The load shedding for overload shall be initiated by generator RTDs and current computation.

8.6.4. Automatic Load Reconnection

The Power Management system shall reconnect loads following successful start of a standby gas Turbine generator and load sharing.

The Power Management System shall:

- Check power availability and voltage level.
- Offer 'manual' or 'automatic' reconnection for distribution feeders only. If 'automatic' is selected the Power Management System shall systematically reconnect loads without exceeding allowable voltage drops.
- If 'manual' is selected it will reconnect each load without exceeding allowable voltage drops as they are selected by the operator.

Motors will receive start commands from the DCS. For starting of HV/MV motor feeders (from DCS), permissive signal shall be given from the PMS (after checking for power availability, voltage level and comparing with pre-determined voltage drop).

8.6.5. Analog Parameters

Gas Turbine Generator System

All salient parameters of the Gas Turbine Generator System which are required for Control, Display, Load shedding and Load Reconnection shall be obtained through the Communication link from the Gas Turbine Generator Control System.

Diesel -Generator System

All salient parameters of the Diesel Generator System which are required for Control and Display shall be obtained through the Communication link from the Diesel Generator Control system.

Feeder and Bus parameters

The following parameters shall be available in the PMS for Control/Display/Computation. These parameters may be obtained either from the numerical relays (if available) in the switchgear through



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Communication link. If facilities are not available, PMS Supplier shall provide suitable arrangements (like measuring units with communicating facility, transducers etc.).

- For 6.6kV/2.2kV incoming and outgoing feeders: Currents on all the three phases, Energy and Power (active and reactive).
- For each 6.6/2.2kV bus section: Voltages (RY, YB, BR).
- For each 6.6/2.2kV bus section: Frequency one phase.
- For each 6.6/2.2kV bus coupler: Current in all three phases.
- For LV incomings: Currents on all the three phases, Energy and Power (active and reactive).
- For LV coupler: Current in all three phases.
- For each LV bus sections: Voltages (RY, YB, BR).
- For each LV bus sections: Frequency one phase.

8.6.6. Status Indication

Gas Turbine Generator System

All salient parameters of the Gas Turbine Generator system which are required for Control, Display, Load shedding and Load Reconnection shall be obtained through the Communication link/Hardwire from the Gas Turbine Generator Control System.

Diesel Generator System

All salient parameters of the Diesel Generator system, which are required for Control and Display, shall be obtained through the Communication link/Hardwire from the Diesel Generator Control system.

Feeder and Bus parameters

The following parameters shall be available in the PMS for Control/Display/Computation. These parameters may be obtained either from the numerical relays (if available) in the switchgear through Communication link. If facilities are not available, PMS Supplier shall provide suitable arrangements (like input/out modules with communicating facility, etc.).

- For 6.6kV/2.2kV incomers, bus sections, outgoing feeders to transformers: ON, OFF positions, service position, Local remote selector switch positions, synchronizing switch positions (wherever applicable).
- For all LV incomer, LV bus tie circuit breakers and DG circuit breakers: ON, OFF positions, service position, Local remote Selector switch positions, synchronizing switch positions (wherever applicable).

8.6.7. Alarms handling and processing, permissive signals

Gas Turbine Generator/Diesel Generator Alarms: These shall be transmitted through communication link.



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Distribution system alarms: These shall be obtained through the relays or from the switchgear. These shall consist of protective device generated alarms, protective relays watchdog alarms, external alarms like DC failure, UPS failure, transformer alarms, etc.

PMS generated alarms: PMS generated alarms, like alarms pertaining to Load shedding and Load Restoration: The PMS shall have a self-monitoring facility to detect and alarm any internal fault and provide the alarm to DCS through communication link.

PMS shall also send signals to the respective MV or LV switchgear & DCS to block auto-changeover and block start-up of stand-by drive after Load shedding.

8.6.8. Trending

The system shall provide trending of measured parameters. These shall include as a minimum total generated MW, MVAR, MVA, bus voltages and bus frequencies.

8.6.9. Manual control of feeders from PMS

- ON and OFF all 6.6kV/2.2kV Incomers, Bus ties and outgoing feeders to transformers.
- ON and OFF LV Incomers and Bus ties.
- Control of Emergency DG Circuit breakers.

8.6.10. Time Stamping

All data acquired by the PMS or generated by the PMS shall be time stamped. The resolution of time stamping shall be less than or equal to 10 ms. Data communicated to DCS shall not be time stamped at PMS end.

8.6.11. Data Communication Arrangement

All necessary hardware and software on the PMS side for communication links between various PMS modules and Generator Control Systems, Diesel Generator Control systems, MV switchboards and LV switchboards should be provided.

Backbone fiber optic system should be considered between various platforms. The backbone system will be terminated in the patch panel of LER room at each platform.

The fiber optic system will be single mode fiber 1300nm wavelength.

The communication system between the PMS Master and Slave Stations shall be redundant radial.

The data communications between devices and to the PMS Slave Station shall be in the form a minimum of one ring per platform. Each ring shall be self-monitoring and self-reconfiguring such that any one open or short circuit fault (or failure of an optic fiber) will not affect Power Management System operation.



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Communication of PMS to DCS shall be redundant serial link RS485 Modbus RTU.

8.7. Security Access

Access to the PMS functions via the PMS workstations shall be protected on a priority basis by programmable passwords. The minimum priority levels are as follows (Priority 1 is highest level):

8.7.1. Priority 3 – Operator

This priority shall have access to:

- A. Start and stop generators
- B. Initiate breaker open/close commands
- C. Reset commands
- D. Initiate motor start inhibit overrides
- E. Change operator presets

8.7.2. Priority 2 - Supervisory/Maintenance

This priority shall have access to:

- A. Adjustment of alarm set points for main generator;
- B. Adjustment of load sharing set points for main generators;
- C. Revision of load shedding sequences and set points;
- D. Initiation of load shedding test sequences;
- E. Opening of MV bus sections
- F. Start inhibit load assignment values.
- G. Adjust PMS date and time
- H. All Operator access

8.7.3. Priority 1 - Engineering

Restricted to specialist Company/Vendor modifications only.

This priority shall have access to:

- A Access to commissioning mode
- B Access/control of diagnostic pages
- C Changing any level of user password
- D All Supervisor and Operator access

Access to the display/alarm/control systems at the operator station shall be controlled separately, but should be consistent with the above.



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9. TESTING

9.1. GENERAL

The VENDOR shall be required to complete a Factory Acceptance Test (F.A.T.) and Site Acceptance Test (S.A.T) on the PMS. The COMPANY shall attend any FAT and shall reserve the right to refuse release of the PMS, if in their opinion, the FAT results are unacceptable.

The VENDOR shall test the serial links between the PMS and PCS.

The PMS VENDOR shall supply a 'bitmap' to allow the PCS VENDOR to configure the communication with the PCS.

9.2. ACCEPTANCE TESTS

Testing and inspection shall comprise, but not be limited to, the items listed below together with any other tests considered necessary by the CONTRACTOR and/or the COMPANY:

- Pre-inspection meeting
- Visual and dimensional inspection
- Items/components check
- Loop and sequence test
- Insulation resistance test
- Complex loop and logic test
- Control /alarm/trend grouping test
- Electrical operation test:
 - alarm circuit test
 - protection device operation test
 - switching device test
- System shut down/reboot function test
- Performance, function test
- Communication interface test
- Raw Material Check
- Display Graphic Building Sketch Check
- Cabinet Structure Check
- Network Communication check
- MODBUS network Communication check
- Ethernet Bus network Communication check
- Load shedding functional test
- Redundancy Check
- Mechanical operation test
- Painting/preservation
- Manufacturer's data records
- Pre-shipment inspection (packing, marking, ...)
- Documentation review prior to release



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9.2.1. DOCUMENTATION AND CONSTRUCTION

A- Qualitative and quantitative checks on contractual and technical documentation.

B-Visual examination (appearance, paintwork, finish, welding, sheet metal, lifting rings, assembly bolt tightness, busbar tightness, conformity of torque tightness for main connections, wiring and internal cabling appearance, lining up of measurement instruments, remote-control and signaling, indicator devices and name plate).

C- Check for conformity and existence of rating plates, identification and name plates, notice boards and warning notices, identification of wiring, identification of terminals and terminal boxes, identification for earths, identification of phases by colors and any supplementary identification depending on specification stipulations.

9.2.2. FUNCTIONAL CHECKS

- A) Complete functional check (hardware and software).
- B) Check calibration of indicating instruments, alarm and controller set points.
- C) Simulation of status indications and alarms.
- D) Prove security access priority inhibits and method of resetting alarm and controller set points.
- E) Simulate load shedding sequence and measure response time for various gradual overload conditions, falling frequency and system overload due to loss of generation under all possible supply arrangements.
- F) Prove start inhibit interlocks for specified drives.
- G) Prove operation of load shedding with generation (by simulation).

10. QUALITY ASSURANCE / QUALITY CONTROL

The VENDOR shall have in effect at all times, a QA/QC program that clearly establishes the authority and responsibility of those responsible for the quality system. Persons performing quality functions shall have sufficient and well defined authority to enforce quality requirements, initiate, identify, recommend and provide solutions to quality problems and verify the effectiveness of the corrective action.

A copy of the VENDORS QA/QC program shall be submitted to the CONTRACTOR with its quotation for CONTRACTORS review and concurrence prior to award. If VENDOR'S QA/QC program and facility, where the work is to be performed, is ISO 9001: 1994 certified, then only a copy of the VENDORS ISO 9001: 1994 certificate is required. In addition, if VENDORS facility is ISO certified, CONTRACTORS QA audit requirements will be waived in favour of ISO 9001:



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1994 registrar audits, unless the CONTRACTORS trend analysis program indicates areas of concern.

The VENDOR shall identify in purchase documents to its SUBVENDORS all applicable QA/QC requirements imposed by the CONTRACTOR, and shall ensure compliance thereto.

On request, VENDOR shall provide objective evidence of its QA/QC surveillance of its SUBVENDORS activities.

The VENDOR shall submit certified reports of production tests as soon as the tests are completed satisfactorily.

The COMPANY/CONTRACTOR reserves the right to inspect materials and workmanship at all stages of manufacture and to witness any or all tests. The VENDOR, 30 days after award but prior to the pre-inspection meeting, shall provide the CONTRACTOR with a copy of its Manufacturing and Inspection Plan for review and inclusion of any mandatory COMPANY/CONTRACTOR witness points

11. DOCUMENTATION

VENDOR shall submit the type and quantity of drawings and documentation for CONTRACTORS authorization or information as listed in the individual Material Requisitions and Purchase Orders.

Mutual agreement on scheduled submittal of drawings and documentation for CONTRACTORS authorization or information as listed in the individual Material Requisitions and Purchase Order.

Comments made by CONTRACTOR on drawing submittal shall not relieve VENDOR or SUBVENDORS of any responsibility in meeting the requirements of the specifications. Such comments shall not be construed as permission to deviate from requirements of the Purchase Order unless specific and mutual agreement is reached and confirmed in writing.

Each drawing shall be provided with a title block in the bottom right-hand corner incorporating the following information:

- Official trade name of the COMPANY.
- VENDORS drawing number.
- Drawing title giving the description of contents whereby the drawing can be identified.
- A symbol or letter indicating the latest issue or revision.
- PO number and item tag numbers.
- Reshadat Renovation & Development Project number.

Revisions to drawing shall be identified with symbols adjacent to the alterations, a brief description in tabular form of each revision shall be given, and if applicable, the authority and date of the revision shall be listed. The term "Latest Revision" shall not be used.



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11.1. OPERATING AND MAINTENANCE MANUALS

In addition to the instructions in standard forms, the VENDOR shall comply with the following additional requirements for Installation, Operating and Maintenance Manuals.

- a) The front cover, spine and inside page shall state the purchase order number and VENDORS reference number.
- b) The inside front page shall carry and index listing the content of each section of the manual.
- c) Individual sections shall be complete and shall refer to equipment actually supplied.
- d) Published data shall also be included, including published data for bought in items.
- e) Full details of any special equipment shall be clearly set out in separate sections.
- f) A punch list of “do’s” and “don’t” shall be included.
- g) Full details for installation setting up shall be included.
- h) Recommendation test data shall be stated, covering initial and also regular testing, i.e. values for high voltage, A.C. or D.C. etc. shall be given.
- i) Items requiring regular inspection, checking, testing and maintenance shall be listed and the time scale clearly indicated.
- j) Important items shall be cross referenced to other parts of the manual as necessary.

11.2. DELIVERABLES

The following drawings/documents shall be submitted as a minimum, in the quantities and at the times stated in the Requisition:

- k) General Arrangement of the PMS panels showing main dimensions, front/panel views, cable access and weights.
- l) Detailed description and itemised parts list.
- m) Power requirements and heat emission.
- n) Single Line Diagrams, block diagrams.
- o) Schematic and connection diagrams covering all circuits.
- p) Type and special test certificates.
- q) Software Functional Specification, screen/mimic diagrams and I/O Schedule
- r) Preparation and Painting Specification.
- s) Schedule of recommended spare parts.
- t) Technical manual giving installation, operation and maintenance instructions.

12. SUBVENDORS

The VENDOR shall assume unit responsibility and overall guarantee for the equipment package and associated equipment.



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The **VENDOR** shall transmit all relevant purchase order documents including specifications to his **SUBVENDORS**.

It is the **VENDORS** responsibility to enforce all Purchase Order and Specification requirements on his **SUBVENDORS**.

The **VENDOR** shall submit all relevant **SUBVENDOR** drawings and engineering data to the **CONTRACTOR**.

The **VENDOR** shall obtain and transmit all **SUBVENDOR** warranties to the **CONTRACTOR/COMPANY** in addition to the system warranty.

13. HANDLING

13.1. PACKAGING AND SHIPPING

Preparation for shipment shall be in accordance with the **VENDORS** standards and as noted herein. **VENDOR** shall be solely responsible for the adequacy of the preparation for shipment provisions with respect to materials and application, and to provide equipment at the destination in ex-works condition when handled by commercial carriers.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the jobsite.

Preparation for shipment and packing will be subject to inspection and rejection by **COMPANY'S/CONTRACTORS** inspectors. All costs occasioned by such rejection shall be to the account of the **VENDOR**.

After inspection and test, equipment shall be completely free of water and dry before start of preparation for shipment.

Equipment shall be packed, securely anchored, and skid mounted when required. Bracing, supports, and rigging connections shall be provided to prevent damage during transit, lifting, or unloading. All temporary bracing/supports shall be marked "REMOVE BEFORE EQUIPMENT COMMISSIONING AND STARTUP".

Separate, loose, and spare parts shall be completely boxed. Pieces of equipment and spare parts shall be identified by item number and service and marked with **CONTRACTORS** order number, tag number, and weight, both inside and outside of each individual package or container. A bill of material shall be enclosed in each package or container of parts.

One complete set of the installation, operation, and maintenance instructions shall be packed in the boxes or crates with equipment. This is in addition to the number called for in the Purchase Order.



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13.2. PRESERVATION AND STORAGE

Equipment and materials shall be protected to withstand ocean transit and extended period of storage at the jobsite for a minimum period of 18 months. Equipment shall be protected to safeguard against all adverse environments, such as: humidity, moisture, rain, dust, dirt, sand, mud, salt air, salt spray, and seawater.