







## SPECIFICATION FOR SCADA HP02-00-IN-SPC-0002



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## 1. INTRODUCTION

### 1.1 Purpose of Document:

This engineering specification defines the minimum requirements for the design, manufacturing, supply, installation, inspection, testing (FAT and pre-commissioning), documentation and delivery of the SCADA system required for the HAI PHONG 2 Project. SCADA system shall be engineered and constructed in accordance with this Specification. In case of any conflict between this specification and contract, deviation list shall specify in writing and get approval by OWNER/CONTRACTOR.

### 1.2 Definition and Abbreviations



#### 1.3.1 Definitions:

Definitions used in this document are describe below:

PROJECT	HAI PHONG 2 PROJECT
OWNER	The Branch of Top Solvent (Vietnam) Limited Liability Company – Hai Phong Terminal
EPC CONTRACTOR	PTSC Thanh Hoa Technical Services Company

#### 1.3.2 Abbreviations

AC	Alternating Current
API	American Petroleum Institute
CPU	Central Processing Unit
CPP	Central Processing Platform
dB	Decibel
EMC	Electromagnetic Compatibility
FGS	Fire and Gas System
FAT	Factory Acceptance Test
FRS	Functional Requirement Specification
GUI	Graphical User Interface
HMI	Human-Machine Interface
I/O	Input/output
ICSS	Integrated Control and Safety System (PCS, SDS, FGS)
IOM	Installation and Operation Manual
IP	Ingress Protection
IPSEC VPN	Internet Protocol Security, Virtual Private Network
ITP	Inspection and Test Plan
LAN	Local Area Network
LCD	Liquid Crystal Display
MDR	Manufacturers Data Report
MPR	Material Purchase Requisition
MMS	Maintenance Management System
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
ODBC	Open Database Connectivity

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OLE	Object Linking and Embedding
OMM	Operation and Maintenance Manual
OPC	OLE for Process Control
P&ID	Piping and Instrument Diagram
PCS	Process Control System
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
RTDH	The Real Time Data Historian
RTU	Remote Terminal Unit
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition System
SDS	Shut Down System
SQL	Standard Query Language
SSL	Security Sockets Layer
UHF	Ultra High Frequency
VHF	Very High Frequency
UPS	Uninterruptible Power Supply

### 1.3 Scope of Work and Services



VENDOR shall responsible for design, engineering fabrication, testing, documentation, and delivery a completed of SCADA system. VENDOR shall furnish all components and ancillary equipment necessary to complete the SCADA system ready for operation safety and smoothly. In general, VENDOR's scope of work for the equipment, materials and systems specified shall include, but not limited to the following:

- Project Management
- Engineering Design
- Software License purchase and registration
- Configuring and/or programming
- Fabrication and Painting
- Interfaces to other systems if any
- FAT and works inspection
- Support Site Installation and termination
- SAT, Commissioning and documentation
- Training
- Start-up and Commissioning spares and special tools
- Recommended spares for two (2) year operation

### 1.4 System Overview

The function of the SCADA is to control and monitor the plant to continuously produce on-specification products.

The latest SCADA system will be utilized for this project, which operate on a MS Windows (Updated version) based platform.

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The control and data acquisition equipment shall be housed in the control building equipment room and other remote equipment rooms (if required) distributed throughout the plant.

## 1.5 Applicable Codes and Standards

All design, Engineering and Supply shall conform to the appropriate sections of the latest editions (with amendments) of the relevant Codes and Rules.

The following is the order of precedence of the documents:

- Project Documentation (Data Sheets, Drawings and Specifications),
- CLIENT General Specifications (if any),
- Local Codes and Standards,
- Applicable International Codes and Standards of the latest editions (IEC, API, ISO, etc.).

In case of conflict between documents, the most stringent requirement shall apply. Where no recognized standard exists, the **VENDOR** is to define and agree with **CLIENT** the requirements to be followed.



In all cases, the latest edition of the relevant Regulations, Codes, Guidelines, Standards and Specifications shall be used unless specifically indicated within this document.

### American Petroleum Institute (API)

API RP 505	Recommended Practice for Classification of locations for Electrical Installations at Petroleum Facilities. Classified as Class 1, Zone 0, Zone 1 and Zone 2
API RP 552	Transmission Systems
API RP 554	Process Control Systems

### International Electro Technical Commission (IEC)

IEC 60227	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V
IEC 60331	Tests for electric cables under fire conditions – Circuit integrity
IEC 60332-1	Tests on electric and optical fiber cables under fire conditions Part 1-1: Test for vertical flame propagation for a single insulated wire or cable – Apparatus.
IEC 60332-3	Tests on electric cables under fire conditions
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 60801	Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment
IEC 61000-4-2	Electromagnetic compatibility (EMC)- Part 4-2: Testing and

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	measurement techniques - Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3 : Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
IEC 61508	Functional safety of electrical/ electronic/ programmable electronic safety-related systems
IEC 61131-3	Programmable controllers - Part 3: Programming languages

#### **Institute of Electrical and Electronic Engineers (IEEE)**



IEEEC37.90.1	Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE 730	Standard for Software Quality Assurance Plans
IEEE 828	Standard for Software Configuration Management Plans
IEEE 1042	Guide to Software Configuration Management
IEEE C37.1	Definition, Specification and analysis of system used for Supervisory Control, Data Acquisition And Automatic Control.

#### **Instrumentation, Systems and Automation Society (ISA)**

ISA S5.1	Instrumentation Symbols and Identification
ISA S5.2	Binary Logic Diagrams for Process Operations
ISA S5.3	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems
ISA S5.5	Graphic Symbols for Process Displays
ISA 18.1	Annunciator Sequences and Specifications
ISA S51.1	Process Instrumentation Terminology
ISA S71.01	Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity
ISA S5.4	Instrument Loop Diagrams

#### **International Organization for Standardization (ISO)**

ISO 9001	Quality management systems - Requirements
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## 2. GENERAL INFORMATION AND REQUIREMENTS

### 2.1 Language and Units of Measurements

The content, references, attachments and any supplementary information for all engineering documents shall be in English.

Units of measurement for all engineering documents shall be in the System International (SI).

### 2.2 Design Criteria

All equipment shall comply with the relevant local and international recommendations. The VENDOR shall determine what equipment requires type approval by the local Authority and shall provide type approval equipment where necessary. This specification requires the design, construction and testing of the SCADA system to meet all requirements of the codes and standards.

### 2.3 System Environment / Site Conditions

Control rooms and equipment rooms will normally be an air conditioned environment. This area is specified as a 'non-classified Area' where hazardous area protection for electrical equipment will not be required.

These areas will be subject to the following conditions:

- Ambient Air Temperature: Min: 5deg C, Max: 45 deg C
- Relative Humidity: 85% -95% (maximum)

The SCADA system shall be installed in air-conditioned environment, but It shall be designed to operate under air-conditioning failure when the ambient temperature may reach 50 deg C with a relative humidity of up to 95%.

### 2.4 System Architecture

The SCADA shall comprise of the multiple module for distributed architecture with a microprocessor-based and data acquisition system interconnected to provide overall system functionality.

The SCADA shall be based on the inherent capabilities to integrate and exchange information with other systems and/or platforms if required via industry standard protocols.

### 2.5 System Spare Capacity, Loading and Expansion Requirements

#### 2.5.1 The system shall be designed so that after commissioning the spare capacity shall be available:



I/O Modules : 20% installed, wired and fully functional I/O of all types used I/O Racks  
: 20% fully wired spare rack

Terminal Blocks : 20% spare terminal blocks shall be provided in cabinets

System Cabling : 20% spare pairs over and above I/O module/rack spare require

Free Space : 20% Spare of space for future expansion



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2.5.2 The system communication network, processing capacity and/or memory shall also be design so as not to exceed 70% loading after commissioning (spare capacity to be included).

2.5.3 The system power supply units shall include 30% spare capacity over and above the required loading (including the spare capacities).

## 2.6 System Protection Requirements

The SCADA system shall support at least three different levels of system security for access control either via the use of a removable key and/or by entering password. It shall be possible to configure User-specified functions to each level.

Operator Level:

- This level shall permit to access operating display, trend, alarm/acknowledgment display, control, set points and any operator function, password shall be required.

Supervisor Level:

- This level shall permit to access all the operator functions as well as access to change alarm set points, loop ranges, turning parameters and system management function. Password and removable key shall be required.

Engineering Level:

- This level shall permit to access all entire data base, programming, functions and system security. Password and removable key shall be required.

## 2.7 System Electrical Requirements

The SCADA system shall be received one feeder 230 AC volts 50 Hz Uninterruptible Power Supplies:

- 230VAC +/- 1%, 50 Hz +/- 0.5% (UPS)

## 2.8 Design Life

The VENDOR shall provide all relevant information in relation to the design life and overall reliability of the equipment.



All equipment, materials and components shall designed for minimum life duration of 25 years.

## 2.9 Standard Hardware and Software

All systems provided shall compose of standard hardware, system software and firmware (those published in standard product literature, which can be configured to meet the project requirements).

The system's standard operating software shall not require modification to meet any of the project requirements.

The system software shall be the latest commercially released version at the time of purchase order.

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All necessary software licenses shall be provided.

## 2.10 Noise Limitation

Maximum noise emissions shall be in accordance with local and international legislation, Noise in Public and Residential Areas, QCVN 26:2010/BTNMT National Technical Regulation on Noise.

Noise levels shall be limited in order to:

Minimize the risk of hearing damage to personnel in work areas

Ensure that warning signals are audible

Allow adequate speech including telephone and radio conversations

Maintain working efficiency

The design of the facility shall minimize the noise levels to the lowest practicable. Maximum noise levels for external areas shall be 85 dB(A) measured at 1m.

The equipment located within equipment rooms shall not generate a noise level exceeding 45 dB at 1 meter, laterally, from the source and 1.5m, vertically, from the floor.

In general, noise shall be controlled via a cost-effective balance between equipment selection and the fitting of control measures. All adopted measures shall rationalize operational, maintenance and initial cost factors.

## 2.11 Electronics tools requirements

Document shall be used for submission of electronic file in addition to hard copy documents; when as-built documents are submitted, the latest revision of following software are applied.

- Microsoft word
- Microsoft excel
- Microsoft project
- AUTO CAD

All documents shall be written in English.



## 3. HARDWARE REQUIREMENTS

### 3.1 Operator Console

3.1.1 The workstation shall comprise of standard PC hard ware with capability of handle project scope graphic from a reliable, proven manufacturer. It shall provide all required operator interface capabilities for the remote control and monitoring of the plant.

3.1.2 Operator workstations shall be powered from an Uninterruptible Power Supplies (UPS).

3.1.3 The visual display units (VDU's) shall be as minimum LCD 24" diagonal screens with high

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resolution graphics, dedicated keyboard, and optical mouse. The VDU shall be flicker-free and glare-free. Standard VDU controls such as brightness, etc., shall be accessible to the operator.

- 3.1.4 Engineering workstation shall be a desktop style PC and it shall include all the functionality as specified for the operator console. In addition, it shall provide all of the Engineering tools necessary to configure, modify and verify system, include storage tool for period backup/restore system. Project database for loading or storing software, an alpha/numeric keyboard art and any other enhanced hardware features as required by the system.
- 3.1.5 The latest Antivirus software with license shall be installed on each workstation.
- 3.1.6 The Operator Work Station shall be provided buzzer for acting sound when normal alarms are activated, warning to operator.

**3.1.7 Existing Operator Console shall be modified as required to integrate new devices of the HAI PHONG 2 Project.**

### **3.2 Printers and Copiers**

Printer shall be provided to allow each operator console or Engineering workstation to have access to a printer for logging of alarm, system events, reports or any other information. A black and white laser printer, which supports A3/A4 size of paper, shall be connected to the control network, available to each workstation so that a copy of any display can be obtained.



*The existing Printer shall be used for Hai Phong 2.*

### **3.3 Control Processor Requirements**

- 3.3.1 These control processors shall be able to support multiple I/O modules.
- 3.3.2 The overall system performance shall, as a minimum, provide the following response times based on the actual system I/O loadings:
  - Analogue and digital control loops execution within 1 second.
  - Operator console command execute within 2 seconds.
  - Operator console refresh rate of 2 second or less.
- 3.3.3 In the event of total communication system failure, the controllers shall continue to operate with the last valid information received. In addition, each output shall be configurable to either maintain its current value or be driven to a predefined state on input or processor failure.

### **3.4 System I/O Requirements**

- 3.4.1 All Input /output signal modules shall have diagnostic function for fault detection (wire break, short circuit)
- 3.4.2 All digital inputs and outputs shall be individually fused or isolated to provide electrical input isolation. Digital outputs shall also be short circuit proof.
- 3.4.3 The SCADA shall support the following analogue input signal types:
  - 4 - 20 mA (Self powered) with support HART communication
  - 4 - 20 mA (Externally powered, floating or grounded)

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- 1 - 5 volts
- Thermocouple
- Resistance Temperature Detector (RTD)

3.4.4 Input isolation shall be provided for all I/O devices with external AC supplies or with grounded 4 - 20 mA signals

3.4.5 All analogue outputs shall be 4 - 20 mA with HART communication

3.4.6 Any control valves operating as split range, the signal shall be 4-20mA with split range functionality be programmed within the controller.

3.4.7 Digital inputs, the system shall support both normally open and normally closed contacts with circuitry to ensure that "chatter" or "bounce", encountered during contact closure, does not initiate an erroneous signal.

3.4.8 Digital input module should be considered to connect to the Field termination assemblies of the appropriate voltage level. The preferred voltage level is 24 VDC. Different voltage level shall not be mixed on the same module.

3.4.9 Digital outputs, the system shall support both solid state and relay contact.

### 3.5 System Communication Requirements

3.5.1 The SCADA software shall support open interfaces with other systems. Software shall employ a graphical user interface (GUI) as the human-machine interface (HMI) and shall be user-friendly, intuitive tool that facilitates ease of use for operating personnel to perform all system functions without any knowledge of operating system commands. The SCADA system shall support the use of "standards" commonly used in the Microsoft environment.

3.5.2 The SCADA system shall support digital communication with other electronic devices using industry standard links such as Modbus RTU/TCP, Profibus DP, Ethernet or OPC Protocol. Typically, serial communications will be used to interface to package vendor PLC.



3.5.3 The SCADA system shall interface with Tank Gauging system, Batch Controllers and Truck Scale system if applicable.

### 3.6 System Cabinet Construction Requirements

3.6.1 Cabinets to be mounted on sub-floor or floor suitably designed to with stand normal plant vibrations

Overall cabinet dimensions shall be 2mm thickness, the equipment cabinet height including 100mm plinth shall not exceed 2100mm, the width shall not exceed 800mm and the depth shall not exceed 800mm. The cabinet size and number of cabinets shall vary from site to site depending on the amount of equipment that is required to populate the cabinet at each location.

Cabinet shall be provided with double front and rear removable and lockable hinged doors. Main control cabinet finish being smooth and following the color table below:

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Description	RAL color	Finish
Exterior	7035	Semi-gloss
Interior	7035	Semi-gloss
Channel base	7035	Semi-gloss



- 3.6.2 Cabinet protection class IP 42 as minimum.
- 3.6.3 The cabinet layouts are to allow full and easy access for installation and maintenance requirements. Equipment shall not be mounted on panel side. Push buttons, Selection Switch, Indicating Lamp can be mounted on Panel door.
- 3.6.4 Cable access shall be bottom entry via suitable cable clamping mechanisms.
- 3.6.5 Utility power supplies shall be provided such as fluorescent Lighting and Fan.
- 3.6.6 The cabinet shall be provided separate one instrument grounding bar (IE).
- 3.6.7 The cabinet shall be provided Cabinet Alarm Signal to Operator Console as normal process alarm.

3.6.8 Existing Cabinet shall be modified as required to integrate new devices of the HAIPHONG 2 Project.

### 3.7 System Wiring Requirements

- 3.7.1 All wiring inside cabinets shall run in dedicated plastic ducts or wire ways and secured with plastic spiral wrapping or tie-wraps and anchors.
- 3.7.2 All signal wiring shall be single core with sufficient current carrying capacity. A minimum core size of 0.5 mm<sup>2</sup> for signal wire and 1.5mm<sup>2</sup> for power wire shall be used unless otherwise stated.
- 3.7.3 System card pins shall be interconnected with plug and socket type system cables and edge connectors. The sockets and both ends of the cables shall be labeled with the "Origin" and "Destination" tags.
- 3.7.4 Grounding cable for bonding between enclosures and enclosure metalwork shall be single core, stranded copper, PVC insulated, color YELLOW/GREEN with a cross sectional area of 10 mm<sup>2</sup>.
- 3.7.5 Wiring shall be identified using sleeve type markers at both ends. All wires shall have crimped lugs (bootlace type).
- 3.7.6 Wire passing through holes in panels shall be fully protected against abrasive damage by the use of grommets or bushes.
- 3.7.7 Within the cabinets the incoming field multi-pair cables shall terminate either sequentially onto terminals or directly onto the IS barrier terminals/Surge terminals.
- 3.7.8 Cable color of power supply and distribution signal shall be as follows:

Type	Description	Color
1	230 VAC (Line)	Brown

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Type	Description	Color
2	230 VAC (Neutral)	Blue
3	24 VDC Power Supply	Red
4	0 VDC Power Supply	Black
5	Discrete signal (24 VDC)	Yellow
6	Analogue signal (24 VDC)	Gray
7	Intrinsically Safe signal	Light Blue
8	Signal shield ground	Black
9	Safety ground	Green/Yellow
10	Intrinsically shield ground	Green

### 3.8 Other Requirements

- 3.8.1 The displays shall be based on LCD screens driven from standard SCADA workstation processors.
- 3.8.2 Screen shield of cable shall be connected to Grounding Point
- 3.8.3 **All the additional equipment and components shall be seminal with the existing equipment and components for the manufacture and model.**

### 3.9 Identification

- 3.9.1 All SCADA cabinets shall be clearly labeled at the front and rear side of the cabinets, identifying the UNIT's controlled. The label shall be engraved laminated plastic with WHITE background and BLACK lettering 10 mm high, e.g.



<p style="text-align: center;">SYSTEM CABINET-&lt;SERVICE&gt; &lt;CABINET NO.&gt;</p>
---

- 3.9.2 Instrument and accessories mounted inside the panel shall be provided with similar nameplates. General Labels shall have BLACK lettering on WHITE background.
- 3.9.3 Danger or warning labels shall have RED lettering on WHITE background. In general text shall be 5 mm high. Label shall be secured by either stainless steel screwed or suitable adhesive.
- 3.9.4 Label carrying warnings or safety related information shall have RED lettering on WHITE background and shall be engraved in the English.
- 3.9.5 Labels are required for isolator, Power supplies, switches and etc.

## 4. FUNCTIONAL REQUIREMENTS

### 4.1 Process Control and Data Acquisition Requirements

- 4.1.1 The system process control functions shall be performed by predefined following:
- Control algorithms such as PID, ratio control, gap control, etc.
  - Computational algorithms such as addition, subtraction, etc.
  - Logic algorithms such as "AND", "OR", Set/Reset, etc.
  - Shall be included with Batch control function

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4.1.2 Sequential, timed and computational control program shall be supported via a high level programming language. The following typical functions shall be supported:

- Expressions such as "Equal To", Not Equal To, etc.
- Mathematical functions
- Timer related functions
- Counter/Pulse related functions
- Logic type functions.

4.1.3 The system shall also support logic control program where the grouping/linking of various logic functions shall provide the required functionality. The following typical function shall also support

- Logic functions such as "AND", "OR", etc.
- Timer related functions
- Counter/Pulse related function

## 4.2 Graphic Display Requirements

4.2.1 Graphic displays can be divided into “standard” and “custom” types. The custom graphic display details a schematic presentation of the plant at different levels, from overview level right through to equipment detail level. The standard graphic displays provide the operator with a standard format for displaying information and are configurable and normally accessible from dedicated function keys.

4.2.2 The graphic displays shall provide a complete window to the plant for all control and monitoring requirements (about 15 pages include graphic and report).

4.2.3 The real time data within these displays shall be automatically updated without the need for operator action with a configurable refresh rate of one seconds or less.

4.2.4 The following standard type of graphic displays shall be provided and accessible from dedicated function keys:



4.2.5 Loop (Faceplate) Displays: the loop display shall contain, in engineering units and bar-graph format, the process variable, process/alarm set point and loop output values. In addition, all control and configuration parameters including tuning constants shall be displayed. All adjustable parameters shall be changeable from within the display.

4.2.6 Group Displays: Predefined and operator configurable group displays should consist of approximately at least eight loops displayed in similar format as in Loop displays. Configuration parameters shall not normally be changeable from within this display.

4.2.7 The flexible custom graphic display shall include, as a minimum, the following:

- Hierarchical display relationship for ease of movement.
- Display capacity of at least 200 dynamic elements per graphic including calculated values.



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- Symbolic presentation of data by means of change in color/shape and/or flashing.
- Configurable data/numeric format including color.
- Unique color combination display capability for multi-state devices.
- Suppression of inactive status messages and/or alarms.
- At least two different text/data sizes.
- Movement of displays from one screen to another.

4.2.8 The system shall support windows technology which shall, as a minimum, provide the following added features:

- Displaying data from other window devices connected to the SCADA/workstation
- Displaying multiple sets of data on a single screen.
- Display resizing, repositioning including reduction to icon size.
- Running other standard software packages such as Microsoft Office etc.

### 4.3 Alarm Management Requirements

4.3.1 The alarm management system shall be a fully configurable system capable of processing all alarms in an appropriate manner to maximize the information provided, but to minimize the number of alarms displayed.

4.3.2 In order to minimize the number of alarms, grouping, suppression and/or filtering techniques shall be available. Suppressing and/or filtering of alarms shall include:

- Automatic suppression of individual and/or groups of alarms based on the occurrence of a pre-selected alarm or event.
- Automatic disabling of alarms based on the associated equipment running status.

4.3.3 Each alarm point shall be capable to be configured at least three different alarm priority levels in order to discriminate between critical, non-critical alarms and information/status.



4.3.4 Each alarm shall activate an audible and visual alarm at the configured operator console. The alarm shall be displayed on the alarm summary and on the respective graphic displays. In addition, each workstation screen shall display a warning that a point is in an alarm state including the number of unacknowledged alarms.

4.3.5 All alarms and first out alarms from other machinery packages shall be time stamped with a resolution of at least one second. Both the alarm occurrence and acceptance times shall be recorded.

4.3.6 All alarms and associated information shall be stored on the mass data storage medium for historical purposes.

4.3.7 All alarms configured to be logged shall automatically be printed at the assigned alarm printer and in the event of a printer malfunction; the alarm system buffer shall be able to store up to 200 alarms while the printer is restored to normal.



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4.3.8 All devices connected to the communications network shall be monitored for failure. An alarm indication shall be generated for each failure detected. System alarms shall be logged separately from the process alarms.

#### 4.4 History Data Collection and Trend Requirements

4.4.1 The real time and historical data collection facility shall be fully configurable and shall, as a minimum, contain the following for each event:

- Tag/ID Number
- Tag Descriptor
- Time and Date of Event
- Event Value/State
- Type of Event
- Long term data for Trend

4.4.2 The following events shall automatically be recorded:

- Process Events: Points going in and out of alarm, Points changing state, Equipment state changes, Sequence of event records
- Operator Events: All operator action affecting the process.
- Engineering Events: All engineering actions changing the control and monitoring of the process.
- System Events: All system event errors and failures.

#### 4.5 Report Generation



4.5.1 The system shall include a report generation facility to produce both pre- formatted and customized reports.

4.5.2 Pre-formatted report shall use the system's standard facilities for hourly, shift, daily and monthly averages.

### 5. MODIFICATION IN EXISTING SYSTEM

Vendor shall verify and reconfirm spares and space availability for new additional equipment, instruments or equipment during engineering detailed design and get prior approval from "OWNER/CLIENT" before using the existing spare. The following description is provided as a guideline to get an overview scope of work modification to the existing system. It is the responsibility of "Vendor" to ensure all components, hardware, software and services are included to complete the required work modification.

The system spare capacity after modification shall comply with the requirement in section 2.5.

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## 5.1 Scope of Work Modification

Vendor shall do all following activities (but not limited to) for the work modifications identified in this document and other related modification documents as follow:

- 1) To develop all necessary design drawings / documents as VDRL and modifications strategies and provide it for “OWNER /CLIENT” approval.
- 2) Generate specifications for new components and all related components and accessories if required and provide for “OWNER /CLIENT” approval.
- 3) To Procure and install the new Components and necessary accessories related wherever identified.
- 4) Reconnect existing and install necessary cabling and wiring for all the modifications identified in this document and new cablings, where applicable.
- 5) To Procure and install cabling, accessories if the existing cabling for components being installed are not in good conditions.
- 6) To Procure and install all necessary hardware system like IS barriers, I/O modules Hart multiplexer, Signal Splitters, etc., if required.
- 7) To Procure and install necessary cabling and wiring for all the modifications identified in this document and other related modification documents. This includes field cabling, wiring inside Marshalling cabinets, System cabinets, Power Distribution Boards and other cabinets related.
- 8) Do necessary additions and software work modifications in configurations (like change range setting, new signals added, unit change etc.); and also, logic programmable as well as, graphic modifications and other additional work required in existing systems
- 9) Do loop and interlock and all function checking related to the system.
- 10) Proceed all testing requirements related to engineering design practice. Vendor is required to contact other System Vendor (if any) to provide interfacing list and / or other information related to Vendor scope of work for smooth operation and modification.
- 11) Any item not described or expressly set forth herein, but necessary to complete the work to the true intent and meaning of the specifications, shall be furnished by Vendor without extra cost.

## 6. PROJECT MANAGEMENT

The VENDOR shall provide project management services as required to maintain the project schedule and quality of work prescribed within this Technical Specification.

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## 6.1 Risk Management

The VENDOR shall use risk management procedures to identify and quantify cost and delays in terms of human and environmental safety. The VENDOR shall devise and implement strategies to avoid or minimize the impact of serious risks.

## 6.2 Reviews and Meetings

The VENDOR shall conduct design reviews by running a series of meetings with the PURCHASER and others to finalize and freeze the "Approved System Design". These meetings will take place periodically until the system design is approved; only then, may procurement, installation, and construction works start.

During the construction phase, the VENDOR shall conduct regular meetings with the PURCHASER to inform the PURCHASER on the general status and progress of the project.

## 6.3 Reports

The VENDOR shall submit a monthly progress report to inform the PURCHASER of the project status and progress for that month, three working days prior to any progress meeting. All project related issues will be discussed here, e.g. technical, procurement, variations, financial, documentation status and QA / type approval/certifications status.

These reports shall briefly outline major works completed and planned as well as changes to costs and events that may impact on overall project cost and milestones.

Full explanations shall be provided for any changes to schedule. Actions taken or planned to overcome cost overrun and schedule delays shall be described.

## 6.4 Work Schedule

The VENDOR shall provide planning charts with milestones and completion dates. This schedule shall be updated regularly by the VENDOR with actual progress.



The work schedule shall provide sufficient detail to identify all project deliverables and identify PURCHASER related activities to ensure adequate communication and coordination between all parties.

## 7. FACTORY ACCEPTANCE TESTING

The SCADA shall be subjected to rigorous inspection and testing throughout its manufacture, commissioning and operation. On completion of manufacture, VENDOR shall assemble the complete new equipment as a freestanding system in their works. This shall include system cabinets, , operator interface console and others related system equipment.

The VENDOR shall carry out a 100% test to demonstrate that each I/O in the cabinet is correctly inputted on the system and all functions operate correctly.

The VENDOR shall provide suitable portable test equipment to test these interfaces at the

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relevant third party VENDOR's works. The extent of these test requirements shall be advised during detailed engineering.

The VENDOR internal FAT must be executed similar to the FAT ie all points shall be checked by VENDOR and not only spot checks. The internal software FAT shall be shown in the Schedule.

The FAT shall include performed items as below, but is not limited:

- To verify that hardware architecture, quantities, dimensions, painting, etc. are in accordance with the relevant documents. Furthermore, software licenses, spares and consumables shall be checked.
- To verify that the wiring is in accordance with the guidelines given by the project specification and approved documents.
- To verify 100% of each I/O type for in the cabinet is correctly for loop test, Control function test and interlocking function test.
- To verify that the system has no problems to start up, recover from a power failure and perform on-line loading. Furthermore, it shall be verified that the system is operating within the given limits.
- To verify the announcement of system related failures, cabinet alarms and system generated alarms to appear on system.
- To verify the operation and monitoring of redundant component.
- To verify the functionality of standard and graphic display arrangements in accordance with the specification.



## 8. INSTALLATION AND TESTING

On delivery to site, the equipment shall be installed and powered up. It shall be arranged as a freestanding system and prior to any field connection. The Site Acceptance Test (SAT) shall be carried out to confirm the equipment that is functioning correctly and has not suffered transit damage. The SAT is not a full repeat of the 100% I/O FAT; however, when do the function test and commissioning, 100% I/O shall be test.

The VENDOR shall supervise the installation of their equipment. The SAT is performed to prove the functionality of the system after delivery and installation.

The relevant equipment shall be delivered to the site and properly installed. The following items shall be completed during the installation:

- Controllers, I/O cards, cabinet and operating/engineering stations shall be completely installed.

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- Power supply installed for the relevant equipment being tested.
- Grounding system installed for the relevant equipment being tested.
- Network communications installed (for example, hubs, switches, fiber optics, Ethernet).
- Software inventory check (correct Firmware, latest updated software...)
- Start-up/initialize relevant equipment and perform diagnostic check

## 9. COMMISSIONING TESTING PROCEDURE

The VENDOR shall develop a commissioning test procedure for each site. This document shall provide procedures that demonstrates and verifies that the installed system fully complies with the project requirements. The commissioning test procedure shall be similar to the ones produced for the FAT and shall include, but not be limited to the following:



- Description of prerequisite tests and measurements;
- Results to be achieved;
- Example test forms;
- List of all required test equipment;
- Schedule of tests.
- Test forms prepared by the VENDOR shall include:
- Test date;
- Results;
- Observations;
- Minor deviations;
- Name and signatures of VENDOR and EMPLOYER witnesses.

## 10. TRAINING

Training of the SCADA system has incorporated in the VENDOR scope of supplied.

The VENDOR shall provide suitably experienced and qualified personnel to train OWNER's personnel in both maintenance and operation of the SCADA. The training program shall be covered but not limit to the following topics:

- Introduction to overall system
  - System Architecture
  - Functionality
-

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- Hardware and software requirement
- Data Communication
- System and Network Configuration
- Interfacing with other systems
- Human Machine Interface and alarm history
- Operation, Testing and Maintenance
- Diagnostic and Troubleshooting

Training shall be carried out by VENDOR facilities and shall also be included the provision of support documentation.

## 11. SPARE PARTS AND SPECIAL TOOLS

The VENDOR shall provide project management services as required to maintain the project schedule and quality of work prescribed within this Technical Specification.

### 11.1 General

VENDOR shall provide in Tender the recommended spare parts and priced lists for commissioning and operational spares as well as special tools for the equipment specified herein to cover the commissioning and start-up and the first two (2) years of operation.

### 11.2 Commissioning Spares

Commissioning spares should largely comprise of consumable items and spares estimated by the VENDOR. The VENDOR shall propose the commissioning spares which comprise of consumable item and spares that may be required during the commissioning works.

### 11.3 Operational Spares

Replacement parts shall be the responsibility of VENDOR during the Defects Liability Period.

VENDOR shall provide a two-year list of operational spares.



The quantities of spares provided shall be based on the expected reliability figures of each item.

VENDOR shall assure from equipment manufacturers that spare components and expansion module or units will be available for a minimum period of fifteen years after Final Acceptance.

### 11.4 Special Tools

In case special tools are required, VENDOR shall provide a priced list of all special tools for the installation and/or maintenance of the equipment with Tender. Special tools shall be purchased at the PURCHASER's discretion.

Prior to shipment, each special tool shall be tagged with stainless steel tags indicating Purchase

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Order number, identification of the tool and equipment that the tool relates to.

## 12. WARRANTY AND PERFORMANCE GUARANTEE

Vendor shall warranty of the design, materials and fabrication of the equipment to be free from defect and meet the specification.

The guarantee certificate shall be issued by vendor to cover the guarantee period.

Should the equipment or any parts thereof be repaired or replaced to fulfill the foregoing guarantee, vendor shall renew the guarantee period of that equipment or parts, which is Twelve (12) months from operation completion date.

Unless otherwise agreed, all equipment shall be guaranteed as follows:



- All equipment shall perform satisfactorily under the specified operating conditions detailed on the data sheets, and shall be fit for the intended purpose.
- All hardware and software supplied shall be guaranteed free from defects.
- All workmanship shall be guaranteed free of defects and in accordance with the best industrial standards and practices.
- VENDOR shall guarantee the operation of the system to be in full compliance with the specification, including all attachments and listed specifications, codes and standards.
- VENDOR shall guarantee the mechanical and structural integrity, workmanship and the materials of construction used.
- Under the warranty, VENDOR shall replace all hardware, software and subsystems that are found faulty due to defective devices, workmanship, engineering or programming during the warranty period at no cost to PURCHASER. VENDOR shall, if required by PURCHASER, supply the services of an experienced technician to supervise the necessary repairs and replacements.
- The warranty and Performance Guarantee shall be twelve (12) months from the date operation completion of Plant.

## 13. PRESERVATION, PACKING AND SHIPPING

VENDOR is only permitted to ship equipment and materials to site upon successful completion and acceptance of the FAT. Shipping shall include the following:

- Packing and crating for international shipment.
  - Insurance to site.
  - Customs and excise formalities and duty charges at both source and destination ports.
-



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- Transportation from entry port to site within Vietnam.
- Temporary in-country storage, if required.
- Expediting delivery to site.
- Packing list for each box crate

It shall be possible to store the packaged equipment in a non-air-conditioned environment for a period of three months.

## 14. DOCUMENTATION

### 14.1 General

Documents shall be submitted in accordance with the Vendor Data Requirements List attached to the Technical Requisition Document.

Submission of documents shall be made under cover of a transmittal, marked for the attention of VENDOR Data Control and referencing the Purchase Order.

All quantities and dimensions shall be expressed in metric units. All information, manuals, certificates, data and inscriptions shall be in the English language.

All documentation shall be forwarded to PURCHASER's nominated address.

Fabrication of any equipment shall not commence until the PURCHASER has reviewed and approved calculations, drawings and any other design documentation.



### 14.2 Design Information

#### General

Documentation shall include functional and detail design documents that are developed in conjunction with the VENDOR. These documents represent the agreed system definition prior to the beginning of fabrication. The detailed design documentation shall be provided for all equipment and application provided, but is not limited to the documentation of the Technical requirement:

- List of equipment and accessories on system drawings
- System overview drawings, cabinet and console layout and arrangement drawings
- Module arrangement, insert drawings and internal arrangement drawings for all system cabinets
- Outline dimensions, mounting details, interconnection drawings, cable lists, weights, heat loads and power requirements for all equipment
- Itemized cable list with cable lengths, to/from destinations and cable identification



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- Detailed power distribution diagrams for all power levels within the system including circuit breaker power entries, plug and strips for power distribution within workstations and system cabinets
- Electrical connection drawings
- Detailed grounding diagram for the system
- Manufacturers data report (MDR)
- Operation and maintenance manual (OMM)
- Test plan
- An index of all documentation provided for the system.

### **Configuration**

All documentation for configuration, programming and other related project engineering services shall be provided. As a minimum these shall include:

- System configuration diagrams and workstation assignments.
- Source code for all application code written for this system.
- Cross reference listings of tags, tag descriptors and addresses for all elements of the system.
- I/O assignment list.
- Copies of graphics and printouts of reports and logs.
- Documentation of completed FAT, SAT test results.



### **Application Software**

All application software shall be well documented. Word processor files of all application software documentation shall be provided on CD ROMs in addition to printed descriptions.

Software coding and documentation shall be in English, including code syntax and comments in the source code, and error messages.

The following shall be provided for all control strategies to supplement the representations of applications on software listings, instrument loop diagrams and P&ID's:

- Functional diagrams
  - Narrative descriptions of strategy and functionality, and engineering information including derivations of constants.
  - Implementation description for all elements, control processor blocks or high level language programming elements.
-

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### 14.3 Manufacturer Data Reports

A Manufacturer's Data Report (MDR) book shall be compiled concurrently with fabrication such that a full record of the fabrication, materials, inspection and testing is available. The report shall be available for the Inspector's review at any time. All items in the Manufacturer's Data Report shall be numbered and combined separately for each piece of equipment. Contents shall include, but not be limited to, the following:

- Front cover sheet with Project Title, PO No, Package Title, Package No.
- Inspection and Test Plan
- Inspection and Test Records
- Performance Test Reports
- Commissioning Records and Calibration Sheets
- Material Test Certificates (Mech. & Instruments)
- Hazardous Area Equipment Certificates
- Drawings and Calculations

### 14.4 Installation, Operation and Maintenance Manual

Installation, Operation and Maintenance Manual (IOM) shall contain as a minimum:

- Front Cover Sheet with Project Title, PO No., Package Title, Package No.
- Assembly and Installation Instructions
- Commissioning Instructions
- Operating Procedures; including Start-up, Operation and Shutdown
- Maintenance Requirements and Procedures
- List of Parts (Bill of Materials)
- List of special tools
- "As-built" Drawings.

## 15. SERVICE CONTRACT

In case request, a service contract for 1 year after system acceptance shall be provided. This shall include, but not limited to, all system upgrades, call in maintenance support (24 hours per day, 7 days a week) within 2 time zones of Vietnam, a site follow up visit to check the performance of the SCADA System and perform routine maintenance on the system, and assist loading any upgrades.