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				ESUP		

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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	SEP/18/18								
DESIGN	ESUP								
EXECUTION	GNIEDU								
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SUMMARY

1 INTRODUCTION.....3

2 REFERENCE DOCUMENTS, CODES AND STANDARDS5

3 ENVIRONMENTAL AND OPERATING CONDITIONS6

4 GENERAL6

5 OVERVIEW6

6 MAIN COMPONENTS8

7 MINIMUM HARDWARE AND SOFTWARE REQUIREMENTS11

8 SOS SERVERS PANEL.....15

9 PERFORMANCE REQUIREMENTS16

10 SCOPE OF SUPPLY16


11 DOCUMENTATION16

12 ACCEPTANCE TESTS17

13 WARRANTY.....18

14 PACKING REQUIREMENTS.....19

PRELIMINARY

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 3 of 19	
			NP-1
			ESUP


1 INTRODUCTION

1.1 Object

- 1.1.1 This technical specification describes the minimum requirements and basic characteristics for the design and supply of the Supervision and Operation System (SOS), part of the Automation and Control Architecture of the UNIT.
- 1.1.2 The main hardware components of the SOS are: Real Time Data Servers (RTDS), Historical Data Servers (HDS), Human Machine Interfaces (HMIs), Servers Panel, Supervisory Network Switches and Panel, Engineering Workstation, printers and all accessories – software, switches, routers (if applicable). CONTRACTOR shall be responsible to supply and interface the SOS with CSS PLCs and other systems.
- 1.1.3 The main software components of SOS are: the Operational System of each computer and the Supervisory Software modules, which vary depending on the functions of the computer they are installed in.

1.2 Definitions


UNIT	FPSO (Floating, Production, Storage and Offloading), FSO (Floating, Storage and Offloading), SS (Semi-Submersible) or Fixed Offshore Unit.
PACKAGED UNIT	An assembly of equipment supplied interconnected, tested and operating, requiring only the available utilities from the UNIT for the PACKAGE operation.
PACKAGER	The responsible for project assembly, construction, fabrication, test and furnishing of the PACKAGE.
MANUFACTURER	The responsible for fabrication of equipment or components internal to the PACKAGE.
MODULE	The metallic structure suitable for lift and transport, where PACKAGES and equipment will be installed, being supplied completely mounted and precommissioned.
BIDDER	The responsible for the lift, hook up, installation and integration of all MODULES on the UNIT Hull.
CONTRACTOR	Entity responsible for the whole supply of Automation Systems delivered as an integrated solution.
PURCHASER	The Company designated as such in the Contract or the Purchase Order.

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 4 of 19	
			NP-1
			ESUP

1.3 Abbreviations

1.3.1 The following abbreviations are used in this document:

A&C	Automation & Control
AEPR	Automation & Electrical Panels Room
AFDS	Addressable Fire Detection System
ALARM	Alarm Management System
AMS	Asset Management System
CCR-EA	Central Control Room – Equipment Ambiance
CCR-OA	Central Control Room – Operation Ambiance
CCTV	Closed Circuit Television System
CLOTS	Control Loops Optimization and Tuning System
CMS	Corrosion Monitoring System
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
CSS	Control and Safety System
CPU	Central Processing Unit
DVD	Digital Video Disc or Digital Versatile Disc
EMI	Electromagnetic Interference
FAT	Factory Acceptance Test
FGS	Fire and Gas System
FMS	Flow Metering System
HDS	Historical Data Server
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air-conditioning
I/O	Input/Output
KVM	Keyboard, Video, Mouse (remote connection adapter)
LAN	Local Area Network
LCD	Liquid Crystal Display
LCF	<i>Lista Contratual de Fornecedores</i> (vendor list)
MAC	Media Access Control
OLE	Object Linking and Embedding
OPC	OLE for Process Control
PAS	Package Automation System
PC	Personal Computer
PCS	Process Control System
PI	Plant Information
PLC	Programmable Logic Controller
PSD	Process Shutdown System
RAID	Redundant Array of Inexpensive Disks
RM-OSI	Recommended Model for Open Systems Interconnection
RTDS	Real Time Data Server
SAT	Site Acceptance Test
SOS	Supervision and Operation System
TCP/IP	Transmission Control Protocol/Internet Protocol
UPS	Uninterruptible Power Supply
VLAN	Virtual Local Area Network

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 5 of 19	
		NP-1	
		ESUP	

2 REFERENCE DOCUMENTS, CODES AND STANDARDS

2.1 External References

2.1.1 International codes, recommended practices and standards:

IEC – INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC	61000-4	ELECTROMAGNETIC COMPATIBILITY (EMI) SERIES
IEC	62381	AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY- FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT) AND SITE ACCEPTANCE TEST (SIT)

IEEE – INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

IEEE	802.3	STANDARD FOR CSMA/CD (ETHERNET) BASED LANS
IEEE	802.1Q	LOCAL AND METROPOLITAN AREA NETWORKS—MEDIA ACCESS CONTROL (MAC) BRIDGES AND VIRTUAL BRIDGE LOCAL AREA NETWORKS
IEEE	802.1S	STANDARD FOR VIRTUAL BRIDGED LOCAL AREA NETWORKS
IEEE	802.1W	STANDARD FOR LOCAL AND METROPOLITAN AREA NETWORKS— COMMON SPECIFICATIONS PART 3: MEDIA ACCESS CONTROL (MAC) BRIDGES — AMENDMENT 2: RAPID RECONFIGURATION

2.1.2 Classification Society

2.1.2.1 The detailed design will be submitted to Classification Society approval. The design and installation shall take into account their requirements and comments.


2.2 Internal References

2.2.1 Project Documents

I-ET-3010.00-5140-700-P4X-003 - I-ET-3010.00-1200-800-P4X-002 -	ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGED UNITS
I-ET-3010.00-5520-861-P4X-002 - I-ET-3010.00-5520-800-P4X-001 -	CONTROL AND SAFETY SYSTEM – CSS SUPERVISION AND OPERATION SYSTEM (SOS) SCREENS

2.3 Order of Precedence

2.3.1 To minimize doubts and solve conflicts amongst project documents, the order of precedence for the SOS requirements shall be:

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 6 of 19	NP-1
			ESUP

- This specification;
- Other Project documents listed above (see item 2.2.1);
- Codes and Standards.

2.3.2 It shall be CONTRACTOR responsibility to inform the PURCHASER about any discrepancy between documents. CONTRACTOR shall not proceed with any aspect of the work until receiving PURCHASER answer.

3 ENVIRONMENTAL AND OPERATING CONDITIONS

- 3.1** For operating and environmental conditions, refer to project documentation.
- 3.2** Equipment shall be suitable to withstand the dynamic loads imposed by the vessel motions during tow and on location.
- 3.3** Topsides SOS Servers Panel shall be installed indoors at AEPR, with air conditioning system. Nevertheless, it shall be capable to operate without loss of reliability at the failure of HVAC System, according to Classification Society rules.
- 3.4** Hull SOS Servers Panel shall be installed indoors at CCR-EA, with air conditioning system. Nevertheless, it shall be capable to operate without loss of reliability at the failure of HVAC System, according to Classification Society rules.
- 3.5** The available power supply is 220 Vac – 60 Hz (HOLD), as defined in technical specification I-ET-3010.00-5140-700-P4X-003 - ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.

4 GENERAL


- 4.1** Plant automation architecture is represented in AUTOMATION AND CONTROL ARCHITECTURE document. For further information about the Control and Safety System, see I-ET-3010.00-5520-861-P4X-002 – CONTROL AND SAFETY SYSTEM – CSS.
- 4.2** SOS HMIs, Engineering Workstation, microcomputers, supervisory switch panel, printers, among others equipment shall be installed at CCR-OA.
- 4.3** Servers, panels, switches, routers, among others shall be located at CCR-EA (for Hull equipment) or AEPR (for Topsides Equipment).

5 OVERVIEW

5.1 General Description

5.1.1 The SOS is the interface between operators and A&C System.

5.1.2 The SOS consists of:

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 7 of 19	NP-1
		ESUP	

- Pairs of redundant Real Time Data Servers (RTDS), installed inside panels and dedicated to consolidate and serve data between the operation layer (PLCs and packaged units) and the supervision layer (HMIs, HDS).
- Human-Machine Interfaces (HMIs)
- A pair of redundant Historical Data Server (HDS), installed inside panel.
- An Engineering Workstation
- Redundant switches L2 or L3, depending on the application, installed inside panels.

5.1.3 The supervisory system to be installed at the SOS shall run under-on Windows Operational System platform (from Microsoft®). All software shall be furnished at the latest version, at purchase time. For further information, see item 7.2.

5.1.4 All SOS equipment shall be powered by Emergency Loads UPS with 2 (two) x 220 Vac, phase-to-phase, 60 Hz (HOLD), except Microcomputer for Administrative Purposes and printers which shall be fed by 220Vac derived from normal source. Concerning the dual video monitors connected to each HMI workstation, each one is to be fed by a different UPS. Dual power supplies are not required.

5.2 Main Functions

5.2.1 Real-time data acquisition and command from/to all systems – PCS, PSD, FGS, HCS and HSD.

5.2.2 Real-time data acquisition and command from/to packaged units' Automation systems.


5.2.3 Historical data collection and archiving, including those derived from packaged units, subsea and special systems.

5.2.4 Historical alarms and events collection and archiving, including those derived from packaged units, subsea and special systems.

5.2.5 Human-machine interface functions, allowing operators to:

- Visualize real-time process data (value, engineering unit, timestamp and quality of each process variable);
- Visualize real-time equipment, alarms and events status;
- Actuate in process variables, including the change of equipment status, control variables and execution of operational / maintenance overrides commands;
- Visualize and acknowledge alarms;
- Generate reports;
- Visualize real-time and historical trend graphs.

5.2.6 Maintenance functions, allowing technicians to:

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 8 of 19	NP-1
			ESUP

- Setup, test, edit, compile, download and upload all SOS components through Engineering Workstation.

5.3 Access Level

5.3.1 According to automation security policy of PURCHASER, it will be necessary to identify which user can access the supervisory system (Personal Login) with access group and privileges defined.

5.3.1.1 Access Groups:

- **OPERATOR:** the same privileges as Viewer, plus carry out start and stop equipment actions, change set points values, parametric control loops (PID), reset totalizers and carry out bypass. It does not have operational system access;
- **SUPERVISOR:** the same privileges as Operator level, plus change alarms limits and carry out overrides. It does not have operational system access;
- **ADMINISTRATOR:** the same privileges as Supervisor, with operational system access.

6 MAIN COMPONENTS

6.1 SOS Servers Panel

6.1.1 The Servers Panel installed at AEPR (Topsides) shall house 4 (four) sets of redundant RTDS, for PCS, PSD, FGS and Topsides Packaged Units; 1 (one) set of redundant Domain Servers and network communication equipment.

6.1.2 The Servers Panel installed at CCR-EA (Hull) shall house 3 (three) sets of redundant RTDS, for HCS, HSD and Hull Packaged Units; 1 (one) set of redundant HDS and network communication equipment.


6.2 Real Time Data Servers (RTDS)

6.2.1 There shall be sets of redundant RTDS to perform data acquisition in hot standby configuration, as follows:

- 1 (one) set to collect real time data / send commands from/to PCS;
- 1 (one) set to collect real time data / send commands from PSD;
- 1 (one) set to collect real time / send commands data from/to FGS;
- 1 (one) set to collect real time / send commands data from/to HCS;
- 1 (one) set to collect real time / send commands data from/to HSD;
- 1 (one) set to collect real time / send commands data from/to Topsides Packaged Units;
- 1 (one) set to collect real time / send commands data from/to Hull Packaged Units.

6.2.2 For each RTDS, at least the following modules of software are needed:


- Microsoft Windows® Operating system or its equivalent at purchase time;

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 9 of 19	NP-1
			ESUP

- Microsoft® Office software or its equivalent at purchase time;
- Real-time data acquisition module of the Supervisory Software;
- Redundancy module of the Supervisory Software;
- Database runtime tool, if required by the supervisory software configuration tool;
- Communication driver between RTDS and CSS PLC CPUs through Ethernet TCP/IP. This communication driver shall be developed or certified by the supervisory software manufacturer. The communication driver shall consider PLC redundancy in hot standby configuration. OPC-UA technology will be considered acceptable if there is no impact in communication performance.;
- For packaged units' RTDS, OPC-UA communication driver between Packaged units processors and RTDS is acceptable;
- OPC-UA client and OPC-UA server;
- Other specific communication driver(s) necessary to integrate SOS with the automation system shall be submitted for PURCHASER approval.
- Packaged units processors communication with Packaged Units Real Time Data Servers shall be implemented using OPC-UA communication driver.

6.3 Historical Data Servers (HDS)

- 6.3.1 One (01) set of redundant Historical Data Servers shall be supplied to collect and archive all historical data from the RTDS's, as well as historical alarms and events. HDS shall also serve these data via OPC-UA to upper layers (supervision and corporate layers).
- 6.3.2 Data from all RTDS, including those derived from packaged units, shall be historically collected and archived in HDS.
- 6.3.3 Each HDS shall have black box capability, consisting of an external removable solid-state drive (non-mechanical) with capacity for storing at least 30 (thirty) days of historical data collection/registering. In order to make it easy to extract the removable hard-disks from their base, they shall be installed in CCR-EA panel.
- 6.3.4 HDS redundancy can be implemented either by fault-tolerant hardware or through 2 (two) servers configured in hot standby architecture. If it is implemented through two servers in hot-standby configuration, the Windows® Operating System version shall support disk cluster facility.
- 6.3.5 Historical data analysis capability shall be provided allowing historical data visualization, reports generation, queries and historical data analysis performed from any SOS HMIs.
- 6.3.6 Historian collector shall be a module part of the Supervisory Software suite;
- 6.3.7 At least the following software modules are needed for each Historical Data Server:
- Microsoft Windows® Operating system or its equivalent at purchase time;
 - Microsoft® Office software or its equivalent at purchase time;
 - Historical data collector and archive module of the supervisory software (with

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
			SHEET 10 of 19
			NP-1
			ESUP

redundancy capability);

- Database runtime tool required by the Supervisory Software Historian module;
- Historical trend charts visualization;
- Historical data report generator / viewer;
- OPC-UA client and OPC-UA server;
- Communication driver between Supervisory software and Plant Information Software (PI®, from OSIsoft). By the purchase time, CONTRACTOR shall guarantee the versions compatibility between the Supervisory Software Historian module and PI®.

6.4 Domain Servers

6.4.1 If necessary, 1 (one) domain server shall be supplied to define IP addresses for all SOS components.

6.4.2 The Domain Server shall have black box capability, consisting of an external removable mechanical-shock proof hard-disk with capacity for storing at least 30 (thirty) days of historical data collection/registering.

6.4.3 At least the following modules of software are needed for Domain Server:

- Microsoft Windows® Operating system or its equivalent at purchase time;
- Microsoft® Office software or its equivalent at purchase time;
- Specific communication driver(s) necessary to integrate SOS with the automation system shall be submitted for approval;
- Relational data-base, if required by the supervisory software configuration tool.

6.5 SOS HMIs


6.5.1 SOS HMIs dedicated to SOS operation shall be installed at CCR-OA.

6.5.2 At least the following modules of software are needed for each Operation Workstation:

- Microsoft Windows® Operating system or its equivalent at purchase time;
- Microsoft® Office software or its equivalent at purchase time;
- Run-time module of the supervisory software;
- Real-time trend graphics module;
- Real-time data display module of the supervisory software;
- Alarm viewer and acknowledge;
- Alarm summary and alarm history functions;
- All additional supervisory software modules needed to perform the functions described in item 5.2.5.

6.5.3 Although HMIs shall normally be dedicated to a specific function group or area, it shall be possible for an operator, with the appropriate login, to use any of them to operate any area or function group.

6.6 Engineering Workstation

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 11 of 19	
		NP-1	
		ESUP	

6.6.1 One (01) Engineering Workstation dedicated to perform engineering/diagnosis for the equipment that belong to SOS, such as HMIs, Data Servers, switches etc.

6.6.2 At least, the following modules of software are needed for these workstations:

- Microsoft Windows ® Operating system or its equivalent at purchase time
- Microsoft® Office software or its equivalent at purchase time;
- Configuration module of the supervisory software;
- Run-time module of the supervisory software;
- All the communication drivers between the supervisory software and CSS PLCs;
- All the communication drivers between the supervisory software and packaged units´ Automation systems;
- OPC-UA client and OPC-UA server;
- CSS PLC OPC server software module and packaged units OPC server software modules;
- Application Programming Tool for CSS PLCs and for the packaged units controllers;
- Software for management and maintenance of switches, LANs and VLANs;


7 MINIMUM HARDWARE AND SOFTWARE REQUIREMENTS

7.1 Hardware

7.1.1 SOS HMIs shall be supplied as industrial microcomputers for use in offshore environmental conditions with 2 (two) 24" LED video monitors each (5 ms or less refresh time), wired ABNT2 keyboard and wired optical mouse and 1 (one) Fast Ethernet network interface card. Processor type, internal drives space and memory shall be according to the use of the necessary software in its maximum performance configuration. No mechanical drives are allowed (as hard disks), only solid-state drives


7.1.2 RTDSs shall be supplied as industrial servers for use in offshore environmental conditions, wired ABNT2 keyboard and optical mouse and at least 4 (four) Gibabit Ethernet network interface cards. Processor type, internal drive space and memory shall be according to the use of the necessary software in its maximum performance configuration. The use of extra network interface cards shall be evaluated during detal engineering design phase depending on the supervisory software redundancy strategy. No mechanical drives are allowed (as hard disks), only solid-state drives

7.1.3 HDSs shall be supplied as industrial servers for use in offshore environmental conditions, wired ABNT2 keyboard and optical mouse and at least 1 (one) Gigabit Ethernet network interface card. Processor type, internal drive space and memory shall be according to the use of the necessary software in its maximum performance configuration. The use of extra network interface cards shall be evaluated during detail engineering design phase depending on the supervisory software redundancy strategy and on the definition for the type of fault-tolerance used, according to item 6.3.4. No mechanical drives are allowed (as hard disks),

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 12 of 19	NP-1
		ESUP	

only solid-state drives

- 7.1.4 Engineering Workstation shall be supplied as industrial server for use in offshore environmental conditions, one 23" video monitor, wired ABNT2 keyboard and optical mouse and at least 2 (two) Gigabit Ethernet network interface cards with support to IEEE 802.3an, 1 (one) BlueRay/DVD/CD recorder, and USB-C interface. Processor type, internal drive space and memory shall be according to the use of the necessary software in its maximum performance configuration. The use of more than two network interface cards shall be evaluated during detail engineering design phase depending on the final quantity of VLANs configured in this workstation. No mechanical drives are allowed (as hard disks), only solid-state drives
- 7.1.5 Only mission-critical computers and equipment suitable for industrial environment shall be used. Refurbished, used or economy-line equipment are forbidden.
- 7.1.6 All CPU cabinets shall have internal shock absorbers to protect the internal components from balance movements and vibration.
- 7.1.7 The external removable disks of the Historical Data Servers shall be used to log all information from supervisory system, being a mirror of the HDS internal disks with RAID1 configuration.
- 7.1.8 The redundant RTDS's shall be composed of two (2) independent servers equipped with the necessary hardware to perform full redundancy in hot-standby configuration.
- 7.1.9 All computers shall be powered by dual power supplies, each one to be fed by a different UPS.
- 7.1.10 Engineering Workstation shall have mirrored internal drives (RAID 1 configuration).
- 7.1.11 CONTRACTOR shall be responsible for the adequate memory sizing of all SOS equipment (RTDS's, HDS's, HMIs and switches/routers).
- 7.1.12 Hard disks shall be sized adequately to store system data (such as log files). The memory sizing shall take into account the following requirements:
- RTDS (hardware and supervisory software module) shall be sized for the I/O count specified and their installed spares, plus the I/O tags to be allocated from each packaged unit – defined during detailing phase - all with 30% capacity for future expansion. The total amount of real time data to be acquired shall be defined during detailing design phase by CONTRACTOR.
 - HDS (hardware and supervisory software module) shall be sized for the I/O count specified and their installed spares, plus the I/O tags to be allocated from each packaged unit plus the historical data to be collected from each system. The total amount of data to be historically collected shall be defined during detailing design phase by CONTRACTOR.

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 13 of 19	
		NP-1	
		ESUP	

7.1.13 CONTRACTOR understands that the whole application fits in the previously depicted servers and HMIs (item 6). The need of extra servers other than the previous depicted in this Specifications are by CONTRACTOR. Servers virtualization will not be accepted.

7.1.14 All hardware shall be of the most recent model at purchase time.

7.1.15 All CPUs shall be installed in server 19" racks, properly housed in cabinets, except the SOS HMIs and Engineering Workstation which shall be installed directly in the CCR-OA.

7.1.16 CONTRACTOR shall provide 3 (three) years on-site warranty.

7.2 Software

7.2.1 Operating System of RTDS: Microsoft ® Windows Server Standard Edition at its latest version.

7.2.2 Operating System of HDS: Microsoft ® Windows Server Enterprise at its latest version.

7.2.3 Operating System of SOS HMIs and Engineering Workstation: Microsoft ® Windows Professional at its latest version

7.2.4 Microsoft® Office Automation Software at its latest version

7.2.5 Supervisory software modules as determined by each server/workstation function, as described at items 6.3.2, 6.4.8, 6.5.4, 6.6.2 and 6.7.2 and

7.2.6 Security mechanisms (firewall, antivirus, etc) for all servers/workstations.

7.2.7 The supervisory software shall have facilities to implement hot standby function.

7.2.8 Because of alarm generation PURCHASER standard, the supervisory software shall have facility to implement individual PLC bit writing due to alarm acknowledgment.


7.2.9 The supervisory software shall have built-in facilities to perform alarm acknowledgement from one single workstation to all other workstations. Additional scripts to perform this function shall not be acceptable.

7.2.10 The supervisory software shall be native OPC UA Client/Server (Universal Access)

7.2.11 The supervisory software shall carry out real-time data synchronization among all servers/workstations.


7.2.12 The supervisory software shall carry out real-time alarms synchronization among all servers/workstations.

7.2.13 The supervisory software shall permit configuration of at least 6 (six) levels of

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA: BÚZIOS	SHEET 14 of 19	
	TITLE: SUPERVISION AND OPERATION SYSTEM - SOS	NP-1	
ESUP			

alarm priorities, in different colors – critical, high, medium, low, alert and event, in accordance with Petrobras guidelines for alarm management (N-2900).

- 7.2.14 The supervisory software shall have built-in configuration mechanisms to define logic layers of operation, based on definition of users.
- 7.2.15 The supervisory software shall be able to ordinate alarms annunciation in most recent and in most priority orders.
- 7.2.16 Supervisory Software Historian Module shall be able to archive historical data in hot-standby configuration.
- 7.2.17 All software shall be furnished in their most recent versions at purchase time, accompanied by their corresponding licensing, installation media(s) and manuals, as well as with one year of technical support and maintenance. Demo versions and under development will not be accepted.
- 7.2.18 If it is required the development of any additional software, this requirement shall be submitted to CONTRACTOR approval. Unless CONTRACTOR formally expresses the contrary, this development shall be of CONTRACTOR responsibility, including its compatibility with other related software modules.
- 7.2.19 The communication driver(s) between SOS and any system, including CSS and packaged units CPUs, shall be certified by the supervisory software manufacturer.
- 7.2.20 The dedicated communication drivers shall be defined in the detailing engineering design phase, after the definition of the CSS PLCs and other systems connected to SOS.

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
			SHEET 15 of 19
			NP-1
			ESUP

8 SOS SERVERS PANEL

8.1 General

8.1.1 SOS Hardware Redundant equipment shall not be installed at same section of Server Cabinet.

8.1.2 Server cabinet shall be:

- Installed at AEPR (Topsides Servers Panel) and CCR-EA (Hull Servers Panel);
- Composed of 02 (two) sections;
- Appropriate to house server CPUs, time server, Ethernet switches and
- network accessories

8.1.3 Minimum characteristics of each section of server cabinet:

- Dimensions: Height 2,000 mm, Length externally 800 mm (19 inches internally), Width 1,000 mm;
- Rapid rail;
- Perforated doors (hole diameter 10 mm) ;
- Locking doors and side panels;
- Support 200 kg;
- Forced air ventilation;
- Split rear doors;
- Leveling feet;
- Open bottom.

8.1.4 Each section that house RTDS and/or HDS shall be supplied with built-in rack console, composed of retractable monitor, keyboard, mouse and an 1u console switch in order to allow its configuration and maintenance. The computers CPUs and the above mentioned video monitor, keyboard and mouse shall be connected to the internal console switch.


8.1.5 The retractable video monitor shall occupy 1u and be 15" TFT (flat) with 1280x1024 @ 60/75 Hz resolution.

8.1.6 The internal keyboard shall be USB 104-key ABNT-2 and shall be mounted over a 1u drawer.

8.1.7 The retractable monitor, keyboard and mouse shall be ergonomically placed in order to allow their use by a person in sit-down position (typically 0.80 m above floor).

8.2 Scope of Supply

8.2.1 It is CONTRACTOR scope of supply the design of the internal arrangement of

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
			SHEET 16 of 19
			NP-1
			ESUP

each sub-section, taking into account the necessary ventilation and the necessary equipment contained in each sub-section.

8.2.2 The final lay-out shall be defined in detailed engineering design phase.

9 PERFORMANCE REQUIREMENTS

9.1 Hot standby time switchover between RTDS shall not exceed 5 (five) seconds.

9.2 Data refreshes performed by the communication drivers shall be executed in configurable time intervals equal or less than 1 (one) second.

9.3 Different software sections schedule is allowable to be configured at different scan rates in order to optimize PLC CPUs loading. The following response times are to be achieved for major activities, i.e. those scheduled to be executed at the fastest speed and with high priority:

- Field inputs to system, from input terminal to HMI: 2 s;
- Operator outputs to field, from HMI to output terminal: 2 s;
- Closed loop control, input terminal to output terminal: 2 s.

9.4 Alarm and event discrimination (maximum allowable time):

- Alarm occurrences: 2 s;
- Sequence of events recording: 500 ms.

9.5 HMI display requirements for response time (maximum allowable time) are as follows:

- Delay from requesting a screen display to its appearance on the HMI: 3 s;
- Update time for dynamic data on a display already open: 2 s;
- Time delay between operator keyboard input to data appearing on HMI display: 0.1 s.

10 SCOPE OF SUPPLY

10.1 The scope of supply by CONTRACTOR shall include the following items:


10.1.1 Hardware – RTDS's, HMIs, HDS's, Engineering workstation, switches, routers, patch panels, panels,

10.1.2 All Software with their respective licenses. Demo and under development versions will not be accepted.

10.1.3 All the additional hardware and software necessary for the connection of SOS equipment.

10.1.4 SOS main components shall be of manufacturers approved by PURCHASER.

11 DOCUMENTATION

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 17 of 19	
		NP-1	
		ESUP	

11.1 Complete documentation of the SOS, covering all devices shall be supplied with the proposal, for approval, and for final acceptance.

11.2 There shall be supplied with the proposal, in the number of copies defined at CONTRACTOR documents, at least the following technical documents:

- Technical specifications, comprising: equipment, accessories, panel, software and materials;
- Data-sheets and brochures for each equipment;
- All equipment and installation data including: material list, equipment list, spare part list, power consumption, weight, panel lay-out, programming tools, configurations tools, etc;
- Complete description of services, tests, etc.

11.3 There shall be supplied for approval, in the number of copies defined at CONTRACTOR documents, at least the following technical documents:

- Technical specifications, comprising: equipment, accessories, panel, software and materials;
- Descriptive of the integration activities and screens standard of the workstations;
- Data-sheets and drawings for all panel and racks;
- Installation drawings including general arrangement, electrical diagrams, wiring diagrams, cable list, material list, equipment list; panel lay-out, etc;
- All equipment and installation data including: power consumption, weight, programming tools, configurations tools, etc;
- Test procedures;
- Certificate of materials and equipment, software licenses, etc.

11.4 Complete SOS certified documentation, including Operation Manual and Maintenance Manual.


12 ACCEPTANCE TESTS

12.1 CONTRACTOR shall be responsible for performing all the acceptance tests as defined at IEC-62381 – AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY – FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT) AND SITE INTEGRATION TEST (SIT), see item 2.1.1.

12.2 CONTRACTOR shall be responsible for providing personnel, material, necessary equipment and instruments for all the tests, independent of the place where they are carried out, until the final commissioning and acceptance of the unit by PURCHASER.

12.3 CONTRACTOR shall submit to PURCHASER, for approval, detailed FAT, SAT and SIT programs, 60 (sixty) days in advance.

12.4 In order to shorten the time at the tests onboard, the documentation and system screens shall be checked at CONTRACTOR's office.

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	SHEET 18 of 19
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	NP-1
			ESUP

12.5 After the conclusion of the installation of the SOS equipment at the platform, CONTRACTOR shall repeat all tests performed at MANUFACTURER office.

12.6 These tests shall include all interconnection and communication tests with all other systems which have any interface with the Automation and Control System, including report generation.

12.7 There shall also be provided all functional tests regarding operational and safety aspect, as detailed at the Tests Program approved by PURCHASER.

12.8 The following tests shall be performed at supplier installations (FAT), besides the tests required at I-ET-3010.00-5520-888-P4X-001 - CSS / SOS PANEL, where applicable, prior to delivery:

- Mechanical Inspection;
- Hardware and Software inventory check;
- Wiring and Termination inspection;
- Start-up Test;
- Visualization/operation;
- General System functions including hardware redundancy and diagnostic check;
- Functional test;
- Subsystems interface test.

12.9 After the SOS installation at the site, at least the following tests (SAT) shall be provided in order to assure that the equipment is correctly installed:

- Mechanical Inspection;
- Hardware and Software inventory check;
- Start-up/Diagnostic Check;
- Software downloads and functional tests.


13 WARRANTY

13.1 CONTRACTOR shall give warranty for all SOS components, even for equipment or devices furnished by others, up to 24 (twenty four) months from delivery or up to 12 (twelve) months from operation.

13.2 This warranty shall cover fabrication or installation problems, as well as any service included in the scope of supply.

13.3 CONTRACTOR shall warranty the supply of spare parts, at least, for up to 10 (ten) years after the acceptance test date, and technical assistance at installation site performed by qualified and certified maintenance staff, when requested.

13.4 During warranty period, any defective part shall be changed for a new one, within 1 (one) week, after the problem reported by CONTRACTOR.

	TECHNICAL SPECIFICATION	Nº I-ET-3010.00-5520-861-P4X-002	REV. 0
	AREA:	BÚZIOS	
	TITLE:	SUPERVISION AND OPERATION SYSTEM - SOS	
		SHEET 19 of 19	
		NP-1	
		ESUP	

14 PACKING REQUIREMENTS

- 14.1** On completion of testing at factory all equipment shall be prepared for proper shipment and storage.
- 14.2** Equipment supplied loose shall be packed and crated for transport. In addition, if some rack equipment is susceptible to transport damage, it shall be removed from the System Rack for separate packing and crating.

PRELIMINARY