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ORLEN Unipetrol RPA s.r.o.

N STANDARD

DCS, ESD and PLC STANDARDS

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Table of Contents

1 Scope of Validity

This standard contains the essential requirements that apply to the selection and design of DCS, ESD and PLC control systems of ORLEN UNIPETROL RPA s.r.o. located in the Litvínov - Záluží a Kralupy area.

2 Introduction

The standard is binding on all entities involved in the operation, installation, maintenance and revision of the DCS, ESD and PLC control systems concerned and other equipment listed in the text.

This standard applies both to newly installed control systems and to extension of the existing ones.

This standard is regularly updated approximately once a year.

This standard includes the following chapters:

Chapter	Description
Chapter 2 Introduction	explains the purpose of the standard, for whom it is binding and describes its general structure
Chapter 3 Terms and abbreviations	explains the terms and abbreviations used in the document
Chapter 4 Requirements for DCS and ESD systems	contains detailed requirements for DCS and ESD systems, particularly in terms of hardware, software, licensing, documentation, and training
Chapter 5 Requirements for PLC systems	contains detailed requirements for PLC systems especially in terms of hardware, software, licenses, documentation and training
Chapter 6 General requirements	contains requirements generally applicable to control systems, in particular item marking
Chapter 7 Related standards and regulations	contains an overview of related standards and other binding regulations

3 Terms, Definitions and Abbreviations

3.1 General terms

Company	Orlen Unipetrol RPA s.r.o.
Contractor	Supplier of DCS/ESD/PLC or general contractor of the work, part of which includes DCS/ESD/PLC supplied by a subcontractor.

3.2 Abbreviations

Abbrev.	Meaning	Note
A/D	Analogue/Digital	
APC	Advanced Process Control	higher-level control system
ARC	Advanced Regulatory Control	complex loop control
ATPCS	Automation Technological Process Control Systems Department (ATPCS dpt.)	department within the Technical Division
ASW	Application SoftWare	
CRAC	Computer Room Air Conditioning	precision air conditioning systems of computer/server rooms
DCS	Distributed Control System	
DMZ	Demilitarized Zone	physical or logical subnet separated from other devices in terms of a computer security
DWG	DraWinG	AutoCAD file format
EPS	fire detection system	
ESD	Emergency Shutdown	
FAT	Factory Acceptance Test	
FBD	Function Block Diagram	graphical language for creating programs for programmable logic controllers
FDS	Functional Design Specification	
HART	Highway Addressable Remote transducer	
HAZOP	HAZard and OPErability	
HMI	Human-Machine Interface	visualization and control
HW	HardWare	
I/O	Input/Output	control system Input/Output modules
IPS	Instrumented Protective System (similar to ESD)	security system consisting of a separate and independent combination of sensors and devices designed to achieve a specified risk

KVM	Keyboard-Video-Mouse	
MCC	Motor Control Centre	
OPC	OLE for Process Control	OPC communication protocol
P&ID	Piping & Instrumentation Diagram	
PC	Personal Computer	
PDF	Portable Document Format	Adobe Acrobat file format
PDU	Power Distribution Unit	switchboard power supply rail/rack-mount
PID	Proportional – Integral – Derivative	PID regulator
PLC	Programmable Logic Controller	
SAT	Site Acceptance Test	
SIF	Safety Instrumented Function	
SIL	Safety Integrity Level	defined in IEC61508, IEC61511
SIS	Safety Instrumented System	security system consisting of a separate and independent combination of sensors and devices designed to achieve a specified risk
SW	SoftWare	

4 DCS and ESD systems requirements

4.1 Introduction

Chapter 4 hereof contains the essential requirements for DCS/ESD supplied to the Company. When selecting for a specific application, it is possible to agree on partial specifics different from this standard. Any such changes must be consulted with and approved by the ATPCS dept.

At the Litvínov and Kralupy Refinery Units, the abbreviation IPS with the same meaning is used instead of ESD.

Although the requirements in this document are general, therefore not intended for any particular DCS / ESD, the contractor must treat them as a specification for a particular DCS/ESD offered or supplied.

The supplied DCS / ESD must meet all valid technical standards in the area of power supply, color marking, intrinsic safety, and others.

The Czech affiliate of the supplied DCS/ESD system manufacturer, as a future contractual maintainer, must be a part of the investment project and must be involved in the DCS/ESD design and system configuration.

4.2 ATPCS Department Role

The Automation Technological Process Control Systems (ATPCS) Department role within the Company is to determine the DCS/ESD long-term acquisition and maintenance strategy and to participate in all investment or maintenance projects where the DCS/ESD form part of the supply, including modifications to the existing DCS/ESD.

In the course of selection procedure/tenders for DCS/ESD and its subsequent implementation, the ATPCS department is a single expert body that decides on the technical specifications used and whether the DCS/ESD offered/to be supplied meets such requirements.

Application software (ASW) is not part of the contractor delivery. The application software is created by the ATPCS dept. based on the documentation of the Contractor. The specific legal form of such cooperation must be defined by a contract.

At the Litvínov and Kralupy Refinery Units, ASW is part of the contractor's delivery.

4.3 Vendor list

If a tender is announced, the subject or part of which is the DCS/ESD control system, the following vendor list applies. The bids of the individual tenderers may therefore include different DCS/ESDs corresponding to the vendor list below. However, at the time of signing the contract, it must be clear which specific system will be supplied and its specification (manufacturer, series) must be stated in the contract.

The **DCS** supplied to the Company must be exclusively of the following types and by the following manufacturers:

4.3.1 ABB

Series: ABB System 800xA
Controllers: Series AC800M
I/O: S800/900, Select I/O

4.3.2 Emerson Process Management

Series: DeltaV
Controllers: SQ, MQ, SX, MX, PK controller
I/O: Series S or M, Intelligent Marshalling (CHARM)

4.3.3 Honeywell

Series: Experion PKS
Controllers: C300, ControlEdge
I/O: Series C

The **ESD** supplied to the Company must be exclusively from the following manufacturers and must be of the following types:

4.3.4 HIMA Paul Hildebrandt GmbH

Series: HIMax, HIQuad, HIMatrix, Planar4

4.3.5 Honeywell

Series: Safety Manager SC
Controllers: S300
I/O: SDIO (Safety Digital IO)

4.3.6 Schneider Electric - Triconex

Series: Tricon, Tricon CX

4.3.7 Emerson Process Management

Series: DeltaV SIS

4.3.8 ABB

Series: ABB System 800xA High Integrity

4.4 Scope of Delivery

The contractor must supply the DCS/ESD that it is fully operational and meets all technical, operational and safety requirements. Both in bidding and designing stages the contractor must meet requirements for DCS/ESD parts, defined in all following paragraphs of the chapter 4.

4.5 Hardware

4.5.1 Controllers

1. Controllers must be provided as redundant with automatic switchover in the event of one of the pair faulty, without affecting the controlled technological equipment.
2. Under both normal and abnormal conditions (production unit failure, start-up or shutdown, etc.) the controller must be used at not more than at 70% of the maximum load recommended by the manufacturer.
3. The total number of controllers must be optimized for the required performance ensuring appropriate division of control of the individual parts of the technology between the controllers.
4. Peer-to-peer communication between the individual controllers must be minimized to the necessary number of cases that cannot be resolved in another way (redesigning the system architecture, redistributing items between controllers, etc.).
5. Therefore, all signals of one controlled technological part or a loop must be brought to the same controller unless it is contrary to other higher priority requirements (division due to redundancy, safety or security, etc.).
6. There must be a dedicated controller or controllers for communication between the DCS and ESD with respect to the number of transmitted data and the corresponding reserve.

4.5.2 I/O modules

The individual Input/Output types will be designed with a 20% reserve of I/O connections, evenly distributed over all controllers.

The inputs and outputs of one measuring loop must be in the same controller and, if possible, on the same I/O module.

The analogue inputs module (AI) must meet at least the following requirements:

- At least 12-bit A/D converter
- Self-diagnostics
- Detection of open and short-circuited loop
- Possibility of galvanic separation of individual channels
- Support of “pass-through” HART protocol functionality
- Possibility of redundancy

The digital inputs module (DI) must meet at least the following requirements:

- Status indication of each individual channel directly on the card
- Self-diagnostics
- Possibility of galvanic separation of individual channels

The analogue outputs module (AO) must meet at least the following requirements:

- Detection of open loop
- Protection of the output against a short-circuited loop
- Support of “pass-through” HART protocol functionality
- Self-diagnostics

The digital outputs module (DO) must meet at least the following requirements:

- Possibility of galvanic separation of individual channels
- Status indication of each individual channel directly on the card
- Self-diagnostics

4.5.3 Active Network Devices

The DCS shall be equipped with a firewall that will be the only link to the company IT network.

All switches, routers and other active components must be manageable and must allow remote diagnostics over the local DCS network. If DCS offers such an option, these elements must be introduced directly into the system and their defects indicated (system alarm).

The delivery must also include SW for administration and monitoring of the supplied active network elements.

Firewall Specifications:

- redundant design (High availability), unless otherwise specified
- dual power supply
- vendor and type of firewall will be specified during a specific event

4.5.4 Rack Units

Apart from the operator station peripherals placed in the control room all DCS/ESD elements - especially controllers, I/O modules, communication modules, servers, operator stations, active network elements, power supplies - must be placed in dedicated industrial rack-type cabinets meeting the following requirements:

- removable roof panels and cabinet sides
- for IT racks or server cabinets glass front doors unless otherwise stated
- height 42U, width 800 mm, depth 1200 mm – except of special cases and requirements
- load capacity 1500kg, degree of protection IP 54
- temperature measurement inside the rack unit with alarm indication and historicized in the DCS
- lighting that comes on when the rack unit door is opened
- open door sensor indicating the status by alarm in the DCS/ESD
- equipped with a smoke and fire detection and / or extinguishing system according to the strategy determined by the company or according to the results of the HAZOP study of a specific production unit
- equipped PDUs to power all installed components from two independent backups
- equipped with cable management system

All DCS / ESD switchboards must be located in a separate room (substation, server room) with limited access of persons meeting all requirements for temperature, cleanliness, humidity and other conditions required by the located equipment.

If a new substation or server room is being built, a space reserve must be taken into account for the installation of additional cabinets when expanding the systems in the future. This reserve must be minimum 30% of space, but at least suitable for two additional cabinets of each type (controllers, I/O, IT rack).

4.5.5 Optical and metallic networks

- all critical DCS / ESD communication networks must be redundant
- in particular, a network connecting I/O modules and controllers and a network connecting controllers, servers and operators
- in the case of a redundant optical or metallic network, each branch of a pair must be routed by a different route
- DCS will be equipped with an additional network to connect servers, operator stations and other computers. The purpose of this network is to ease the traffic on the main control network by running services such as backup, update of antiviruses and MS Windows, copying data, remote access via RDP, etc. Computers must therefore be equipped with an Ethernet port specifically for this network. This network does not have to be redundant.
- IP addresses in DCS/ESD networks shall be allocated by the ATPCS dpt.
- optical and metallic cables will be dimensioned with a sufficient length reserve for possible future movements of cabinets

Optical networks requirements:

- outdoor optical cables will be stored along the entire route in ducts, each cable in its own duct
- the ducts will be yellow in a weather-resistant design, including UV radiation protection
- all optical cables, resp. ducts will be marked:
- at the outlet/ inlet from the building or fire section
- at the crossing and/or division of the cable route
- every 50 meters, unless one of the above rules has been applied
- all types of cables / ducts will be marked at both ends so that it is clear where from and where to the cable leads (building, floor, cabinet, equipment, etc.)
- cable labels will be attached with stainless steel straps and will be in a weather-resistant design, including UV radiation protection
- all newly installed cables / fibers / connectors will be properly measured and a report will be provided

4.5.6 Fieldbus

Foundation Fieldbus or Profibus can be used for communication between field and DCS instrumentation as well as for communication with the MCC.

However, the following signals must be transmitted by means of standard conductors (hard-wired) and via 4 -20 mA and digital ON/OFF signals:

- All ESD signals
- Control and critical or otherwise essential DCS signals

The fieldbus design must incorporate safe to fail feature. Loss of communication or power supply must cause the valves to reach their safe positions.

The fieldbus used, including power supplies and cards, must be fully redundant; no single failure shall result in the loss of more than one control loop or the inability of the operator to access the device or part of the device.

4.5.7 Operator stations and servers PC

- the alarm keypad must be part of the DCS if it is available
- all PCs must be rack-mounted, including the front and rear access and withdrawable rails
- all PCs will be supported by the Next Business Day Onsite Service for five years
- all PCs must be located in cabinets, no PC should be placed in the control room except as provided in Chapter 4.6.2 (in the case of thin clients located in operator workplaces, access to ports must be restricted using a combination of SW or HW measures)

4.5.8 PI collector PC – connection to company MES

The PC "PI collector" must be a part of DCS. From the network viewpoint, this PC is located in the DMZ, reads data from the DCS OPC server, and sends it to the company PI server.

The DCS will be equipped with all HW and SW to transmit at least all analogue measurements, calculated values, setpoints, outputs and selected digital signals to the corporate LAN using OPC technology while maintaining maximum security of interconnection

Minimum Computer Specification for PI Collector:

- PowerEdge Rxxx with Intel Core i3/3.6GHz processor with English Windows Server Standard OS, 32GB RAM, disks with a capacity of at least 2TB in RAID1 configuration, iDrac, redundant power supply
- ProSupport and Next Business Day Onsite Service Initial, 12 months
- ProSupport and Next Business Day Onsite Service Extension, 24 months

The final configuration must be consulted with and approved by ATPCS.

4.5.9 Power Supply and UPS

All critical parts of the DCS/ESD (controllers, I/O modules, servers, operators' stations, network elements) will be powered from two independent uninterruptible sources. Power supply from these two sources must be distributed between individual (even non-critical) devices so that a single source failure does not limit the ability of DCS/ESD to control the technology.

Non-backed up voltage 230V for lighting, service sockets, etc. will also be supplied to DCS / ESD cabinets, circuit breakers will be equipped with auxiliary contacts for introducing signaling into DCS/ESD.

All power failures must be signaled and alarm sounded in the appropriate DCS/ESD.

The power supply must be dimensioned to allow the safe shutdown of the controlled technology in the event of a large power outage.

4.5.10 KVM extenders, Thin Clients

Due to the location of operators' workplaces in the control room and PC operator stations in a separate room, a suitable and reliable system for remote connection of keyboards, displays and pointing devices (mouse, trackball, etc.) must be provided, using KVM extenders or switches. This

also applies to all servers and other computers that must be accessed from the control room or the ATPCS engineering room.

Rack cabinets where PCs are installed will be equipped with a pull-out KVM switch with LCD for local access to the PCs.

4.5.11 Data storage

A NAS with RAID storage with sufficient capacity for storing all backups and maintaining at least two older versions of these backups must be included in the supply.

Minimal NAS Server Configuration:

- NAS server Synology RSxxx Rack Station
- sliding racks for NAS server
- three hard disks + one hot spare of Western Digital Red (or another type of similar or better parameters) with a capacity according to the needs of a specific application, but at least 10TB in RAID 10, RAID 01 or RAID 5 configuration

The final configuration must be consulted with and approved by ATPCS.

4.5.12 Air-conditioning

The DCS / ESD substation or room will be air-conditioned with the CRAC (Computer Room Air Conditioning) precision redundant air conditioning system, with a bottom cold air outlet with overpressure into the double floor. From there, the air will be led through the perforated ventilation floorboards back to the space among the racks to provide a targeted cold air supply to the side of the racks on which the server fans are taking the air in. Above the opposite side of the racks where the server fans blow out heated air there will be extraction of this air installed and its routing back to the CRAC unit. All racks and floors must be suitable for this type of cooling.

The temperature in the distribution room or the DCS/ESD rack room will be taken to the DCS and connected to an alarm. Likewise, the condition of the air-condition AC unit will be taken into the DCS and an eventual alarm triggered in the event a malfunction.

4.5.13 Printers

The DCS/ESD will include a network laser printer serving operators to print trends, alarm statements, etc. and to print DCS/ESD documentation.

4.5.14 Update server

An update server located in the DMZ must be included in the delivery. This server must be equipped with software enabling distribution of antivirus updates of databases/engines and Microsoft Windows updates to all other computers of the DCS system.

The update server will not be connected to the Internet and the requested updates approved the DCS supplier will be carried out manually.

4.5.15 Virtualization

Except main servers and operator stations, it will be possible to operate the DCS computers as virtual machines. This for example includes domain controllers, OPC servers, PI collectors, update servers, etc.

When designing and implementing DCS/ESD, we prefer virtualized IT solutions wherever appropriate and beneficial. This approach allows for more efficient hardware utilization, better scalability, and flexibility in systems management.

4.5.16 Real time synchronization

The DCS/ESD real time will be synchronized from the NTP server of ORLEN Unipetrol (Windows Time Service) connected in DMZ.

PLCs will not be connected directly to the DCS network. If the PLC server (the configuration station computer) is connected to the DCS network through a firewall, the time of the PLC server (computer) will be synchronized according to the DCS engineering station and the PLC itself will then synchronize its time with its server. In other cases, the PLC time synchronization will be provided within the DCS communication, e.g. by a one-off entry of hour/minute/second in an agreed interval.

4.6 Control center, Operator workstations and Engineering workstation

4.6.1 Control center

All technology control via DCS takes place in the control center (control room). Operator workplaces are located in the control center. If not in another room (ATPCS dpt. room), there is also an engineering station located in the control center from which the application software and DCS/ESD control system configuration changes are carried out. The control center also contains operator stations or graphical panels of other potential PLC or packaged control systems, etc.

The control center must allow safe, ergonomic and comfortable control of the technology in both, normal situations as well as in critical, in 24/7 mode. The layout of the room, the layout of the operators' workplaces, the furniture, and the management of the environment in terms of temperature, lighting, and ventilation must be adapted accordingly.

The control center must meet the applicable hygiene/sanitary and ergonomics requirements of the operators’ work environment.

The Control Center must be equipped with at least the following:

- automatic adjustable HVAC system of the entire space - heating, ventilation, air conditioning
- possibility of effective window shading
- lighting suitable for control centers
  - without reflections on operator monitors and other surfaces
  - without perceptible flicker
  - adjustable in light intensity, suitable for 24-hour operation
- engineering workplace for ATPCS engineer, if it is not located in another room, e.g. in the ATPCS office of the given production plant
- phones, radios
- sufficient 230V socket outlets for additional equipment
- a control center access control system including access logging and entry point camera recording

4.6.2 Workplaces of operators and engineers

Operator and engineering workplaces will be suitably arranged in terms of ergonomics and the movement of people in the control center.

Operator and engineering workplaces must meet at least the following general requirements:

- a professional desk designed for a 24-hour operator's workplace
- equipped with an electrical system for adjusting the height of the entire workplace and thus able to work in both sitting and standing positions
- equipped with a combination of small (min. 24") and large (min. 50") LCD monitors that allow display of operator graphics; the number of monitors will be specified in a particular scheme, depending on the complexity of the technology being controlled
- engineering workplace will be equipped with the same number of monitors as the operator workplaces, however with three at the very minimum
- monitors will be designed for continuous operation 24/7 and this parameter will be explicitly stated in their documentation
- equipped with an acoustic alarm system and lighting
- equipped with a professional operator's chair, which meets all ergonomic requirements, with sufficient load-bearing capacity and the possibility of adjusting the position and height of the seat, backrest and armrests
- equipped with an integrated cable management system
- power redundancy support
- in the case of Honeywell DCS, the “Experion Orion Console” solution must be used
- in the case of ABB DCS, the “ABB EOW Extended Operator Workplace” or “CERGO” solution must be used
- in the case of DCS Emerson, the “Emerson iOps Workspace Solution” must be used
- if the DCS supplier's standard solution is to locate the operator PCs or thin client PCs directly at the operator's workstation, these PCs are exempted from Chapter 4.5.7 "PCs for operator stations and servers", point 4 of this document regarding the location of PC operator stations and servers. To accommodate these PCs, the workstation must be equipped with storage boxes with an integrated system for their power supply.

The specific type, number and configuration of operators' workplaces will be specified in more detail by the operations representatives as part of the specific case requirements. For reasons of redundancy and substitutability, there must be at least two operator workplaces.

4.7 Software

4.7.1 Historization HW and SW

- Historization station must have a disk capacity of at least 2TB
- Historization HW and SW must allow historization of all analog measurements, calculated quantities, setpoints and outputs in second-rate storage with online access for users, including operators, for a minimum period of at least 5 years with the possibility of further data archiving.
- The historization HW and SW must also allow the historization of all operator interventions and other events.
- The historization SW must allow export of raw and aggregated (averages, min. for interval, etc.) of historical data to Microsoft Excel.

4.7.2 Engineering software

- The delivery must include SW capable of configuring individual parts of the application software (at least the control database) offline on user PCs other than DCS/ESDs and also PCs within the DCS/ESD.
- The delivery of the SW must include the necessary licenses to simulate the controllers and other devices for purposes of testing the application logic.

4.7.3 Backup software

The DCS/ESD must be equipped with a SW to back up all computers. This SW will be installed on all computers and centrally managed from one server. It will allow, among other things, online backup of whole disks (image) and process data to the designated storage.

The DCS/ESD must be equipped with SW for online backup and recovery of all parts of the application software (control database, graphical and trending displays, configuration of historical database, etc.).

In the case of a virtualized solution, backup will take place at the virtualization platform level, i.e. backup of entire virtual machines.

4.7.4 Alarm system and Alarm management software

- The DCS must be equipped with a special SW for statistics, analysis and optimization of the alarm system according to EEMUA 191, ISA 18.2 and IEC 62682: 2014, including the alarm shelving function.
- The DCS must allow page acknowledgment function - confirm by one click all alarms related to objects currently displayed on an operator’s display.
- One of the functions of the alarm system must be a direct link from a particular alarm in the list of alarms leading to the respective operator’s display. The operator must be able to quickly access any alarm in the alarms list for a detailed display of the device or parts of the technology affected by the alarm. If the software does not allow the feature, it must be provided with a sufficient number of hardware alarm keyboards at each operator's workstation.

4.7.5 Management Of Change and documentation software

- A part of the ESD must be software for the management/audit of changes. This software must store any changes made to the application software, including detailed information about what change was made, and who made the change, when and where it was done. The software must allow a retrospective audit of the changes made and return to previous versions of the application software.
- The DCS/ESD must include functions for application software documentation including cross-references between control database items, historical databases, and operating environments including graphical displays. The acquisition of such documentation must be possible directly from the DCS/ESD in a print form and/or by export at least to PDF.

4.7.6 Antivirus and antimalware software

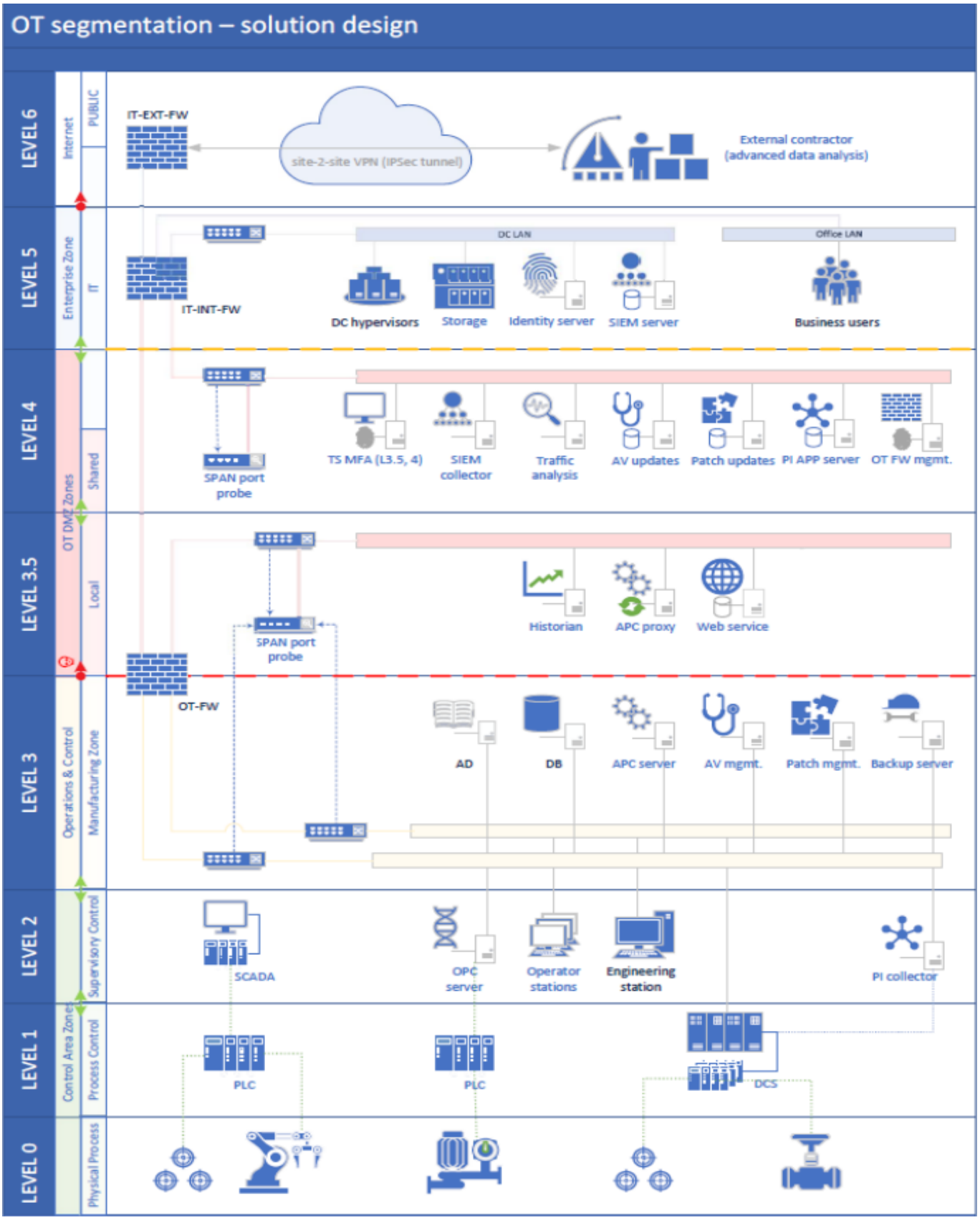
- Each DCS/ESD computer must be equipped with antivirus SW.
- The antivirus SW will update its viral databases from one common server.
- The antivirus license will be valid for a minimum of five years including updates of virus databases as well as the update of the SW itself.

4.7.7 Cybernetic security software

The cybernetic DCS/ESD security must be resolved by a combination of all of the following tools:

- In case of a Cybersecurity requirement, the segmentation and network communication requirements in the OT zones must be met. The overall solution must be approved by ORLEN Unipetrol‘s IT Security department.
- Software tool for network monitoring and management with automatic graphical representation of DCS/ESD network topology. Such a tool must be included in the delivery.
- Antivirus SW.
- Backup SW.
- User access control system.
- Logging of all security-related events.
- Managing remote access from the company IT network.

The basic required OT segmentation is shown in the following diagram:


OT segmentation – solution design
LEVEL 6
Internet
PUBLIC
IT-EXT-FW
site-2-site VPN (IPSec tunnel)
External contractor
(advanced data analysis)
LEVEL 5
Enterprise Zone
IT
IT-INT-FW
DC LAN
DC hypervisors
Storage
Identity server
SIEM server
Office LAN
Business users
LEVEL 4
OT DMZ Zones
Shared
SPAN port probe
TS MFA (L3.5, 4)
SIEM collector
Traffic analysis
AV updates
Patch updates
PI APP server
OT FW mgmt.
LEVEL 3.5
Local
SPAN port probe
Historian
APC proxy
Web service
OT-FW
LEVEL 3
Operations & Control
Manufacturing Zone
AD
DB
APC server
AV mgmt.
Patch mgmt.
Backup server
LEVEL 2
Supervisory Control
SCADA
OPC server
Operator stations
Engineering station
PI collector
LEVEL 1
Control Area Zones
Process Control
PLC
PLC
DCS
LEVEL 0
Physical Process

4.7.8 Other software

- Selected operator stations and the engineering station must be equipped with Microsoft Office - at least Excel and Word, and at the engineering station also with the MS Access.
- Each operator and engineering station must be equipped with a SW for viewing PDF files.
- The delivery must include the appropriate number of OPC servers for communication with other systems and for sending data to the Company's MES system. All OPC communications must be equipped with OPC tunnellers.

4.8 Licenses

All parts of the DCS/ESD for which the licenses are designed for the number of tags or in a similar way must be supplied with a 20% reserve. This applies in particular to the following licenses:

- The DSC/ESD system software itself
- All licenses linked to I/O numbers
- OPC, MODBUS or other communications
- Historization SW
- Backup SW
- The antivirus and antimalware SW
- The Alarm Management SW
- Microsoft Remote Access CAL license
- The license of the standard solution of the DCS producer for remote access to the DCS/ESD from the company IT network – e.g. ABB Smart Client, Honeywell eServer or similar.

4.9 Documentation

4.9.1 General documentation requirements

The documentation must be provided in PDF and in editable MS Excel, MS Word, DWG, etc. formats. The documentation must also be supplied in printed form.

Tables, databases, etc. must be in a format that allows at least searching, sorting and filtering, i.e. MS Excel, MS Access, INtools/SPI etc.

If the documentation is created by using for database documentation SW such as Comos, Aveva, PDMS or any other similar software, all documentation will also be submitted in the native format of the software in which it was created, with all the necessary data required for viewing in browsers compatible with the original application, or directly in it, i.e. including databases of technical data used and giving full names of used SW applications including their versions.

4.9.2 Required documents

The delivery of the DCS/ESD must include at least the following documents:

4.9.2.1 Protocols

- FAT/SAT DCS/ESD protocols
- Protocols of the DCS/ESD power supplies tests
- Protocols of loopchecks, interlock checks, sequences, ARC and other control structures
- Copies of the DCS user training protocols signed by them; the training agenda must be enclosed under an annex

4.9.2.2 DCS/ESD documentation

- A detailed topology diagram of the entire DCS/ESD including the power supply of each component and the connection to other equipment (PLC, MCC, analyzers, etc.). The topological scheme must be vertically layered according to the principle of network segmentation from the point of view of cyber security of OT systems.
- I/O list
- Loop drawings; At the Litvínov and Kralupy Refinery Units, individual tags must be entered into the INtools/SPI database, and paper drawings must be printed from this database
- Documentation for communication with other systems (PLC, analyzers, other DCS, etc.) - memory maps, tag lists, communication protocols configuration, etc.
- DCS/ESD producer standard documentation for HW and SW
- List of all licenses provided, including their validity
- Original installation media and user manuals for all installed SW
- As-built DCS/ESD documentation
- General operator's manual for working with DCS and ESD (working with trends, alarms, diagnostics, faceplate description, etc.) in the Czech language

- A list of I/O containing:

  Analogue loops
  - Name, description
  - Signal characteristic (e.g. 4-20 mA, linear, SqRt extraction,…)
  - The range and units of measurement corresponding to the SI system of units of measurement
  - All alarm limit values and parameters
  - Type and direction of control relative to the physical position of the valve
  - The characteristics and extent of the output
  - Valve position when power failure occurs
  - Valve position at 4 mA
  - Initialization values
  - location of items placed in the P&I diagram
  - Accurate positioning of inputs and outputs to/from DCS/ESD (periphery)
  - Reference to logic or other control structure

  Digital loops
  - Name, description
  - Signal characteristic (permanent, moment…)
  - Significance of individual states
  - Alarm status determination (or determination of alarm states by combination of signals) – the alarm status and safe state of the device will be logic 0, end position of a valve and motor operation will be indicated by logic 1
  - Initialization values

- Accurate positioning of inputs and outputs to/from DCS/ESD (periphery)
- Reference to logic or other control structure

4.9.2.3 DCS/ESD administration and maintenance documentation

- Instructions for installing operators and engineering stations and servers
- Instructions for safe start up/shut down of the DCS/ESD components
- Instructions for creating system and application SW backups
- Instructions for restoring system and application SW from backups
- Three complete ASW backups created before the production unit start up, properly described (content, type and number of backup media)

4.9.2.4 FDS

A very important document is the FDS - Functional Design Specification.

This document must be approved by the ATPCS prior to the start of other project activities. The FDS must be created through collaboration of the Detail Engineering supplier (Contractor), the DCS/ESD supplier (producer) the ATPCS (creator of the application software) and the representatives of production plants (future user).

The FDS is a basic document that describes DCS/ESD in terms of system hardware, system software and functionality of individual application software components such as logic, HMI, and so on.

Typical control and graphical structures of application SW must be based on the structures already in use at DCS/ESD in the Company.

A fundamental requirement for project documentation for the creation of application software is the maximum use of the features and capabilities of the particular system delivered. The aim of this requirement is to avoid inefficient programming by generic patterns that might have been prepared for any DCS/ESD system. It is necessary to bear this in mind during the preparation of the FDS and to propose typical structures of logic and graphics in cooperation with the ATPCS dpt. so that all the possibilities of a particular system are used advantageously.

It must contain both a detailed description of the system as such, including a topological scheme, and a description of the functionality of all standard application software components, in particular:

- PID controller
- valve, motor
- interlock
- operator display and navigation requirements
- the alarm system philosophy
- trends
- safety

The FDS must also include a detailed specification for, in particular:

- all controls
- sequences
- interlocks
- Control and Safeguarding Narratives

- interface
- device ranges
- alarm and trip values setting
- spare parts philosophy and DCS/ESD expansion options

In the event that DCS/ESD will communicate with packaged units (e.g. extruders) with their own control system, their supplier must cooperate in creating the FDS.

Relevant outputs from eventual HAZOP or SIL studies must be included in the FDS.

4.10 Testing and commissioning

The contractor must perform ASW DCS/ESD tests to verify their compliance with the FDS.

The contractor must perform DCS/ESD FAT and SAT tests at appropriate stages of implementation based on pre-agreed procedures and protocols of the system supplier.

These tests can be carried out at several stages.

- Typicals tests - include generic software components and philosophies. They should be performed before the bulk use of these components.
- Hardware and standard components - this test includes all system hardware, I/O tests, interfaces to other systems, and all simple controls, indications and displays. All DCS/ESD interfaces must be tested. Upon completion of this test, the DCS/ESD main components can be transported to the building site if further tests can run without them.
- More complex controls - this test includes all interlocks, more complex control and control logic, sequences and related displays. The test usually requires simple simulations for its implementation.

If the control of packaged units is more complex, their supplier should also be present.

The contractor is responsible for the overall consistency of all tested systems and for meeting all technology control requirements.

Prior to putting the plant into operation, the following tests will be performed, among others:

- FAT – online form is not accepted; the procedure must be carried out in the physical presence of Company representatives
- SAT
- Loopcheck – DCS/ESD loops and configuration must be tested by complete field circuit tests across all marshalling cabinets and junction boxes, and across any intrinsic safety barriers, I/O modules, any communication between ESD and DCS up to the DCS operator screens. At least the following checks must be made and recorded:
  - The engineering ranges setting check
  - The valves position check (100% = open, 0% = closed)
  - Status signals check
  - The check of alarm/switching/blocking limits (including presentation of alarms on DCS screens)
  - The check of the presence and accuracy of individual signals on DCS technology displays

- The check of the accuracy of communication of each signal between DCS and ESD
- The check of the accuracy of digital and analogue outputs directly on the device in the field or by measuring on the terminals directly in the field.

Once a new or extended system has been commissioned the manufacturer must conduct a performance, network, communication and security audit. The aim of this measure is to know the initial state of the system after the commissioning and any changes made in association with the commissioning.

4.11 Training

The delivery must also include the DCS/ESD manufacturer's training under the following conditions:

1. Scope of training
   - DCS – at least four weeks for two SW engineers
   - ESD – at least four weeks for two SW engineers
   - The scope of the training must cover, in particular, system administration, control database configuration and management, history, graphics creation, alarm management and other additional third party configurators and applications
2. Type of training
   - Standard Certified Training pre-selected from the DCS/ESD manufacturer catalogue, to be held at the DCS/ESD Official Training Centre
3. Date
   - the training must take place prior to call for comments to be made by the Company on the first version of the FDS

4.12 Other General requirements for DCS/ESD

1. The maximum of the technology elements must be controlled by the DCS. The number of other controllers of the PLC type must be minimized. Any PLCs will be connected by digital communication with DCS to input or monitor data and all PLC items. If technically possible, the communication will be of the MODBUS RTU or MODBUS TCP type - at the Litvínov and Kralupy Refinery Units it will be of the MODBUS TCP type only. The control and blocking signals must be wired separately.
2. Only safety and locking functions must be implemented in the ESD. The ESD alarm and lock limits will be available to the plant operator on DCS screens. Performing safety and locking functions must be completely independent of the DCS status.
3. Spare parts and support for all DCS/ESD parts must be available for at least 15 years from the DCS/ESD date of initiation.
4. At the time of putting the DCS/ESD into operation (after the completion of the investment project, construction, etc.), all software must be fully supported by the manufacturer for at least another three years. The aim of this and the previous point is to avoid a situation where

a newly installed system needs an immediate upgrade, because the support of some of its HW or SW parts has ended.

5. The DCS/ESD will be designed in all parts of the HW and SW in such a way that it can be used in every part (including all communications, controllers, operators, etc.) under both the normal and abnormal conditions (factory failure, plant start up or production shutdown, etc.) to a maximum of 70% of the maximum load recommended by the manufacturer.

6. Prior to commencing work on the design documentation, DCS/ESD design inspection, including associated PLCs, must be carried out. The aim of the inspection is to minimize the total number of control systems of the DCS/ESD/PLC types and to optimize the division of technological units control between individual control systems, whether DCS/ESD or PLC. The reason for this optimization is, among other things, the effort to maximize the efficiency of future maintenance of all delivered systems.

7. Timers in the DCS timing for longer than one minute must display elapsed or remaining time on operator graphics.

5 Requirements for PLC systems

5.1 Introduction

This chapter hereof contains essential requirements for PLCs supplied to the Company. When selecting for a specific application, it is possible to agree on partial specifics different from this standard. Any such changes must be consulted with and approved by the ATPCS dept.

Although the requirements in this document are general, therefore not intended for any particular PLC system, the contractor must treat them as a specification for a particular PLC offered or delivered.

The supplied PLC system must meet all valid technical standards in the field of power supply, color marking, intrinsic safety, and so on.

5.2 ATPCS department role

The ATPCS department role within the Company is to determine the PLC systems long-term acquisition and maintenance strategy which it has under its management. It participates in all investment or maintenance projects where the PLC forms part of the supply, including modifications to the existing ones.

In the course of selection procedure/tenders for the supply of PLC and its subsequent implementation the ATPCS department is a single expert body that decides on the technical specifications and whether the system offered/to be supplied meets such requirements.

5.3 Vendor list

PLC	Siemens series Simatic S7-1500 including I/O modules
Panels	Siemens series Comfort
Sources	Siemens, Weidmüller, Phoenix Contact, Axima
UPS	Siemens, APC
PC	Siemens, DELL – always in rack design

5.4 Hardware

5.4.1 Controllers

- Controllers of the appropriate type according to the Vendor list must be delivered, suitable for the required application in terms of performance and reliability.
- Under both normal and abnormal conditions (production unit failure or shutdown, etc.) the Controller must be used at not more than at 80% of the maximum load recommended by the manufacturer.
- Peer-to-peer communication between the individual Controllers must be minimized Therefore all signals of one controlled technological part or loop must be implemented to the same controller, unless of course it is in conflict with other requirements of the higher priority (division due to redundancy or safety, security, etc.)

5.4.2 I/O modules

The I/O modules used must be of the series Siemens Simatic S7-1500, not ET200SP or similar.

The individual Input/Output types will be designed with a 20% reserve of I/O connections, evenly distributed over all Controllers.

A diagnostic screen with status overview of all I/O channels must be configured in the PLC system.

5.4.3 Rack Units

Apart from the operator station peripherals placed in the control room all elements of the PLC system - especially controllers, I/O modules, communication modules, servers, operator stations, active network elements, power supplies - must be placed in dedicated industrial rack-type cabinets meeting the following requirements:

- Temperature measurement inside the rack unit with alarm indication and historicized in the PLC
- Lighting that comes on when the rack unit door is opened
- Open door sensor indicating the status by alarm in the PLC
- Labels with description of all I/O signals directly on the I/O modules
- Air-conditioned either individually or in the case of air-conditioned rooms equipped with adequate ventilation; removable cabinet roof panels are required
- Unless specified otherwise, it must be located in a separate room with restricted access to persons meeting all the requirements for temperature, cleanliness, humidity and other conditions required for the installed equipment
- If the cabinets are located outdoors, both the cabinets and their equipment must be designed for the full range of temperature they can be subjected to; must also be fitted with a suitable rain and snow cover and ventilation, but not air conditioning.

5.4.4 Computers

- All PCs must be rack mounted and withdrawable, mounted on telescopic rails
- None of the PCs must be placed in the control room space or even in the furnishing of the operators' work places (in the case of thin clients located in operator workplaces, access to ports must be restricted using a combination of SW or HW measures)

5.4.5 Operators panels

When using HMI operator panels in outdoor cabinets, the cabinets must be fitted with double doors, and the panels must be located on the inside doors so that they are not exposed to the effects of inclement weather.

5.4.6 Power supply and UPS

All critical parts of the PLC (Controllers, I/O modules, servers, operator stations, network elements) will be powered from two independent uninterruptible sources. Power from these two sources must be distributed between individual (even non-critical) devices so that a single source failure does not limit the ability of the PLC to control the technology.

The power supply line of the processors will be equipped with a power supply buffer module (e.g. SITOP PSE201U order no. 6EP1961-3BA01) designed to bridge short-term power failures.

All power failures must be signaled and alarm sounded in the appropriate PLC, circuit breakers will be equipped with auxiliary contacts for signaling into the PLC.

The power supply must be dimensioned to allow the safe shutdown of the controlled technology in the event of a large power outage.

5.4.7 KVM extenders, Thin Clients

Due to the location of operators' workplaces in the control room and PC operator stations in a separate room, a suitable and reliable system for remote connection of keyboards, displays and pointing devices (mouse, Trackball, etc.) must be provided, using KVM extenders, thin clients and the like.

5.4.8 Air-conditioning

The individual PLC cabinets or the entire space where they are located must be equipped with appropriate air conditioning and ventilation to meet the requirements of all installed equipment for temperature, humidity, cleanliness and other environmental parameters. The air-conditioning system must be powerful enough to minimize the risk of exposure to equipment in inappropriate conditions, especially high temperature.

The temperature in the switchboard or room with PLC cabinets will be fed into the PLC and alarmed. Likewise, information about the status of the air conditioning unit will be fed into the PLC and any malfunction will trigger an alarm.

5.5 Software

5.5.1 Engineering SW

Both the program in the controller and the visualization on the operator panel or operator PC must be configured in the Siemens "TIA portal" software. A specific version of the TIA portal will be agreed for a specific project.

For visualization on the PC platform, Siemens WinCC software must be used within the TIA portal.

Development licenses will be delivered as required by a specific project.

Simulation software will also be supplied as needed.

5.5.2 Application software

The application software must meet the following requirements:

- The source code must be readable, i.e. FC, FB, OB etc., the blocks must not be locked.
- The source code must be consistently commented (comments of blocks, symbolic names, etc.).
- The ASW master control functions must be created in the FBD language or in Ladder.

5.5.3 Backup software

The DCS/ESD must be equipped with a SW to back up all computers. This SW will be installed on all computers and if possible centrally managed from one place (server). It will allow, among other things, backup of whole disks (image format) to the designated storage.

5.5.4 Antivirus and antimalware software

- Each computer must be equipped with antivirus and antimalware SW.
- The antivirus and antimalware SW will update their viral databases from one common server.
- The antivirus and antimalware licenses will be valid for at least five years, including updates of virus and malware databases as well as the SW itself.

5.6 Licenses

All parts of the PLCs for which the licenses are designed for the number of tags or the like must be supplied with a 20% reserve.

This applies in particular to the following licenses:

- The actual SW system itself
- WinCC visualization
- All licenses linked to I/O numbers
- Historization SW
- Backup SW
- Antivirus and antimalware SW
- OPC, MODBUS or other communication

5.7 Documentation

5.7.1 General documentation requirements

The documentation must be provided in PDF and in editable MS Excel, MS Word, DWG, etc. formats.

Tables, databases, etc. must be in a format that allows at least searching, sorting and filtering, i.e. MS Excel, MS Access, INtools/SPI etc.

If the documentation is created by using for database documentation SW such as Comos, Aveva, PDMS or any other similar software, all documentation will also be submitted in the native format of the software in which it was created, with all the necessary data required for viewing in browsers compatible with the original application, or directly in it, i.e. including databases of technical data used and giving full names of used SW applications including their versions.

5.7.2 Required documents

The delivery of the PLC must include at least the following documents:

5.7.2.1 Protocols

- FAT/SAT protocols
- Protocols of the power supplies tests
- Protocols of loopchecks, interlock checks, sequences, ARC and other control structures

5.7.2.2 PLC documentation

- A detailed topology diagram of the entire PLC including the power supply of each component and the connection to other equipment (PLC, MCC, analyzers, etc.)
- I/O list
- Loop drawings; At the Litvínov and Kralupy Refinery Units, individual tags must be entered into the INtools/SPI database, and paper drawings must be printed from this database
- Control and Safeguarding Narratives with relevant outputs from HAZOP or SIL studies (SIL classification results will be incorporated into the online SIF for databases)
- Documentation for communication with other systems (PLC, analyzers, other DCS, etc.) - memory maps, tag lists, communication protocols configuration, etc..
- PLC manufacturer’s standard documentation for HW and SW

- Operators manual
- Description of control of system parts of visualization - alarms, history, trends, etc.
- A description of the control of the technology control application itself
- List of all licenses provided, including their validity
- Original installation media and user manuals for all installed SW
- As-built documentation

- List of I/O containing:

Analogue loops
- Name, description
- Signal characteristic (e.g. 4-20 mA, linear, SqRt extraction,…)
- The range and units of measurement corresponding to the SI system of units of measurement
- All alarm limit values and parameters
- Type and direction of control relative to the physical position of the valve
- The characteristics and extent of the output
- Valve position when power failure occurs
- Valve position at 4 mA
- Initialization values
- location of items placed in the P&I diagram
- Accurate positioning of inputs and outputs to/from PLC (periphery)
- Reference to logic or other control structure

Digital loops
- Name, description
- Signal characteristic (permanent, moment…)
- Significance of individual states
- Alarm status determination (or determination of alarm states by combination of signals) – the alarm status and safe state of the device will be logic 0, end position of a valve and motor operation will be indicated by logic 1
- Initialization values
- Accurate positioning of inputs and outputs to/from PLC (periphery)
- Reference to logic or other control structure

5.7.2.3 Application software documentation

- Regulating circuit diagrams
- Power distribution diagram
- Inventory of the HW used in the PLC
- Operating instructions for HW and SW of the PLC
- Description of the SW function (description of the function of the whole program)
- Program structure (program structure and individual blocks calls)

- Program listing (full program listing with segments and signals)
- SW address description (full description of all signals)
- Descriptions of data blocks and variables (a complete description of all data words including their values)
- Cross referenced SW (interconnection between signals)
- Bits used (a complete list of all bits used in the program)

5.7.2.4 FDS (Functional Design Specification)

A very important document is the FDS - Functional Design Specification. FDS must be created through collaboration of the Detail Engineering supplier and the PLC system supplier. It must contain a description of the functionality of all standard components, in particular:

- PID controller
- valve, motor
- interlock
- The philosophy of the operators displays and navigation
- The alarm system philosophy
- Trends
- Safety

The FDS must also include a detailed specification for, in particular:

- All controls
- Sequences
- Interlocks
- Control and Safeguarding Narratives
- Interface
- Device ranges
- Alarm and trip values setting
- Spare parts philosophy and PLC expansion options

Some of the listed functionalities or specifications may be part of the project documentation. Relevant outputs from HAZOP or SIL studies must be included in the FDS.

5.8 Testing and commissioning

The contractor must perform the application software tests to verify their compliance with the FDS.

The contractor must perform FAT and SAT tests on the PLC at appropriate stages of implementation based on pre-agreed procedures and protocols of the system supplier.

Prior to commissioning, the following tests will be performed, among others:

- FAT – online form is not accepted; the procedure must be carried out in the physical presence of Company representatives
- SAT
- Loopcheck – PLC loops and configuration must be tested by complete field circuit tests across all marshalling cabinets and junction boxes, and across any intrinsic safety barriers, I/O

modules, any communication between PLC and DCS up to the DCS operator screens. At least the following checks must be made and recorded:

- The engineering ranges setting check
- The valves position check (100% = open, 0% = closed)
- Status signals check
- The check of alarm/switching/blocking limits (including presentation of alarms on PLC or DCS screens)
- The check of the presence and accuracy of individual signals on technology displays
- The check of the accuracy of communication of each signal between PLC and other systems
- The check of the accuracy of digital and analogue outputs directly on the device in the field or by measuring on the terminals directly in the field.

6 General requirements

6.1 Tagnaming rules

There is an effort to unify the naming of the tags of the measured circuits. The naming is based on ČSN ISO 3511-1 through 4. It should be noted that this standard addresses only the naming of general types of tags. In the case of circuits with special functions, their naming must be consulted with the Company's ATPCS department prior to implementation of the project.

The implementation of the DCS/ESD/PLC systems sets out a convention in the Company for naming of individual tags. Such marking system can be integrated in the project in the case of new applications or renovations.

The naming adjustments are based on the following principles:

1. Respecting general standards when naming individual types of measurement
2. Eliminating unnecessary characters in tagnames while respecting item identity
3. Establishing unambiguous tagnames for the entire Company
4. Pooling of tags, rationalizing their use and clarifying their functions

As the tagnaming system is slightly different in each production unit the tagnaming manual will be part of each individual project, detailing this issue. The specific solution must always be consulted with the ATPCS department. At the Litvínov and Kralupy Refinery Units, tag naming and rules for working with the INtools/SPI database are governed by standard N 00 502.

If the PLC and DCS exchange data, then the tags originating from the PLC must correspond to tagnaming principles of the DCS and the PLC tags must have a tagname such that it is clear at first sight that it is a PLC tag, e.g. such as another AREA number, another number range, etc. (e.g., all PLC items of a given production plant have a number range of 800 - 999).

7 List of Related Documents

7.1 General

All standards and regulations apply inclusive of their all amendments and extensions.

ČSN 33 3051	Protection of electrical machines and distribution equipment
ČSN 33 2000-5-51 ed.3+Z1+Z2	Electrical installations of buildings - Part 5-51: Selection and erection of electrical equipment – Common rules
ČSN IEC/TR 61439-0	Low-voltage switchgear and control gear assemblies - Part 0: Guidance to specifying assemblies
ČSN 73 0875	Fire protection of buildings – Setting specification for design of fire detection and fire alarm systems in terms of fire safety solution
ČSN ISO 3511-1 to 4	Measurement, control and instrumentation of technological processes - Schematic representation
Directive EU 2009/125/ES	Establishes a framework to set mandatory ecological requirements for energy-using and energy-related products
Decree No. 246/2001	On stipulation of fire safety conditions and on State fire supervision performance (Decree on fire prevention)
Act No. 258/2000 Coll.	On protection of the public health and on amendment to some related laws
Government Order No. 272/2011 Coll.	On protection of health from adverse effects of noise and vibrations
Act No. 73/2012 Coll.	On substances that deplete the ozone layer and fluorinated greenhouse gases
Act No. 201/2012 Coll.	On air protection
Act No. 87/2014 Coll.	Clean Air Act amending Act No. 201/2012 Coll. On air protection
Act No. 360/1992 Coll.	On practice of profession of authorized architects and authorized engineers and technicians working in the field of building constructions
Act No. 458/2000 Coll.	Energy Act
Act No. 250/2021 Coll. a Government Order No. 194/2022 Coll.	On occupational safety in connection with the operation of dedicated technical equipment, Government Regulation on requirements for professional competence to perform activities on electrical equipment and for professional competence in electrical engineering
ČSN EN 60079-0 ed.5	Explosive atmospheres - Part 0: Equipment – General requirements

Government Order No. 101/2005 Coll.	On detailed requirements for workplaces and working environment
Decree No. 48/1982 Coll.	Decree of the Czech Bureau of Safety laying down basic requirements for ensuring safety of work and of technical equipment
Act No. 90/2016 Coll.	On conformity assessment of products when made available on the market
Act No. 22/1997 Coll.	On technical requirements for products and on amendments to some Acts, as amended
Government Order No. 116/2016 Coll.	On the conformity assessment of equipment and protective systems for use in potentially explosive atmospheres
Government Order No. 117/2016 Coll.	On the Conformity Assessment of Products in terms of Electromagnetic Compatibility when made available in the market
Government Order No. 118/2016 Coll.	On conformity assessment of electrical equipment designed for use within certain voltage limits when made available on the market

7.2 ORLEN Unipetrol Internal Standards

S 027	Investment project management
S 350	Technical documentation
S 350/1	Requirements for drawing documentation of pipeline isometrics
S 350/2	Requirements for process flow diagrams (PFS) and P&ID Schemes
S 350/3	List and structure of DCC code values
N 00 502	Principles for working with the SI database
N 11 003	Operation of electrical machinery
N 11 017	Loop check standard
N 11 006	Electrical Equipment Regulations
N 11 012	ORLEN Unipetrol electro standards
N 11 022	ORLEN Unipetrol RPA, s.r.o. I&C equipment standards.
N 11 984	Standard for the supply of technical documentation for new machinery and equipment

7.3 International Standards

IEC 61131	IEC standard for programmable controllers
IEC 61511	Standard IEC „Functional safety - Safety instrumented systems for the process industry sector“