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ORLEN Unipetrol RPA s.r.o. (Without Kralupy Rafinery)

N NORM

Standards of the Instrumentation devices for ORLEN UNIPETROL RPA, s.r.o.

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List of changes

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Note: The change management is carried out in accordance with Directive 821.

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1 Introduction

Standard N 11 022 – Standards for Instrumentation devices for ORLEN Unipetrol; it belongs among the standardsthat set profession standards for ORLEN Unipetrol. The Instrumentation standards relate to and amend standard11 012 – Electro standards for ORLEN Unipetrol. All work implementations are governed by standard 11 012. For installations of specific Instrumentation devices, provided they are not included in standard N 11 012, the11 022 standard becomes a superior standard.

For the purpose of this standard, the electro standards for measurement and control devices are applicable to Instrumentation electric devices as well as Instrumentation pneumatic devices – herein after referred to as Instrumentation standards.

Instrumentation standards are based on the existing legislative requirements for electric devices, unification of the Instrumentation device at ORLEN Unipetrol and experience of the employees who are responsible for a safe and reliable technical condition of the electric devices.

Instrumentation standards have no impact on the valid legal controls and ČSN and other standards on theO R L E N Unipetrol premises.

Instrumentation standards represent specified rules and minimal requirements for the implementation of investment and maintenance projects and work conducted for ORLEN Unipetrol RPA at Záluží u Litvínova.

The Instrumentation device standards can be equipped, updated or modified for individual projects, however, such changes are subject to approval by the managers of the Technical Section, Energy Service Unit and Water Management EKO-section Unit. In justified cases, the vendor list can be modified only by the managers of the Technical Section, Energy Service Unit and Water Management EKO-section Unit.

Instrumentation standards must form a part of every tender and direct work orders. Instrumentation standards will be equipped by detailed work descriptions or requirements for activities related to pneumatic and electric devices.

Instrumentation standards can be modified, updated or equipped only by employing the specified procedure for updating N standards at Unipetrol, resp. upon approval of the managers of the Technical Section, Energy Service Unit and Water Management EKO-section Unit.

2 Terminology, definitions and terms

AC	Alternating current
FC	Forced cooling
AFC	Documentation approved for implementation (Approved for construction)
AN	Natural cooling
AS BUILT	As-built documentation
ASŘTP	Automated technological process control systems
ATEX	Nonexplosive device certificate - Directive 2014/34/EU (Devices forexplosive atmospheres – ATEX – ATmosphère EXplosible)
AZ	Automatic backup
BOZP	Occupational health and safety
OIP	Regional Labor Inspectorate
SÚIP	State Labor Inspection Office
DC	Direct current
DCS	Distributed control system
DN	Nominal internal diameters specified an approximate internal diameterof the fitting input and output neck in millimeters
EMC	Electromagnetic compatibility
Energis	Balance information system for measurement energy consumption
ESD	Emergency ShutDown system
Ethernet	Communication standard of the physical layer for communication among various industrial or office devices
EZS	Electronic security systems
GDS	Gas detection system
HART	Highway Addressable Remote Transducer – protocol that allows for two-way digital communication between process devices and theirsuperior and control and monitoring systems for the existing lines
HART communicator	Portable communicator and configurator with the HART communication interface (protocol)
HW	Hardware

IDP	Individual breathing apparatus
IEC	International Electrotechnical Commission
IFC	Issued for comments - Project documentation for comments
IP cover	Degree of protection against contact with hazardous parts, ingress of solid objects and ingress of water.
IP address	Communication address within the Ethernet network
Indicator	Device that does not provide the value of the given measured quantity, but provides information about the reached state (reaching a specified value of the monitored quantity). Some of the indicators include thermostats, gas leakage detectors, etc.)
Instrumentation	Measurement and control devices
I/O	**I**nputs / Outputs
JEKO	EKO unit (water management section)
JESL	Energy services unit
Calibration	It is a process when the data of the tested device are compared with thedata obtained from a reference device that is linked to the given national or international etalon. A part of the calibration is formed by recording the conditions and results of this comparison process
Configuration	It is a process that alternates the set parameters of the given operation device using, for example, a portable HART configurator. The actual configurator cannot be used for metrology calibrations
Kv	Flow rate coefficient that specifies the water volume flow ratein m3/hour, which passes through the control valve under the given flow rate reference conditions for the given lift
LAN	Local Ethernet network
LDS	Local distribution network
LED	Light Emitting Diode
Instrumentation	Measurement and control
MicroSCADA	LDS control system
MS box	Local control box

Measurement device (tool, instrument)	Device designed for conducting measurements, independently or in connection with an auxiliary device (it provides quantity values as multiples of the given units, for example, 36 °C). For the purpose of this standard, measurement devices should also be the so-called indicators
MŽP	Ministry of the Environment
NAMUR NE43	Recommendation that provides instructions how sensor errors can be signaled within the control system using the 4-20 mA signal.
ND	Spare part
Verification	Activity that is supposed to determine if the given measurement devicehas the required metrological characteristics; verifications can only be conducted by authorized entities
PBŘ	Fire safety solution
PID (P&ID)	Process Instrumen tation Drawing – Technological diagram
PLC	Programmable Logic Controller
PN	Nominal pressure (pressure level) states the pressure class of the givenvalve in bar
PO	Fire protection
Operator	Section director who has the overall responsibility for the tangible investment assets
RPD	Implementation project documentation
Self-, fire extinguishing cable	Special cable that stops burning within 1 minute after being removed from the test burner, which is the process conducted as a part of testing the self-, fire extinguishing ability of individual cables pursuant to ČSN EN 60332-1-2
SIL	Safety Integrity Level – safety integrity level of a system or device
SÚJB	State Office for Nuclear Safety
SÚG	Local Zoning Administration
SW	Software (program equipment)
TIČR	Technical Inspection of the Czech Republic
UPS	Uninterruptable power supply
URZ	Closed radionuclide source
ZIZ	Source ionizing radiation

3 Instrumentation devices, general requirements

3.1 Protocol on determining external impacts

The protocol on determining external impacts is a basic project document that monitors proposed facts and fundamental technical requirements for electric installations arising from these external impacts.Apart from the electric installation project engineer, these technical requirements are also determined by specialists from other fields that have an impact on the proposal and operation of electric and other devices of the proposed structure. Apart from considering installation changes, changes of the use of the structure have to be also taken into account.

The protocol on determining external impacts has to be prepared for individual levels of the project documentation pursuant to Directive No. 499/2006 Coll. External impacts will primarily be determined and Marked in compliance with the methodology pursuant to N 11 006 and ČSN 33 2000 5-51 ed.3 +Z1+Z2. External impacts outside of the frame of the above stated ČSN have to be addressed individually by the means of a description in the protocol on determining external impacts, including the appropriate measures. On the premises of the UNI RPA complex, the main issue in question is the issue of electric devices in explosion-hazardous environments of explosive atmospheres pursuant to EN 60079 respectively ČSN EN60079.

3.2 Climatic conditions, general conditions

The devices installed at Chempark have to be designed for standard operation for climatic conditions between -20 °C and +40 °C. This range applies if there are no devices that have an impact on the maximal – minimal temperature, over the stated limit values, at the area in question.

The Instrumentation devices and control elements installed at the control rooms and air-conditioned rooms have to be designed in a way that should there be an air-conditioning defect, they have to endure a surrounding temperature of between 20 °C to 45 °C with a relative humidity of 90% for a period of 4 hours. It is expected that, after a repeatedconfiguration of the specified temperature range, the device will operate without the need of any additional maintenance.

All devices have to be of a design that is able to withstand specific external impacts, such as climatic conditions, vibrations, atmospheric corrosion, and thermal conditions, which could damage the device and influence the device measurement characteristics.

The connection of individual devices to the technological process has to be implemented in a way that eliminates leaks of explosive or toxic substances into the atmosphere.

The devices have to be installed in a way that prevents them against the impacts of vibrations and tension in the pipes; they have to be also safely accessible from individual floors or a fixed service platform with the option of their disassembly for the purpose of maintenance and repairs even under normal conditions.

All devices located in the technological process and their process connections must be safely and permanently accessible so that the devices can be easily mounted and dismantled. All devices in operation will be mounted so that they are located as close as possible to the consumption connection, or directly at the consumption point with a view to achieving maximum measurement (regulation) accuracy, reliability and safety.

The consumption connections of Instrumentation devices have to be equipped with a closing valve; the closing valve has to be always installed as close to the consumption location as possible.

All elements of Instrumentation devices have to be secured in a way that allows for preventing unauthorized interventions, configuration changes, damages, etc. For devices installed in protected boxes or Instrumentation switchboards, the doors of these boxes have to be equipped with locks with a common key for the given technology section (single identical key).

The convertors of individual physical quantities have to be equipped with a closing valve with a bleeding mechanism (pressure release).

The differential pressure transmitters for measurement levels and flow rates (apart from capillary transmitters) should be equipped with a three-way or five-way closing block.

Pressure convertors and contact manometers (apart from the capillary types) will be installed with a two-way valve (for desludging or bleeding needs).

3.3 Instrumentation air distribution for measurement and control devices

The system will be mostly formed of the main distribution line having air distributorsconnected. The distributors will be equipped with a closing ball valve for every consumption branch. Individual ball valves will be provided with stainless or yellow color plastic labels containing the designations of particular fittings. The labels will be attached to the valve using a stainless wire.

The plastic label will have an indelible description (laser printing) in black color

The main distribution lines will be made of zinc-plated pipes.

An air distributor is always connected to the main distribution line.

The air distributor has to be always equipped with closing valves for other distribution lines to individual appliances.

Air appliances always have to be connected to the air distributor separately (connected multiple air appliances to a single distributor outlet are not permitted).

Connected pipe distribution lines (the connection of an air distributor to backbone distribution) will be made of stainless steel 316 (17 348), or, exceptionally, of Cu with regardto environment.

Dimensions of individual consumption locations have to be adequate to the air consumption of the corresponding devices.

Every worker will have valid training for repairs of the instrumentation air distribution system and impulse piping.

3.4 Sealing elements

In order to ensure a safe operation of the measurement and control devices with regard to the use ofsealing and sealing elements, you should particularly consider the following:

- Measured medium (chemical symbol, aggressive medium, toxic medium, flammable and explosive medium, oxygen, hydrogen)
- Temperature of the measured medium
- Pressure of the measured medium
- Possibility of the sealing mechanical damages (mechanical plugs of the control valves)

3.5 Protection level of the electric devices

All installed Instrumentation devices have to be equipped with the corresponding protection level in compliance with the Protocol on determining external impacts for the current production facility.

In compliance with the Protocol on determining external impacts of the production facility, the installed devices should be at least suitable for Zone 2, group IIC and temperature class T3.

3.6 Explosion hazardous environments

All devices installed in the explosion hazardous areas have to be certified pursuant to the ATEX controls by an authorized laboratory. The corresponding copies of these certificates should form a part of the AS-Built documentation.

Applicable general requirements:

- All devices, with the exception of solenoid valves, have to comply with marking Ex-ia(intrinsic safety Zone 0) or Ex-ib (intrinsic safety Zones 1 and 2) whenever possible
- Ex-d (firm closure) for solenoid valves
- Ex-e (increased safety) for diplexer boxes and local control panels

Alternative protection:

- Ex-d firm closure for special devices

The machines have to have corresponding type certificates, issued by an authorized entity. This certificate should form a part of the AS-Built documentation.

3.7 Requirements for proposals, selection and implementation of electric installations

- The “Protocol on determining external impacts” has to be prepared for all newly projected devices and structures; these protocols should form a part of the project documentation.
- Once again, the “Protocol on determining external impacts” has to be also prepared for individual renovations, technological changes, production device changes or changes of the used substances; moreover, the Classification of the given environment parameter group and their accuracy levels has to be reassessed. Electric devices that are not subject to the given renovation have to be also rechecked, making sure they comply with the changed conditions. Subsequently the corresponding conditions for further operation have to be determined (for example, extended the range of the renovation considering the given environment changes - necessity to increase protection etc.).
- The Protocol on determining external impacts has to include all of the required information - protocol number, production facility, structure, and, if applicable, more detailed specifications – operation file etc., committee members, building description, characteristics of the external impacts, decisions, tables, layout diagrams of the object with spatial marking of the range of individual zones.

- The Protocol on determining external impacts has to be prepared in the printed as well as digital forms.
- Individual devices have to be installed in compliance with the accompanying technical documentation.
- Individual installations have to be proposed and devices and materials installed considering the necessity to ensure an easy access for revisions and maintenance.
- Conductors of intrinsic-safe circuits and conductors of measurement and control circuits that are not intrinsic-safe must not be installed in a single cable.
- Conductor insulations have to be able to withstand alternating test voltage, value of which is twice as big as the nominal voltage of an intrinsic-safe circuit, however, at least 500 V.
- A Safety Integrity Level (SIL) must be established for newly designed MaR items

3.8 Requirements for the contractor or main supplier of the assembly works

- The selected company has to demonstrate appropriate qualification of the responsible persons and trained employees.
- The qualification has to be verified and granted in the intervals specified in ČSN.

The company has to demonstrate that its employees:

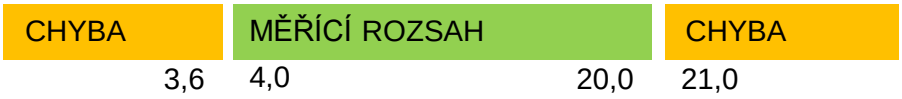
- Have the necessary skills for the given extent of the work
- Can operate within the specified extent of individual activities in a qualified manner
- Have the appropriate and sufficient knowledge

3.9 IP Cover

- The minimal protection level has been determined at IP65
- The minimal protection level for ventilated areas is IP41

3.10 Types of signals

- With the exception of natural signals (measurement by thermocouples and resistance sensors), a thorough unification of analogue 4 – 20 mA DC signals is required.
- Two-conductor connection, 24 VDC, 4-20 mA, HART protocol in compliance with recommendation NAMUR NE43



The picture shows the principle of how the measurement range of the error tolerance works for the device output signal.

The error tolerance should be taken into account when configuring the DCS by the HART exception of the error diagnostics in a way that the bottom limit of the range is 3.6 mA and the upper limit is 21mA.

Values below the bottom limit 3,6mA and above up limit 21mA should be assessed as the circuit disconnection.

- Power supply of the solenoid valves: 24 VDC or 230 VAC (might be different depending on production facilities).
- The used limit switches (proximity switches) should be of a two-conductor design preferentially, NAMUR type (for explosion hazardous areas pursuant to the protocol on determining external impacts)
- Pneumatic signal of the converter of physical quantities: 20 – 100 kPa
- Resistant temperature measurements – 3-conductor Pt-100 or 4-conductor Pt-100

3.11 Accessories

- Electronic transmitters (converters) have to be equipped by integrated displays, which must show the actual range expressed in the appropriate physical units.
- Electric and electronic devices have to be designed, made and tested in a way that limits humidity infiltration in their critical parts.

3.12 Requirements for electric and pneumatic connections of the field instrumentation

- The size, material and color of the bushing for power supply and signal conductors (cables) of electric converters have to be selected considering the current protocol on determining external impacts and in compliance with the corresponding ČSN.
- The bushing has to provide tight seal against humidity or dust particles penetration.
- Unused holes for the bushings of connection cabinets or Instrumentation electric devices have to be equipped with plugs of appropriate sizes. The plugs are subject to the same requirements as the bushings are.
- Metric threads are preferred for the bushings and plugs.
- Impulses for connecting the measured medium (process impulses) should be connected usingstainless pipes 12x1.5 mm, where 12 mm relates to the outer diameter of the pipes (stainless steel l316 (17 348)). The collection impulse pipes have to be selected pursuant to the specification of the measured medium, while considering its pressure and temperature.
- The connections of pneumatic drives and their accessories to the air distribution pipes should be implemented using impulse pipes with an outer diameter of 6 x 1 mm or 12 x 1.5 mm, depending on the expected air consumption – basic material stainless steel 316 (17 348) or, exceptionally, Cu with regard to environment. The dimensions of the air distribution lines have to always be selected based on the expected air consumption, while complying with the requirement for the valve opening or closing speed.
- The connections of the impulse pipes to individual appliances have to be of the so-called double ferrules design; for high-pressure media, they can be welded.
- For the initial and repeated assembly of the connecting double ferrules fittings, the manufacturer assembly procedure has to be complied with.
- Soldered joints are prohibited

3.13 Heating of Instrumentation devices and measurement impulses

- If necessary due to the character of the measured medium, the Instrumentation device has to be installed in electrically heated protection cabinets.
- Considering the measured medium, the incoming impulses to individual measurement instruments and lines with samples for the analysing technology have to be electrically heated using self-regulated heating cables or resistant heating cables. For extremely high medium temperatures, the impulses can be heated by steam.
- For collecting samples for the analysing technology, the preferred heating method is the so-called heating of an integrated design (impulse pipes with the heating are integrated in a single, thermally insulated wrap).
- The electrical heating outlets of the MaR device must always be protected by additional protection with residual current devices.

3.14 Instrumentation installation principles

- Field instrumentation will be installed in compliance with the project documentation. Measurement impulses and other devices have to be installed in accordance with the given installation drawings (hook-ups).
- Transmitters for vapors and gases have to be installed before the consumption location.
- Transmitters for the media with liquids, wet gases and steam have to be installed pass theconsumption location.
- Condensation containers should be used for steam measurements using a choking element.
- The installation must be so performed that the instrumentation is easily accessible for
- manipulation purposes from the ground or from catwalks

3.15 Tag numbering for instrumentation

Field instrumentation equipment shall be marked in accordance with N-00120 and N-00502

4 Flow rate measurements

Measurement range

The flow rate measurement range has to be selected as the highest calculated value:

+ 15% over the standard flow rate, or

+ 10% over the maximal flow rate.

Individual choking elements (screens, nozzles, Venturi nozzles) can be of a flange or welded design.

The orifice plate should be designed with chamber or point collections.

When a steam flow rate is measured or when it is required by the measured medium, a condensation container should be installed pass the screen collection point.

4.1 Primary elements of flow measurement

In order to be able to conduct accurate flow rate measurements, it is necessary to ensure a stabilized flow of the medium to the pre-instrument element and to fulfill other geometric and mechanical accuracy conditions – see ČSN EN ISO 5167-1. The entire route, including the primary element, as a single set(measurement route), should be used as the primary element, which has to comply with the requirements for the given measurement device quality and accuracy.

Depending on the character of the measured medium, the following sensor or measurement device types can be used:

- Orifice plate in connection with a differential pressure transmitter
- Nozzle or Venturi nozzle (for limiting the differential pressure, more accurate than the orificeplate)
- Turbine flowmeter
- Annubar element (when a minimal pressure loss and bigger pipe diameters are required)
- Vortex flowmeter
- Magnetic and induction flowmeter
- Ultrasound flowmeters
- Coriolis meter
- Blade flowmeter
- Rotameter
- Measurement flumes (Parshall flumes)
- Specific weirs
- Thermic flowmeter
- Swirl flowmeter

The specified direct pipe length before and pass the measurement element pursuant to standard ČSN EN ISO5167-1 through 4 has to be observed.

It is recommended to install the orifice plate at a horizontal part of the pipeline.

The orifice plate outlets should be oriented:

- Horizontally or under the angle of 45° in the downward direction for liquids and steam
- Horizontally or under the angle of 45° in the upward direction for gases

If the assembly of the horizontal part of the pipeline not be feasible, the following screen assemblyalternatives are permitted:

- Medium flow in the downward direction for gases
- Medium flow in the upward direction for gases and steam

The orifice plate outlets should be equipped with closing valves that comply with the technologicalconditions at the measurement location.

Considering the measured medium, the flow converter sensors should be protected with a separationmembrane or separation membrane with a capillary.

The differential range of the transmitters should be determined based on the measure element calculation.

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices)

- ABB
- EMERSON
- ENDRESS & HAUSER
- HONEYWELL
- KROHNE
- ROSEMOUNT
- SIEMENS
- WIKA
- YOKOGAWA
- BÜRKERT

5 Level measurements

Each reservoir with an installed level measurement device should be equipped with a local indicator.Depending on the given technological conditions, it should be either a glass (level gauge). The type of the level gauge should be proposed based on the possibilities of the measured container (tank) and on the measured medium. It should always be possible to rinse the level gauges and to remove them from the measured medium. Whenever possible, they should also be lit.

When selecting a suitable level monitoring type and method, you particularly have to take into accountthe following:

5.1 Process conditions – liquids

- Liquid type (water, condensate, chemicals generally)
- Pressure in the measured container
- Temperature of the measured medium
- Medium density – stable, variable
- Electric conductivity
- Permittivity
- Dielectric constant
- Viscosity
- Aggressive liquids – chemical resistance of the sensors, requirements for the sensor material
- Foam on the liquid surface
- Sludge on the bottom of the measured container

5.2 Process conditions – bulk materials

- Humidity
- Granulate granularity
- Abrasiveness
- Specific conductivity
- Adhesion
- Dustiness
- Specific weight
- Measurement range
- Measurement accuracy
- Tank material
- Geometric shape of the tank, silo or reservoir
- Clinging abilities of the material
- Medium stirring YES/NO
- Atmosphere composition above the liquid surface (vapors, fog, dust)

The level gauges for tanks and reservoirs will be equipped with separated level indicators installed at thebase of the given tank or reservoir, provided it is technically possible.

5.3 Sensor types

5.3.1 Continuous level measurement

- Differential pressure sensors
- Buoyant sensors
- Contactless sensors – radar, ultrasound
- Capacity sensors
- Conductivity sensors
- Optical sensors
- Hydrostatic pressure sensors
- Electromechanical sensors
- Radionuklide sensors

5.3.2 Limiting level measurement

- Vibration sensors
- Membrane switches
- Capacity switches
- Float switches
- Ultrasound switches
- Rotational switches
- Optical switches (monitoring flooding of pump suction mechanisms)
- Conductivity switches
- Blade switches
- Radionuklide switches

5.4 Installation of the level sensors

The level sensors can be installed either directly in the measured tank, reservoir, silo, etc., and or a bypass assembly can be utilized in the leading pipe or the float chamber.

For measurement levels of bulk materials using radar or ultrasound sensors, the level sensors should be configured prior to being put into operation for the first time by a representative of the given level gauge manufacturer (shape of the measured container, mechanical parts in the measured container (propeller etc.), fixed roof or floating roof of the tank, shape of the silo bottom or tank, feeding and discharging openings in the measured container).

In order to eliminate interference and echoes, the sensors should be initially configured on the given container without any medium and only after that with the measured medium.

5.5 Level measurement using the differential pressure principle

The differential pressure sensors have to be able to withstand without any damages the minimal operationpressure of the measured medium in the container at the low-pressure side as well as the high-pressure side of the dp sensor.

Sensors designed for monitoring levels at low temperatures of the media (between 0 °C and -50 °C) have to be equipped with a separation membrane with a capillary. The length of the capillary has to be as short as possible considering the given sensor location and size of the container. For sensors with a capillary that is longer than 2.5 m, thermal insulation of the capillary has to be implemented in order to avoid the impact of the surrounding temperature and to ensure measurement accuracy. The membrane size (DN) has to beselected considering the specification of the measured medium and the required measurement accuracy.

The required accuracy for these types of measurement devices starts at ± 0.25% of the measurement range.

5.6 Radar sensors

This type of sensors is suitable for applications with a greater pressure and temperature, for containers with vacuum environments, for highly sticky and viscous media, pastes and sediments, and for containers thathave vapors over the measured level of the medium. In order to ensure accuracy of the measurements, you have to consider internal obstacles in the measured container.

5.7 Radionuclide level reading principles

Installations of the radionuclide level measurement devices have to be conducted exactly in accordance with the given manufacturer instructions. All conditions applicable to the installation of radionuclide transmitters pursuant to Atomic Act No. 263/2016 Coll. have to be fulfilled.

Radionuclide level sensors must not be put into operation until all required documentation arising from the above mentioned Atomic Act is prepared for their application at the given production facility.

All activities that involve radionuclide transmitters, such as their installation, disassembly, repairs, transport or liquidation, can be conducted only by companies with the appropriate permit, issued by the State Office for Nuclear Safety (SÚJB).

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- EMERSON ASCO
- ENDRESS & HAUSER
- HONEYWELL ENRAF
- KROHNE
- ROSEMOUNT
- SIEMENS
- VEGA
- WIKA (KSB Kuebler)
- YOKOGAWA
- BERTHOLD
- ENELEX
- BÜRKERT
- ABB

6 Measurement of pressure and pressure differences, pressure switches

6.1 Local manometers with limit switch

- Indicator diameter of 160 mm, however, at least 100 mm.
- Manometer accuracy at least 1.5% or better
- The manometers have to be equipped with a separation membrane, provided the character of thegiven medium requires it
- The basic structural material should be stainless steel (stainless steel 316 (17 348)).
- One-way valves with a bleeding valve should always be used for the manometers connections
- Technology connections – threaded connections ½” NPT, G1/2 or M20x1/2
- For steam measurements, a condensation loop has to be installed before the given manometer
- Individual pressure elements have to withstand without damages 200% of the standard operation pressure
- The standard operation pressure of the manometers has to be selected in between 30 and 70% of the measurement range; the maximal operation pressure should not exceed 80% of the selected range

6.2 Pressure and differential pressure converters, pressure switches

- Differential pressure converters have to be able to withstand without damages and without any impact on the calibrated pressure range above the level of the calibrated value, applied either simultaneously to both input chambers or to just one of the sides – the other side being open to the atmosphere

- The input chambers of pressure converters have to be able to withstand without damages at least 200 times the maximal value of the calibrated range
- Output signal 4–20 mA designed with the HART protocol
- Required accuracy ± 0.25% or better
- Required protection at least IP68
- Electric connection – cable bushing M20x1.5 , ½“ NPT or ¾“ NPT
- Material design
- Separation membrane – minimal requirements AISI 316L (17349) stainless steel, always pursuant to the measured medium
- Input part minimum AISI 316L (17349) stainless steel, always pursuant to the measured medium
- Converter installation
- Mounted on a wall
- Mounted on a 2“ pipe
- Pressure transmitters have to be able to withstand 1.3 tines the overload of the set pressurewithout any damages
- Absolute pressure transmitters have to be able to withstand the overload of the absolute vacuum,regardless of the range of the emitter
- Individual transmitters have to be equipped with a separation membrane, provided it is requiredby the given medium
- The difference pressure transmitters should be equipped with a three- or five-way valve system

6.3 Pressure switches

- Switches with mercury filling must not be used
- The sensors, in compliance with the protocol on determining external impacts, should be of anintrinsic-safe design with inductive reading; contact switches for other environments
- Mechanical parts of the actual switches have to be vibration resistant
- The pressure switch must withstand surrounding temperatures without damages on the installedtechnology
- Pressure switches for bulk material (at the PE and PP granulation lines) must be of a design witha compensation for the temperature of the liquid alloy
- The used pressure switches should preferably have adjustable switched pressure values
- With a hysteresis setup option depending on the switch type

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- EMERSON ASCO
- ENDRESS & HAUSER
- HONEYWELL
- KROHNE

- ROSEMOUNT
- SIEMENS
- WIKA
- YOKOGAWA

7 Temperature measurements, temperature switches

7.1 Local thermometers with limit switch (contact thermometers)

Basic technical requirements

- Thermometer body – stainless steel 316SS (17349)
- Indicator diameter 160 mm or 100 mm
- The thermometers should be of a robust design with the option to turn the indicator, with a rear orbottom connection, alternatively of a joint design
- The thermometers will be bimetallic for temperature ranges from 30 °C to 500 °C.
- The thermometers with a filling will be used for temperature ranges from –200 °C to 800 °C.
- The measurement range will be differentiated in a way that the standard operation temperature is indicated at the level of 70% of the range of the given measurement device, with the stipulation that the maximal expected temperature is within 90% of the measurement device range
- Pursuant to the protocol on determining external impacts, the switches will be of an intrinsic-safe design with inductive reading; contact switches for other environments.
- Mechanical parts of the contact thermometers have to be vibration resistant

7.2 Thermal sockets

- The temperature sockets should be of a flange- or welded type
- Basic material stainless steel SS316, or other material according to project in cases where SS316is unsuitable with regard to operating temperature
- Connection between the thermal socket and thermal element – threaded 1/2” NPT, bayonetmount or with a weld M20x1.5 resp. M27x1

POX unit

Due to the specific conditions of the temperature measurements on Shell reactors, only **thermocouples with a protective sapphire** can be used for this part of production pursuant to the Instrumentation documentation of the POX unit.

7.3 Resistance thermometers (RTD)

- The resistance thermometers will be of a three- or four-conductor design Pt 100 ohm @ 0 °C,(IEC 60751 Standard, Class A

- RTD thermometers have to be fast, fully protected, shielded in steel (AISI 304, AISI 316),resistant against vibrations / impacts and electrically insulated from the body of the sensor
- The thermometers should be preferably equipped with 4 – 20mA signal converter of the HARTdesign in the thermometer head, provided it is technically possible
- RTD have to be normally grounded
- The diameter of the sheathing has to be 3 mm or 6 mm, the sheathing has to be made of stainless steel 316, installed into a thermal socket, making sure it is not in contact with the measured medium. The length of the thermometer has to be selected based on the length of the given thermal socket.
- Temperatures can be measured based on the resistance change principle within any range between +200 °C and + 600 °C
- The methods of placement of resistance thermometers must always correspond to the given technology.

7.4 Thermocouples

- The thermocouples (TC) have to be of a sheathing design
- Sheathing material – INCONEL, AISI 316, stainless steel 1.4571
- The design has to be resistant against vibrations / impacts and the thermocouple conductors haveto be electrically insulated from the body of the sensor
- The thermometers should be preferably equipped with 4 – 20mA signal converter of the HARTdesign in the thermometer head, provided it is technically possible
- The thermocouple characteristics have to comply with standard IEC 60584-1, Class 1 and IEC 61515
- The thermocouples have to be equipped with heads that are resistant against climatic conditions
- The element diameter has to be 6 mm, the sheathing has to be made of stainless steel 316
- The length of the thermometer has to be selected considering the length of the thermal socket
- For sheathed thermocouples, the element diameter can be 3 mm
- In order to achieve standardization of the temperature measurement process, thermocouples of type “K”, class 1 are usually used. Pursuant to the specific process conditions, other thermocouple types can be used – J, N, R, T, B or S
- Thermocouple placement methods must always be appropriate for the technology.
- Depending on the nature of the measurement, use a compensation line (cable) when extending the supply from the thermocouple elements to the measuring instrumentation.

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- YOKOGAWA
- INELSEV SERVICE for the POX production facility
- ABB
- WIKA
- ZPA
- EMERSON

- ENDRESS & HAUSER

8 Control valves, flaps, ball valves, ON/OFF closing valves, limit valves

Valve selection and use for particular applications require a thorough assessment of all parameters. When determining suitability of control valves for a particular application as a part of a technology, you need to consult valve manufacturers in order to find the best solution for your application.

8.1 Used control valves

- Sliding control valves, single- or double-seat valve, ball cock, eccentric ball valve, butterfly, segment valve

8.2 Drives

The drives of the controls valves should preferably be pneumatic.

- When it is not possible for technical reasons, electric or hydraulic drives can be used.

8.3 Positioners

- Normally, intelligent positioners with a 4-20 mA input and 4-20 mA valve position feedback should be used.
- The use of intelligent positioners is not suitable for some technological applications
- Electro-pneumatic positioners
- Pneumatic positioners

8.4 Body of Control or On/Off valve

The nominal valve internal diameter should be selected from the following line: 10, 15, 25, 40, 50, 80,100, 150, 200, 250, 325, 300, 350, 400 mm and bigger.

- The valves can be flange valves or, for special operation conditions, welded or segment valves(installed in between flanges)
- The noise level 1 meter from the valve and up to the height of 1.5 meters must not exceed 85 dBunder standard operation conditions
- Special valve trim designs or silencers installed in the pipeline can be used to reduce noise muffling.
- The valve tightness should be determined pursuant to the construction project documentation pursuant to standard ANSI B16.104-1976, CEI IEC 60534-4 or ČSN EN-60534- 2-1(individually for each position)
- The k_{vs} coefficient should be determined in a way that the valve is open to 80% of the lift under the maximal operation value
- The valve plugs should be designed in a way that prevents leaks of the medium to the surroundings
- The material of the valve plugs and sealing in the third flanges should be selected considering thegiven medium type, operation temperature and pressure, taking into account the moves of the spindle (sliding, revolving)

- The control valves have to be accessible from the floor or a fixed service platform for repairs and handling purposes
- The quality of the control valve units material have to be of the same or better quality than the quality of the pipe material
- The valve DN can be 1, and in exceptional cases 2 classes lower than the DN of the corresponding pipes
- A closing valve has to be installed before and after every control valve
- Control valve installations have to include a bypass (BY-PASS) with a manual closing valve

8.5 ON – Off (position) valves – closing and limit valves

The on-off valves should have the same internal diameter as the internal diameters of the pipes, on which they are installed.

The valves will be always equipped with a pneumatic drive. Alternatively, a hydraulic or electric (servo) drive can be used when it is required by the given combination of the valve internal diameter and type, and the operation conditions for ensuring the speed of the valve closing.

The valve closing time has to correspond to the operation requirements (fast/slow closure). The valve lift time in seconds should not be greater than the valve internal diameter in inches, unless specified otherwise.

The valves should be equipped with terminal position switches of an induction type (proximity switch).

The valves should be generally equipped with suitable solenoid valves. Solenoid valves should bepowered by 24 VDC or 230 VAC.

Vendor list (might be different depending on production facilities and/or requirement for the unification of Instrumentation devices):

- ARGUS
- AUMA
- EMERSON ASCO
- FLOWSERVE
- HY-LOK
- MAPOL
- METSO
- PARKER
- SAMSON
- ZWICK (TRIVAL)
- VALVEA
- ZPA
- POLNA
- SCHNEIDER ELECTRIC
- BURKERT

9 Analyzers and chromatographs

Analyzing devices, which form a part of the given technology, have to be installed in compliance with the Protocol on determining external impacts in technological containers or in suitable protection cabinets.

Analyzer houses shall be built and equipped with protective elements as “ventilated spaces”, fitted with air- conditioning as necessary so that the climatic conditions suitable for the installation of analyzing devices can be maintained there.

Requirements for the construction and operation of analyzer houses are governed by the ČSN IEC 79-16 standard, which also determines the rules for verification and tests necessary to prove the suitability of individual installations. It also specifies the conditions under which electrical equipment capable of causing initiation may be used in these analyzer houses.

The analyzing devices have to be installed including the necessary sample modification accessories with initial chemical, calibration and main gas fillings.

The sample point has to be protected against clogging.

When necessary, the consumption location should be equipped with a device that ensures sample pointpassability – for example a drilling system.

The sample conditioning system must be designed, including appropriate electrical heating, with a view to ensuring the physical and chemical parameters of the sample (temperature, pressure, flow rate, humidity) required by the manufacturer of the analyzer or chromatograph to achieve a representative result.

The gaseous and liquid components after the conducted analysis have to be returned back to the process or tothe appropriate waste system or a field burner connection, chemical sewerage system, etc.

9.1 Emission measurements

Continual emission measurements of vapor and waste gases have to be designed in compliance with thegiven legislature. European standard ČSN EN 14 181, Stationary emission sources - Demonstrating the quality of the automated measurement systems, describes the procedures for ensuring the quality that is necessary for making sure that the automated measurement systems (AMS) installed for air emission measurements are able tocomply with the required uncertainty values of the measured data specified by Control No. 415/2012 Coll., on the permitted pollution level and its determination, and on implementing some other stipulations of Act No. 201/2012 Coll on the Air Protection, which transposes Control No. 2010/75/EU on industrial emissions.

Standard ČSN EN 14 181 specifies the following quality assurance levels (QAL) for automated emission measurement systems

QAL1 – Assessing suitability of measurement methods by comparison with the required measurementuncertainty (ČSN ISO 14956) – conducted by the AMS manufacturer.

QAL2 – AMS calibration and determining variability of the measured values that demonstrate suitability of the given AMS – conducted by authorized persons after AMS installation and in 3-year intervals after that.

QAL3 – Securing and demonstrating the required quality of the measurement results during the standard AMS operation, which includes verification of the conformity of the MR characteristics with the requirementsspecified as a part of QAL1 – conducted continuously by the source operator.

AST – (Annual Surveillance Test) Annual verification of the data accuracy with the objective to determine ifit operates correctly and fulfills the required characteristics and if it complies with the specified calibration functions and variability – conducted by authorized persons on an annual basis.

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- ABB
- BUHLER
- DURAG
- EXTEC (SENSIGAS)
- GE SENSING
- HARTMANN & BRAUN
- HORIBA
- METTLER TOLEDO
- SICK
- SIEMENS
- SWAN
- YOKOGAWA
- HACH LANGE
- TELEDYNE
- SERVOMEX
- SOLARTRON
- PANAMETRIA
- HAMILTON

10 Gas detection (GDS - gas detection system)

Used gas detection principles:

- Catalytic combustion
- Electrochemical sensors for gas detection in within the ppm range
- MOS – Metal Oxide Semiconductor
- Sensors based on the infrared radiation absorption principle
- Sensors based on the photo-acoustic monitoring principle
- Sensors based on the ultrasound acoustic detection principle

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- DRÄEGER
- ESSER
- EXTEC (SENSIGAS)
- HONEYWELL

- SIEMENS
- OLDHAM
- SIEGER
- AIYI TECHNOLOGIES CO., LTD.
- AE INDUSTRY

11 Weighing systems

The weighing systems of appropriate designs have to be installed in compliance with the protocol on determining the environment. The required measurement accuracy have to comply with the given technological production process.

Weighing system component types

11.1 Strain gauges and force sensors

- Weighing strain gauges
- Weight sensors
- Error weight sensors
- Skid weight sensors

Nominal output 2 mV/V

Minimal protection level IP68

- Linearity ≤ ±0.030 %
- Hysteresis ≤ ±0.030 %

11.2 Belt scales

Their design has to comply with the requirements for robust, corrosion-resistant loads for all application types. The system has to allow for an easy installation and calibration.

11.3 Dispensers

The dispensers are designed for processes that require continuous weighing and material feeding.

11.4 Flowrate meters for bulk materials

They have to comply with the requirements related to weighing freely flowing powders and granulation materials. They must be able to withstand heavy applications with corresponding accuracy and reliability.

11.5 Road and railroad weighbridges

Road weighbridges have to be designed considering the maximal weight capacity and length of the scales.

The scales can be manually controlled (the process of weighing is conducted by the driver of the vehiclebeing weighted) or operated by operation personnel.

The design of the weighbridges has to allow for an easy calibration. Individual sensors have to be installed with predictive diagnostics. They have to be able to withstand lightning and flowing water (protection IP68). The cables between the sensors and the assessment unit have to have a solid protection sheathing made of stainless steel and they have to be able to resist interference by radio frequencies. They also have to be resistant against humidity and rodents.

The actual sensors have to be made of stainless steel with protection IP68 and with a built-in microprocessor that allow for continuous adjustments pursuant to given unstable conditions, such as temperature, humidity and scale bending.

The weighing systems can be, based on the given user requirements, equipped with:

- License plate automatic recognition system
- Identification using chip cards
- Automatic light signaling system
- Camera system for inspecting the scale area with the option of taking pictures
- Optical gate

The scale design has to allow for regular and easy maintenance, including the mandatory official verification of the specified measurement device.

Vendor list:

- TENZONA
- SCHENCK
- METTLER TOLEDO
- ENELEX
- SIEMENS

12 Vibration and shift sensors

The sensors should be selected considering the turbine or compressor design, while taking into account the structural design and recommendations of the turbine or compressor manufacturer.

13 Cables and cable routes

Cable routes of the Instrumentation devices should be always implemented above the ground

- Their implementation has to comply with the requirements of the Protocol on determining external impacts for the given production facility.
- The outer shielding of the cables has to be able to withstand UV radiation and impacts of the given media at the installation location.
- The cable routes have to be implemented separately for individual parts, i.e. electro, Instrumentation, low-current installations, optical lines. etc.

- The cable routes have to be implemented separately for different voltage levels, either by separatechannels or separation partitions inside of the cable channel.
- The material and surface treatment of the cable routes should be at least galvanized. The so-called stainless program should be applied for individual technologies in aggressive environments.
- When specifying individual galvanized materials, you need to state the corrosion class of the proposed routes pursuant to ČSN EN ISO 12944-2. (For chemical production facilities, we recommend to propose corrosion class C4 or C5-I).
- When installing cables in the existing cable routes, you have to recalculate the load and spatial capacities of the existing cable routes and channels.

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- HELUKABEL
- KERPEN WERK
- LAPPKABEL
- PRAKAB

13.1 Cable Labeling

13.1.1 Cable Labeling of the above-the-ground external cable routes:

- By punching on stainless labels; the labels are attached by stainless fastening straps (polyestercoated stainless steel), by milling on UV resistant plastic labels yellow colors.
- By undeletable descriptions (laser printing) black colors on plastic labels.
- The Labeling should be implemented by the building exit/entrance.
- At cable routes crossings and split locations.
- Every 25m.

13.1.2 Cable Labeling inside of buildings and cable collectors:

- By punching on stainless labels; the labels are attached by stainless fastening straps (polyestercoated stainless steel), by milling on UV resistant plastic labels.
- By undeletable descriptions (laser printing) black colors on plastic labels.
- The Labeling should be implemented by the building exit/entrance.
- At cable routes crossings and split locations.
- Every 25m.

13.2 Cable colors

- Light blue for analogue and two-value signals of intrinsic safe circuits.
- Grey for pro analogue and two-value signals.
- Black for cables with a voltage of 230 VAC and 24 V DC
- Light blue with a corresponding color strip pursuant to the used thermocouple for compensationlines

13.3 Cable routes

- They should be always installed above the ground.
- For cable routes for fire safety devices (gas leakage detection), the cable routes can be installedunderground.
- Cable routes laid on cable trays, which will be installed on top of each other, have to have aminimal span of 250 mm, arranged from high to low voltages (higher up).
- Rising trays have to be equipped with dismountable steel covers.
- Cable trays and auxiliary cable route steel structures on the bridges have to be of a screw-ondesign and dismountable (free of welding).
- Intrinsic safe signals will be installed along special routes, separated from the other signals, whilecomplying with the necessary distances.
- The trays will form the loadbearing parts of the cable routes.
- Cable channels should be perforated for water discharge purposes.
- The channels should be equipped with easily removable covers, which can be remounted whenneeded.

13.4 Cables and cable lines for fire safety devices

13.4.1 Fire safety devices

Fire safety devices (hereinafter referred to as “PBZ”) pursuant to Section 1d of Control No. 246 of the Ministry of the Interior from June 29th, 2001, on “Determining fire safety conditions and state fire supervision” (fire prevention control) include:

Devices, systems, technical devices and construction products that are necessary for structures for fire safety of the given building or other devices.

The control specifies that the following devices should be considered fire safety devices:

- Fire signaling devices (such as electric fire signaling systems EPS (in some documentation termed FAS – Fire Alarm System), long-distance transmission devices, flammable gas and vapor detection devices, autonomous fire signaling devices, manual fire alarm devices).

It is clear that PBZ represents very important devices, which should remain operational under fire as long as possible. These requirements include not only requirements for the actual cables, but also for their loadbearing structures.

Section 4 of the above mentioned control also specifies the “dedicated fire safety devices” from among the stated PBZ. They include:

- Electric fire signaling systems
- Long-distance transmission devices
- Flammable gas and vapor detection devices
- Stable and semi-stable fire extinguishing devices
- Automatic anti-explosion devices
- Smoke and heat exhaust devices
- Fire flaps

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- DRÄEGER
- ESSER
- EXTEC (SENSIGAS)
- HONEYWELL
- SIEMENS

13.4.2 Fire protection plugs

Requirements for fire plugs, including adequate fire resistances, are stated in the fire report. When construction modifications are needed, the fire report shall be revised. Shall new constructions be erected, a fire safety solution of the structure shall form a part of the IPD. Passages among individual fire section shall be equipped with fire stoppers of an adequate resistance. Building passages shall be sealed using waterproof and fire plugs. Shall gas seals be required, it will bespecified by the client.

In order to choose a suitable system, the required fire resistance and type of the fire partition structure shall be determined.

Individual passages shall be marked using the fire protection system solutions. The marking shall include the name of the used system, implementation date, company name and name and certification number of the particular employee.

Sealing of the passages and gaps shall remain intact even if the fire partition structure moves (dilatation joint). Passages through the building structure or channels to underground routes have to be furnished with bushings in order to prevent water and gas penetration (for example, EPAF, HILTI, HSI, RDSS or ROXTEC)

Documentation:

- Protocol on determining external impacts.
- Initial revision reports shall be prepared in the extent of “N 11 006 – Rules for electric devices”, Points 9. In case of a fire stopper, a document on the operability inspection of fire safety equipment verified by QP FP as per N 11006 Annex 11
- Registration sheet of fire stoppers, seals and passages as per N11 006 Annex 12
- ATEX certificates.
- Declaration of conformity
- Technical parameters of electric devices
- Size drawings
- Terminal board drawings
- Connection diagrams
- Setup values for assesments
- List of spare parts
- List of recommended spare parts for the initial equipment
- Description of the painting system
- Protocols on measurements and tests conducted by the manufacturer - type tests, piece tests, etc.
- Protocols on conducted measurements and tests after installation.
- Installation and connection instructions
- Repair requirements, i.e. if repairs can be conducted by the user or a repair shop. (in. Czech).
- Information necessary for repairs of electric devices (in Czech)
- Operation manuals (in Czech)
- Calculations
- Documentation of electric devices with special conditions for their use, for example, of a device with a certificate number complemented by the symbol “X”;
- Documentation that describes the system of spark-safe systems.

- Declaration of a manufacturer/qualified person; (Declaration of a manufacturer/qualified person is usable for situations when uncertified devices are used with the exception of simple devices for spark-safe circuits).
- Certificate of the Technical Inspection of the Czech Republic on putting a class I device into operation Fire safety construction solutions and, if applicable, revisions
- Declaration of conformity
- Technical parameters of the fire solution
- Drawings of the layout of fire protection plugs
- Authorization for the assembly of fire protection systems
- Confirmation of the inspection of operability of the given fire safety solution
- Confirmation of implemented assembly of the given fire safety solution
- List of fire protection dividers pursuant to N 11 006.

Vendor list:

Cable routes:

- CABLOFIL
- HILTI
- KOPOS
- NIEDAX
- OBO BETTERMANN
- SCHNEIDER ELEKTRIC (WIBE)

Component markings:

- ABB
- BRADY
- WEIDMÜLLER

Fire protection system:

- HILTI
- INTUMEX

Gas-proof and water-proof plugs:

- BRATTBERG
- EPAF
- HAUFF TECHNIK
- HILTI
- HSI
- RDSS
- ROXTEC
- TYCO ELECTRONICS

Wiring to explosion hazardous environments:

- BARTEC
- CEAG
- CZ EXPLOSION – PROOF
- GENERI
- STAHL

13.5 Cable system

Loadbearing structures, i.e. cable trays, channels and clamps, including cables. The entire cable system has to withstand fire for the specified period of time – it must evince functional integrity for the specified period of time.

Used cables should be not only fire resistant, but also halogen-free, i.e. they must not create poisonous corrosion smoke under fire.

Used cables and conductors, as well as the entire storage system that remains functional under fire,should be installed in a way that their functionality is preserved and not breached by surrounding elements or systems, such as other installation and pipe distribution lines, building structures and parts, at least for the required time period.

Individual signals from electric fire signaling systems and gas leak detection devices must not becombined in multi-wire cables. All signals have to be led to the assessment control room without any interruptions.

14 Protection cabinets, junction boxes, combining signals

When Instrumentation devices need to be heated because of the measured medium, the correspondinginstrumentation should be installed in heated protection cabinets.

The heating instrumentation in protection cabinets can be implemented with an installed heating unit. Aclosing valve or a block with an integrated heating element can be used when it is suitable.

Considering the given local conditions, a protective roof can be installed as a protection againstinstrumentation damages.

14.1 Junction boxes

Cables from individual sensors and control valves will be combined in junction boxes. One cable can house only signals of the same type.

- The design of the junction boxes have to comply with the Protocol on determining the given environment.
- They have to be installed at well accessible locations.
- For junction boxes (cabinets) and multiple multi-wire cables, a 20% reserve has to be considered (20% of the terminal plate or junction box capacity or 20% of the wires in multi-wire cables must remain unused after installation - reserve).
- Junction boxes must be properly marked in a visible place (front side).

14.2 Separation system between the electro and Instrumentation signals

The distance between the installed electro and Instrumentation cable lines have to comply with ČSN EN 50174-2 ed.3 and ČSN EN 50174-3 ed.2

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- CEAG
- CZ-EX
- HACO
- INTERTEC
- STAHL
- GENERI

15 Electric heating

The basic implementation of electric heating systems has to be of a self-regulating design.

Heating cables have to be implemented in accordance with the corresponding prepared calculations forindividual types of impulse lines, while considering the given measured medium.

The heating calculation should form a part of the minimal implementation and AS-Built documentations.

- Heating cables should be installed in accordance with the given manufacturer manual.
- Heating cables installed outdoors must be supplied via additional protection with a residual current device. This also applies to heating cables in Ex areas.
- Electric heating systems should be equipped with error signaling mechanisms
- Electric impulse heating systems should be thermally insulated, using a sheet metal, aluminum sheathing.
- Insulation sheathing should be implemented in a way that water cannot get inside of the insulation material; the Al insulation ends and joints should be treated using a suitable sealant (silicon).

Considering the temperature of the measured medium, resistance cables can be used for heating the instrumentation impulses. The same rules related to thermal and Al insulation apply for this type of heating asfor the self-regulating cables.

Vendor list (might be different depending on production facilities and/or requirement for the unification ofInstrumentation devices):

- BARTEC
- GENERI
- KLOPPER-THERM
- RAYCHEM
- THERMON

Note: The above stated companies **must be manufacturers** of electric heating systems. Deliveries fromother manufacturers than those stated here are not permitted.

16 Elektro supervision worksite (E-Tablo)

16.1 Introduction

- Specification of general rules for the incorporation of additional devices into the E-tablo electrical supervisory worksite.
- For a portion of newly built technologies, the existing E-tablo supervisory worksite must be enlarged (or newly supplied in case of a local worksite) to be equipped with a station (PC), control and diagnostic system AMS for data collection, evaluation, monitoring and archiving, and with SW for diagnostics without dismantling.
- A multiplexer network at the level of intrinsically safe interface will be built in the system of data transmission between DCS, ESD and field instrumentation, providing for the collection of operating and diagnostics data from individual field instrumentation devices contained in HART protocol (unless the DCS or ESD itself makes it possible).
- Only so called intelligent devices suitable for communication through HART protocol may beused (see para 3.10 Types of Signals).
- The worksite enlargement (delivery) refers to the installation of suitable HW as well as the adaptation and enhancement of relevant SW. The SW adaptation and enhancement shall be agreedwith the respective supervisory worksite administrator by contractor.
- SW shall be specified by the client based on his own choice (unification).
- All costs related to the above described supervisory worksite adaptation must be included in acontractor´s quotation.
- The supervisory worksite shall be equipped with computer systems and monitoring SW as necessary.
- The supervisory worksite shall be installed in a pre-agreed manner (e.g. on a computer desk) at apre-agreed location.

16.2 Supplements – PCH supervisory worksites

- Any device connected to the supervisory worksite shall be fitted with a communication interface serving solely for the device remote supervision. The communication interface serving for the control of process technologies systems is unacceptable. If the device to be connected supports an Ethernet-based communication, the interface shall preferably be used for the connection to the supervisory worksite.
- The new device interface shall be Ethernet-connected to the nearest switch assigned to E-tablo. The switch port to which any new device is to be connected shall always be defined, taking account of maintaining the required reserves, by an E-tablo network administrator during the preparation of investment project documentation. In case that the new device has no Ethernet communication interface available and is connected via, e.g., RS485 serial line, a converter for theconversion of such communication to Ethernet must be applied. The device which enables no communication at all shall be connected to E-tablo through a device with binary inputs providing for Ethernet communication (PLC Simatic S7); such device to be supplied within the frameworkof the investment project.
- Active elements required to be newly added for the supervisory worksite enlargement (such as switches etc. …) shall be included into the investment project. Industrial-type active elements complying with the existing network concept, with optional WESTERMO diagnostics shall be used.

- From a switch, via the existing network, data will be forwarded to BoxPC where OPC server will run. The type and parameters of the BoxPC required to be added, if any, shall be defined by the network administrator. The OPC server software shall form a part of the equipment delivery.
- The initial configuration of OPC server is always made by equipment supplier. The OPC server must be so configured that the access to the server data from remote computers is possible.
- The newly supplied device shall be incorporated into the supervisory worksite by the network administrator as a part of the investment project.

16.3 The supervisory worksite enlargement after the application of new devices

Having new devices incorporated, the supervisory worksite system must be so adapted that the representation of diagnostics data from the newly installed devices is possible. The supervisory worksite enlargement includes the following:

- the creation of new screens for the visualization of device statuses
- the addition of new alarms for the archiving of fault conditions
- the supplementation of archives with newly archived information on conditions and measurements
- the creation of trends from the archived measurements
- the creation of alarms for the loss of communication with devices
- the supplementation of devices onto the screens for communication diagnostics
- The adaptation of representation may only be made by a supervisory worksite administrator.

16.4 An engineering station enlargement after the application of new devices

- If it is possible to configure newly added devices remotely by means of specialized software, suchsoftware needs to be installed in engineering station at the supervisory worksite control room (station #8401). The software shall be provided and installed by a device supplier.
- The configuration of the network elements in a path between the engineering station and newlyinstalled device shall be performed by a supervisory worksite administrator as a part of the investment project.

16.5 Local supervisory worksite

- At some sites, local electrical supervisory worksites exist. Such local worksite will need to be enlarged if new devices are added into the existing local supervisory worksite zone.
- To secure the local supervisory worksite independence, data must be transmitted outside of theOPC servers via which the supervisory worksite is connected

16.6 To be carried out by the network administrator:

When connecting a new device to the supervisory worksite network, the network administratorshall conduct the following (these jobs will be included in the frame of the investment project):

- specifying a switch and its port for the new device connection
- setting an IP address and net name of the new device communication interface
- configuring network elements for the creation of a path to the supervisory worksite servers

- configuring network elements for the creation of a path to the supervisory worksite engineeringstation
- including all network changes to the supervisory worksite project documentation

All jobs to be carried out by the ORLEN UNIPETROL network administrator within the investment project shall beincluded in the respective project quotation.

Network administrator / Supervisory worksite manager / Vendor list:

- INELSEV CONTROL

17 Documentation

The part of the standard describes the general minimal requirements for the composition of measurement and control devices. The Instrumentation device documentation has to comply with company controls S350 and S027.

The documentation has been prepared pursuant to the valid ČSN, internal controls and conventions applied on the premises of ORLEN Unipetrol RPA.

The documentation for Instrumentation devices has to comply with N11012 (Electro standards for ORLEN Unipetrol).

The documentation should be also prepared pursuant to the building valid fire safety solution (PBŘ) and current environment protocols.

The final implementation documentation (Marked as AFC) with integrated comments of the investor should form the basis for the work implementation. Based on the extent of the documentation, it will be sent for comments (Marked as IFC) to the investor for at least 10 working days + time needed for making thecorresponding corrections by the contractor.

The trial operation will not commence without the as-built documentation (Red Correct – corrections made by a red pen) being submitted to the device manager – one copy of the implementation documentation with included after-construction changes and after the corresponding device testing.

Device acceptance into operation is conditioned by the submission of the as-built documentation in its full extent and, upon its inspection by a ORLEN Unipetrol technician, simultaneous acceptance of the corresponding manualsin the language mutation pursuant to the contractual conditions, i.e. in the Czech language (legal obligation ofthe European Union member state, in which the given product is introduced and supplied to the Instrumentation ket), with all valid data and information related to the product characteristics, its lifespan, composition, packaging manner, assembly and startup manuals, manual availability, content and comprehensibility, usage manners, including the permitted usage environments, Labeling manner, implementation manner, warning signs, maintenance and liquidation manuals, certificates and certifications to the delivered devices and device sets, with the stipulation that the data and information have to be always stated in the Czech language pursuant to the conditions of Act No 102/2001 Coll., Act No. 90/2016 or Government Directive No. 118/2016.

Basic classification of the measurement and control device documentation:

- Documentary documentation
- Drawing documentation
- Supplier documentation

The content of the documentation can differ for individual Instrumentation device types, and particularly for devices with ionizing sources, depending on the used process technology.

17.1 Documentary documentation

- Technical report
- Initial revision report
- Type certifications
- ATEX certifications of all installed devices
- Certificate TICR
- Quality and completeness certificate pursuant to ČSN EN 10204/2.2
- Material and tightness test pursuant to ČSN EN 10204/3.2
- Conformity assessment pursuant to Control EU 97/23/ES
- Verification confirmation of the specified measurement device (Verification sheet)
- Calibration confirmation (Calibration sheet)

17.2 Drawing documentation

- List of measurement and control circuits
- Circuit connection diagrams (loops)
- Technological drawings R+I (PI&D)
- Layout of the device at the operation facility
- Drawings and cross sections of the cable routes
- Assembly diagrams with corresponding lists of parts (instrumentation hook up)
- Cable journal
- Junction boxes journal
- Specification sheets (data sheets)
- Control valve calculation sheets
- Orifice plate calculation sheets
- Electric heating calculation sheets
- Intrinsic safe circuit calculation sheets
- Instrumentation connections to electro devices
- 3D models – they should be provided in the native language of the application, in which theyhave been created, with all the data that are necessary for displaying the models in browsers that are compatible with the original application, i.e. including the databases of the used technical data, 3D objects, 2D diagrams and information about mutual relations among individual objects (i.e. mutual interconnection from the perspective of the database, 3D and 2D)

17.3 As-built documentation

Each document (drawing, report) should be saved as a single file.

Structure of individual chapters and documentation formats:

- 00 – Table of contents – in the current MS Excel version + pdf, etc.
- 01 – Technical report – doc + pdf
- 02 – List of measurement and control circuits – xls + pdf
- 03 - Circuit connection diagrams (loops) - xls + dwg + pdf
- 04 - Technological drawings PI&D - dwg + pdf
- 05 - Assembly diagrams with lists of devices (hook up) - dwg + pdf
- 06 - Cable journal - xls + dwg + pdf
- 07 – Device specification sheets (datasheet) – xls (doc) + pdf
- 08 – Connections between electro and the control system, E-tablo – xls + pdf
- 09 – Cable journal – xls + pdf
- 10 – Drawings and cross sections of the cable routes – xls + dwg + pdf
- 11 – Calculation sheets
  - Control valves - pdf
  - Orifice plates - pdf
  - Electric heating - pdf
  - Intrinsic safe circuits - pdf
- 12 – Device layout at the operation facility – dwg + pdf
- 13 – 3D models will be delivered in the native format of the application, in which they were created, with all the data that are necessary for displaying the model and information about mutual connections of individual objects (i.e. mutual connections from the database perspective, 3D and 2D).

The as-built documentation will become the property of the investor. Documentation in the PDF format has to allow for text searches and selections.

Drawing documentation submitted in the DWG format should be provided in an editable form with blocks dismantled into “text and lines” and without external references.

All documentations, including 3D models, should be also submitted in the native language of the application, in which they were created, with all the data that are necessary for displaying them in the browsers that are compatible with the original application or directly in it.

3D documentation should be submitted in the form of a complete project in the nwd format. The documentation should be always submitted in the printed as well as electronic version.

The printed version should be submitted in as many copies as it is needed for documentation archiving purposes and for the needs of technicians and service organizations in compliance with S027 and S350.

Electronic documentation should be submitted on a CD, DVD, flash disk or external hard disk.

17.4 Supplier documentation

- Installation and operation manuals of individual control circuit elements
- Maintenance and configuration manuals, various recommendations, etc.

18 Related standards and regulations

18.1 Legislature (Acts, Government regulations and Control)

- **Act No. 250/2021 Coll.** - Act on occupational safety in connection with the operation of reserved technical equipment and on the amendment of related laws
- **Act No. 124/2000 Coll.** – Act that changes Act No. 174/1968 Coll., on State Professional Supervisionof Occupational Safety, as equipped, Act No. 61/1988 Coll., on Mining Activities, Explosives and the State Mining Administration, as equipped, and Act No. 455/1991 Coll., on Trades (Trade Act), as equipped.
- **Act No. 262/2006 Coll.** – Labor Code (**Updated control**, based on the changes adopted by Control No.
- 298/2015 Coll., which came into effect on November 25th, 2015)
- **Act No. 89/2012 Coll. –** Labor Code.
- **Act No. 110/2019 Coll.** – Act on Processing of Personal Data – Act that changes Act No. 101/2000 Coll., Act on Protection of Personal Data and on Amendment to Some Acts
- **Act No. 121/2000 Coll. –** Act on Copyright and Rights Related to Copyright and on Amendment to Certain Acts (the Copyright Act, **Updated control**, based on the changes adopted by Control No. 94/2021 Coll., which came into effect on February 27st, 2021)
- **Act No. 22/1997 Coll.** – Act on Technical Requirements for Products and on Amendments to Some Acts. (**Updated control**, based on the changes adopted by Control No. 526/2020 Coll., which came into effect on January 1st, 2021)
- **Government Directive No. 118/2006 Coll.** – Government directive on assessing conformity of electricdevices designated for being used within certain voltage limits when being supplied to the market
- **Act No. 102/2001 Coll.** – Act on General Product Safety and on the Amendment to Certain Acts - Act on General Product Safety, (**Updated control**, based on the changes adopted by Control No. 183/2017 Coll., which came into effect on July 1st, 2017)
- **Act No. 242/2016 Coll. –** Customs Act, (**Updated control**, based on the changes adopted by Control No. 609/2020 Coll., which came into effect on January 1st, 2021)
- **Act No. 458/2000 Coll.** – Act on Business Conditions and Public Administration in the Energy Sectors and on Amendment to Other Acts (the Energy Act, **Updated control**, based on the changes adopted by Control No. 403/2020 Coll., which came into effect on January 1st, 2021)
- **Act No. 455/1991 Coll. –** Act on Trades - the Trades Licensing Act,(**Updated control**, based on the changes adopted by Control No. 543/2020 Coll., which came into effect on January 1st, 2021)
- **Act No. 251/2005 Coll.** – Act on Labor Inspection. (**Updated control**, based on the changes adopted by Control No. 285/2020 Coll., which came into effect on January 1st, 2021)
- **Decree No. 268/2009 Coll.** – Decree on technical construction requirements. (**Updated control**, based on the changes adopted by Control No. 323/2017 Coll., which came into effect on October 19st, 2017)
- **Decree No. 246/2001 Coll.** – Decree of the Ministry of Interior on determining the conditions for fire safety and state fire supervision - fire prevention decree, (**Updated control**, based on the changes adopted by Control No. 19/2021 Coll., which came into effect on Fabruary 1st, 2021)

- **Decree No. 499/2006 Coll.** – Decree on construction documentation. (**Updated control**, based on thechanges adopted by Control No. 405/2017 Coll., which came into effect on January 1th, 2017)
- **Decree No. 415/2012 Coll.** – Decree on permissibl level of pollution and its detection and on implementation of certain other provisions of Air Protection Act, (**Updated control**, based on the changes adopted by Control No. 216/2019 Coll., which came into effect on January 1st, 2020)
- **Government Directive No. 101/2005 Coll.** – Government directive on more detailed requirements for worksites and work environments.
- **Regulation č. EU 97/23/ES –** Regulation on the approximation of the laws of the Member States concerning pressure equipment
- **Act No. 90/2016 Coll. –** Act on assessing conformity of specified products when introduced on the
- market, (**Updated control**, based on the changes adopted by Control No. 526/2020 Coll., which came
- into effect on January 1st, 2021)
- **Government Directive No. 93/2012 Coll.** – Government directive that changes Government Directive No. 361/2007 Coll., which determines to occupational health and safety conditions, as emended by Government Directive No. 68/2010 Coll.
- **Act No. 541/2020 Coll.** – Act on Waste
- **Government Directive No. 116/2016 Coll.** - Government directive on assessing conformity of individual devices and protection systems designed for beingn used in explosion hazardous environments when introduced on the market
- **Government Directive No. 117/2016 Coll.** - Government directive on assessing products conformity from the perspective of electromagnetic compatibility upon their delivery
- **Government Directive No. 118/2016 Coll.** - Government directive on assessing conformity of electric devices designed for operation within certain voltage limits when introduced on the market
- **Act No. 201/2012 Coll.** – Act on Air Protection, . (**Updated control**, based on the changes adopted by Control No. 403/2020 Coll., which came into effect on January 1st, 2021)
- **Regulation č.2010/75/EU –** Regulation on industrial emissions
- **Act No. 263/2016 Coll. –** Atomic Act
- **Decree SÚJB No. 422/2016 Coll.** – Decree on radiation protection and security of a radionuclide source
- **Decree SÚJB No. 409/2016 Coll.**– Decree on activities of particular importance from the point of view of nuclear safety and radiation protection, special professional competence and training of a person ensuring radiation protection of a registrant
- **Decree SÚJB No. 359/2016 Coll.** – Decree on details to ensure the management of a radiation emergency

18.2 ČSN (in valid edition, including changes and repairs)

- **ČSN ISO 3511-2** 12/05 Measurement, management and instrumental equipment of technologicalprocesses - Schematic diagrams - Part 2: Extension of the basic requirements

- **ČSN ISO 3511-4** 12/05 Measurement, management and instrumental equipment of technologicalprocesses - Schematic diagrams - Part 4: Basic symbols for process management by the means of a computer, interface and shared display and control function
- **ČSN EN 81346-2 ed.2** 07/21 Industrial systems, installations and equipment and industrial products – Structuring principles and reference Labeling - Part 2: Sorting individual objects and class codes
- **ČSN EN 61175-1** 03/16 Industrial systems, installations and devices and industrial products – Signal Labelings
- **ČSN EN 60534 (soubor norem)** Control valves for industrial processes
- **ČSN EN 14181** 07/16 Stationary emission sources – Demonstration of the quality of automated Measuring systems
- **ČSN EN ISO 12944-2** 06/19 Paints – Anticorrosion protection of steel structures using painting products – Part 2: Classification of exterior environments
- **ČSN EN 50174 (soubor norem)** Information technology – Cabling installation
- **ČSN IEC 381-1** 02/93 +Z1 Analogue signals for process system control. Part 1: Direct current signals
- **ČSN IEC 381-2** 04/93 Analogue signals for process system control. Part 2: Direct voltage signals.
- **ČSN IEC 946** 10/92 +Z1 Binary direct voltage signals for measurement systems and process control
- **ČSN EN 60382** 09/95 Analogue pneumatic signal for process system control
- **ČSN EN 60654-1** 05/96 Measurement and control devices for industrial processes - Operation conditions. Part 1: Climatic conditions
- **ČSN IEC 654 (soubor norem)** Operation conditions for measurement and control devices for industrial processes.
- **ČSN EN 60546-1 ed.2** 05/11 Regulators with analogue signals for control systems of industrial processes - Part 1: Operability evaluation methods
- **ČSN EN 61069-1 ed.2** 03/17 Measurement and control of industrial processes. Evaluations of system characteristics for system predictions
- **ČSN EN 61131-3 ed.2** 10/ Programmable control units - Part 3: Programming languages
- **ČSN EN ISO 5167** (soubor norem) Measurement liquid flow rates using differential pressure sensors inserted into completely filled pipelines with a round cross section
- **ČSN 25 7711** 05/94 Measurement liquid and gas flow rates in enclosed profiles. Measurement flow rates using a segment screen and an adjustable segment screen
- **ČSN ISO 3966** 10/22 Measurement liquid flow rates in enclosed profiles – Speed field measurement method using Prandtl tubes
- **ČSN EN ISO 20456** 04/22 Measurement liquid flow rates in enclosed profiles. Methods for assessing the activities of induction, liquid flow rate meters
- **ČSN EN 60584-1 ed.2** 05/14 Thermoelectric segments - Part 1: Voltage and tolerance data
- **ČSN EN 60584-3 ed.2** 11/21 Thermoelectric segments - Part 3: Extension and compensation lines – Tolerance and Labeling system
- **ČSN EN 60751** 09/14 Industrial platinum resistance thermometers and platinum temperature sensors
- **ČSN ISO 9826** 06/94 +O1 Measurement liquid flow rates in open channels. Parshall flumes and Saniiri type flumes

- **ČSN IEC 60050-300** 07/03 +Z1,Z2,Z3,Z4 Ch3 International electrotechnical dictionary - Electric and electronic measurements and measurement devices - Part 311: General terms and measurements - Part 312: General terms of electric measurements - Part 313: Types of electric measurement devices - Part 314: Special terms pursuant to individual machine types
- **ČSN 33 2000 (soubor norem)** Low-voltage electric installations
- **ČSN EN 61140 ed.3** 10/16 Protection against electric current injuries – Common viewpoints for individual installations and devices
- **ČSN EN 10204** 08/05 +O1 Metallic products – Types of inspection documents
- **ČSN EN 60079-17 ed.4** 08/14 Explosive atmospheres - Part 17: Revisions and preventive maintenance of electric installations
- **ČSN 73 0875** 04/11 Building fire safety – Determining conditions for proposals of electric fire signaling systems within the frame of a given fire safety solution
- **ČSN IEC/TR 61439-0** 08/23 Low voltage switchboards – Part0: Switchboard specification manual
- **ČSN 33 3051** 11/92 +Z1 Protection of electric machines and distribution devices
- **TNI IEC/TR 61200-52** 11/14 Instructions for electric installations - Part 52: Selection and construction of electric devices - Electric lines
- **ČSN EN IEC 62368-1 ed. 2** +A11 09/21 Information technology devices
- **ČSN IEC 79-16 (33 2325)** 9/95 Artificial ventilation for the protection of analyzer houses
- **ČSN EN 60079-14 ed.4** 9/14 +O1+O2 Explosive atmospheres – Part 14: Proposing, selecting and establishing electric installations -
- **ČSN EN 60529** 11/93 + Z1,Z2,O1 Degrees of protection provided by enclosures (IP code)
- **ČSN 33 0165 ed.2** 04/14 +O1,O2 Marking of conductors by colours or numerals – Procedure provisions
- **ČSN 73 0848** 10/23 Fire safety of buildings – Electrical equipment, electrical installations and distribution.
- **ČSN 73 0895** 04/16 Fire safety of buildings - Maintenance of functionality of cable routes under fire conditions - Requirements, tests, classification Px-R, PHx-R and application of test results.

18.3 Company internal standards

- **S 027** Management of investment projects
- **S 72/1** Computer control systems of technological processes
- **S 350** Technical documentation
- **S 350/1** Requirements for drawing documentation of the pipeline distribution lines isometry
- **S350/2** Requirements for process flow schemes (PFS) and P&ID diagrams
- **S350/3** List and structure of the DCC code values
- **S350/4** Input data for creating a technical asset register
- **S350/5** Requirements for lists and descriptive data of spare parts
- **N 11 003** Operating electric machines
- **N 11 006** Rules for electric devices
- **N 11 012 CZ-EN** Elektro standars for ORLEN UNIPETROL
- **N 11 017** Standard for implementing reverse inspections of the Loop check circuits

- **N 11 023 CZ-EN** DCS, ESD and PLC standards for ORLEN UNIPETROL
- **N 11 792** Acceptance conditions for complete pressure containers, steam boilers and their parts