



# TECHNICAL REQUIREMENTS

## AUTOMATION AND INSTRUMENTATION

Document No. OL-TR-IR-000

### GENERAL

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## 1. SCOPE

- 1.1 This document defines basic technical requirements in instrumentation discipline and it shall be considered as the mandatory design and / or construction criteria for the Project Management, Supervision and Maintenance Department, Investment project Department, Procurement Department in AB “ORLEN Lietuva” (OL), etc. /referred to as the OL / as well as for Design Offices, Subcontractors, Vendors and other external companies being the party of the contract /referred to as the Contractor/ during construction of the new plants and process units, revamping activities and reconstruction works in the premises of OL.
- 1.2 Basing on this document, CONTRACTOR shall establish with the OL the detailed assumptions (scope of design, construction works, etc.) which ought to be confirmed with a protocol signed by both Parties. CONTRACTOR is liable to make said agreements.
- 1.3 Any instrumentation aspects related to the subject of the contract, which are not included in this document, are to be governed by Lithuanian laws and standards or internal regulations in OL.
- 1.4 Any deviations from technical requirements included in this document shall be agreed with and accepted in writing by OL.
- 1.5 This document contains general requirements for designing of the field instrumentation equipment, DCS and ESD systems and other monitoring systems.

## 2. REFERENCES

### 2.1 General

Design and execution of the equipment shall meet requirements of Lithuanian law, Directives of European Union, standards and regulations as well as this elaboration, in the following priority order:

- a) Legislation of the Republic of Lithuanian;
- b) Directives of European Union;
- c) LST (LST EN) – Lithuanian Standards (consistent with standards of European Union);
- d) CEN/CENELEC – European Committee for Standardization / European, Committee for Electrotechnical Standardization;
- e) IEC – International Electrotechnical Commission;
- f) ASME – American Society of Mechanical Engineers;
- g) API – American Petroleum Institute;
- h) ISA – International Society of Automation;
- i) ISO – International Organization for Standardization;
- j) ANSI – American National Standards Institute.

### 2.2 Main Standards and Regulations actual version

LT Įstatymas [Energetikos įstatymas](#)

LT Įstatymas [Statybos įstatymas](#)

LT Įstatymas [Metrologijos įstatymas](#)

LT Įstatymas [Potencialiai pavojingų įrenginių priežiūros įstatymas](#)

LT Įstatymas	<a href="#"><u>Atitikties įvertinimo įstatymas</u></a>
LT Techninis Reglamentas	<a href="#"><u>Slėginių įrenginių techninis reglamentas.</u></a>
LT Techninis Reglamentas	<i>Įrangos ir apsaugos sistemų, naudojamų potencialiai sprogioje aplinkoje, techninis reglamentas (Technical Regulations for Equipment and Protection Systems Used in Potentially Explosive Atmosphere)</i>
LT Techninis Reglamentas	<i>Matavimo priemonių techninis reglamentas,</i>
LT Techninis reglamentas	<i>Elektromagnetinio suderinamumo techninis reglamentas</i>
STR 1.01.04	<i>STR 1.01.04 Statybos produktų, neturinčių darnųjų techninių specifikacijų, eksploatacinių savybių pastovumo vertinimas, tikrinimas ir deklaravimas. Bandymų laboratorijų ir sertifikavimo įstaigų paskyrimas. Nacionaliniai techniniai įvertinimai ir techninio vertinimo įstaigų paskyrimas ir paskelbimas</i>
STR 1.01.03	<i>Statinių klasifikavimas</i>
STR 1.05.01	<i>Statybą leidžiantys dokumentai. Statybos užbaigimas. Statybos sustabdymas. Savavališkos statybos padarinių šalinimas. Statybos pagal neteisėtai išduotą statybą leidžiantį dokumentą padarinių šalinimas</i>
STR 2.01.01(2)	<i>STR 2.01.01(2):1999 Esminiai statinio reikalavimai. Gaisrinė sauga.</i>
STR 2.01.01(3)	<i>STR 2.01.01(3):1999 Esminiai statinio reikalavimai. Higiena, sveikata, aplinkos apsauga.</i>
LT taisyklės	<i>Elektros įrenginių įrengimo bendrosios taisyklės (Rules for the Installation of Electrical Units)</i>
LT taisyklės	<i>Specialiųjų patalpų ir technologinių procesų elektros įrenginių įrengimo taisyklės (Rules for the Installation of Electrical Units)</i>
LT taisyklės	<i>Elektros linijų ir instaliacijos įrengimo taisyklės.</i>

<b>LT taisyklės</b>	<i>Elektros įrenginių relinės apsaugos ir automatikos įrengimo taisyklės.</i>
<b>LT taisyklės</b>	<i>Saugos eksploatuojant elektros įrenginius taisyklės</i>
<b>LT taisyklės</b>	<i>Elektrinių ir elektros tinklų eksploatavimo taisyklės.</i>
<b>LST EN 60079</b>	<i>Electrical apparatus for explosive gas atmospheres. Elektriniai aparatai, naudojami potencialiai sprogiose atmosferose</i>
<b>LST EN 13463-1</b>	<i>Non-electrical equipment for potentially explosive atmospheres. Part 1: Basic method and requirements (EN 13463-1)</i>
<b>ANSI/ISA S7.0.01</b>	<i>Quality Standard for Instrument Air</i>
<b>ANSI/NACE MR0175 / ISO 15156</b>	<i>Petroleum and Natural Gas Industries - Materials for Use in H2S-containing Environments in Oil and Gas Production - Parts 1, 2 and 3</i>
<b>API-RP 551</b>	<i>Process Measurement Instrumentation</i>
<b>API-RP 554</b>	<i>Process Instrumentation and Control</i>
<b>ASME B46.1</b>	<i>Surface Texture</i>
<b>Directive 2004/108/EEC</b>	<i>Electromagnetic compatibility (EMC)</i>
<b>Directive 73/23/EEC</b>	<i>Low Voltage Directive</i>
<b>Directive 87/404/EEC</b>	<i>Simple pressure vessels</i>
<b>Directive 97/23/EC</b>	<i>Pressure equipment (PED)</i>
<b>IEC 60331-11</b>	<i>Tests for Electric Cables under Fire Conditions - Circuit Integrity - Part 11: Apparatus - Fire Alone at a Flame Temperature of at Least 750 Degrees Celsius</i>
<b>IEC-60331-21</b>	<i>Tests for electric cables under fire conditions - Circuit integrity - Part 21: Procedures and requirements - Cables of rated voltage up to and including 0,6/1,0 kV</i>
<b>LST 1516</b>	<i>LST 1516 Statinio projektas. Bendrieji įforminimo reikalavimai.</i>
<b>LST EN 60529</b>	<i>Degrees of protection provided by enclosures (IP code) (IEC 60529)</i>
<b>LST EN 61000-4-2:2009</b>	<i>Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test (IEC 61000-4-2:2008)</i>

<b>LST EN 61000-4-3</b>	<i>Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3)</i>
<b>LST EN 61340-5-1</b>	<i>Electrostatics - Part 5-1: Protection of electronic devices from electrostatic phenomena - General requirements (IEC 61340-5-1)</i>
<b>LST EN 61340-5-2</b>	<i>Electrostatics - Part 5-2: Protection of electronic devices from electrostatic phenomena - User guide (IEC 61340-5-2)</i>
<b>LST EN 62337</b>	<i>Commissioning of electrical, instrumentation and control systems in the process industry - Specific phases and milestones (IEC 62337)</i>
<b>LST ISO 5725-1</b>	<i>Accuracy (trueness and precision) of measurement methods and results. Part 1. General principles and definitions (ISO 5725-1)</i>
<b>Rekomendacijos R 14-2011</b>	<i>R 14-2011 Santrumpos ir raidiniai žymėjimai ir santrumpos projekcinėje dokumentacijoje.</i>
<b>LT Nuostatai</b>	<i>Darbuotojų, dirbančių potencialiai sprogioje aplinkoje, saugos nuostatai</i>

## **2.3 OL Specifications**

### **2.3.1 General**

**OL-TR-GR-000** *General Requirements*

### **2.3.2 Civil**

**OL-TR-CR-003** *Civil. Fireproofing*

### **2.3.3 Automation and Instrumentation**

**OL-TR-IR-001** *Automation and Instrumentation. Flow Instruments*

**OL-TR-IR-002** *Automation and Instrumentation. Pressure Instruments*

**OL-TR-IR-003** *Automation and Instrumentation. Level Instruments*

**OL-TR-IR-004** *Automation and Instrumentation. Temperature Instruments*

**OL-TR-IR-005** *Automation and Instrumentation. Analyzers*

**OL-TR-IR-006** *Automation and Instrumentation. Control Valves*

**OL-TR-IR-007** *Automation and Instrumentation. ON-OFF Valves*

	<b>OL-TR-IR-008</b>	<i>Automation and Instrumentation. Field Installation</i>
	<b>OL-TR-IR-009</b>	<i>Automation and Instrumentation. Control and Auxiliary Rooms</i>
	<b>OL-TR-IR-010</b>	<i>Automation and Instrumentation. Power Supply</i>
	<b>OL-TR-IR-011</b>	<i>Automation and Instrumentation. Distributed Control System</i>
	<b>OL-TR-IR-012</b>	<i>Automation and Instrumentation. ESD, BMS</i>
	<b>OL-TR-IR-013</b>	<i>Automation and Instrumentation. Programmable Logic Controller</i>
	<b>OL-TR-IR-014</b>	<i>Automation and Instrumentation. Fire and Gas Monitoring Systems</i>
	<b>OL-TR-IR-015</b>	<i>Automation and Instrumentation. Plant Material Balance</i>
	<b>OL-TR-IR-016</b>	<i>Automation and Instrumentation. Antisurge Systems</i>
	<b>OL-TR-IR-017</b>	<i>Automation and Instrumentation. Erection Technical Documentation. Completion of Works</i>
	<b>OL-TR-IR-018</b>	<i>Automation and Instrumentation. Scope of Supply</i>
	<b>OL-TR-IR-019</b>	<i>Automation and Instrumentation. HMI/SCADA System</i>
	<b>OL-TR-IR-020</b>	<i>Automation and Instrumentation. Data Sheets for Instruments</i>
<b>2.3.4</b>	<b>OL-TR-IR-021</b> Electrical	<i>Cybersecurity requirements</i>
	<b>OL-TR-ER-000</b>	<i>Electrical. General</i>
	<b>OL-TR-ER-031</b>	<i>Electrical. Electric Shock Protection</i>
	<b>OL-TR-ER-036</b>	<i>Electrical. General Electric Erection Procedures</i>
<b>3.</b>	<b>TERMS AND DEFINITIONS</b>	
	<b>AISI</b>	American Iron and Steel Institute
	<b>API</b>	American Petroleum Institute
	<b>APS</b>	Abandon Platform Shutdown
	<b>ASME</b>	The American Society of Mechanical Engineers
	<b>ATEX</b>	Equipment intended for use in potentially explosive atmospheres
	<b>BMS</b>	Burner Management System

<b>BS</b>	British Standard
<b>BSPP</b>	British Standard Pipe Parallel
<b>DIN</b>	Deutsches Institut für Normung
<b>EN</b>	European Standard
<b>ESD</b>	Emergency Shut Down
<b>FF®</b>	Foundation Fieldbus
<b>GRP</b>	Glass-fiber Reinforced Plastic
<b>HART®</b>	Highway Addressable Remote Transducer
<b>HMI</b>	Human Machine Interface
<b>HVAC</b>	Heating, Ventilation and Air Conditioning
<b>IE</b>	Instrument Earthing
<b>IEC</b>	The International Electrotechnical Commission
<b>IS</b>	Intrinsically Safe
<b>ISA</b>	International Society of Automation
<b>ISO</b>	International Organization for Standardization
<b>IP</b>	Ingress Protections
<b>IR</b>	Infra-Red
<b>JB</b>	Junction Box
<b>MCT</b>	Multi Cable Transit
<b>N/A</b>	Not Applicable
<b>NAMUR</b>	Normenarbeitsgemeinschaft für Mess- und Regelungstechnik in der Chemischen Industrie
<b>NPT</b>	National Pipe Thread
<b>OD</b>	Outside Diameter
<b>PED</b>	Pressure Equipment Directive (97/23/EC)
<b>Profibus DP</b>	-PA® Profibus Nutzerorganization
<b>PSD</b>	Process Shut Down
<b>RTD</b>	Resistance Temperature Detector
<b>SAS</b>	Safety and Automation System



<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>SI</b>	System International
<b>SIL</b>	Safety Integrity Level
<b>SMART</b>	Field Instrument with Distributed Intelligence
<b>SPL</b>	Sound Pressure Level
<b>SS</b>	Stainless Steel
<b>UPS</b>	Uninterrupted Power Supply
<b>VAC</b>	Voltage Alternating Current
<b>VDC</b>	Voltage Direct Current

#### **4. CERTIFYING ORGANIZATIONS**

Instrumentation Equipment can be certified as:

- a) The pressure equipment;
- b) The equipment intended for use in explosion hazard areas.

#### **5. PRESSURE INSTRUMENTATION EQUIPMENT SUBJECTING TO CERTIFICATION**

**5.1** Devices directly installed on the pipelines and equipment qualified as the pressure ones belong to the instrumentation equipment which subjects to certification. It applies to the control and isolation valves, direct-acting controllers, thermowells for thermo elements and flow meters.

**5.2** Isolation valves installed on the instrumentation equipment nozzles belong to mechanical discipline.

**5.3** Directive No 97/23/EC of 29 May 1997 of European Parliament and Council on closing of the pressure equipment law regulations of the member countries is applied to the pressure equipment.

#### **6. INSTRUMENTATION EQUIPMENT WHICH SUBJECTS TO CERTIFICATION AS THE EQUIPMENT FOR USAGE IN EXPLOSION HAZARD AREAS**

**6.1** Almost all instrumentation equipment will be located in the explosion hazard areas on the plant. Due to this fact, such equipment subjects to certification.

**6.2** It applies to the following:

- a) Pressure and pressure differential transmitters;
- b) Level transmitters;
- c) Flow meters;
- d) R/I transmitters for temperature measurement;
- e) Temperature detectors;
- f) Analyzers;
- g) Junction boxes with accessories;
- h) Analyzer shelter;
- i) Remote controlled valve actuators and positioners;
- j) Solenoid valves;

- k) Cable glands and plugs;
- l) Switches;
- m) Smart positioners;
- n) Limit switches;
- o) And other field equipment.

**6.3** Directive No 94/9/EC of 23 March 1994 of European Parliament and Council on unification of the law regulations of the member countries concerning the equipment and protection systems for usage in explosion hazard areas is applied for manufacturing and operating of the equipment intended for usage in explosion hazard areas.

**6.4** All organizations, which will be entered in the list published in the Official Gazette of European Communities, are authorized for certifying of such equipment.

## **7. REQUIREMENTS FOR EX DOCUMENTATION AND APPROVALS FOR APPLICATION**

**7.1** The following documents should be provided In order to obtained an opinion for electrical instrumentation items to be allowed for operation in explosion hazard zones, and these documents should be submitted to OL:

- a) Project documentation for considered investment project;
- b) As built specification of electrical instrumentation equipment made as explosion proof;
- c) The complete set of Ex certificates;
- d) Explosion hazard zones classification;
- e) Hook-up drawings of instruments equipment;
- f) The results of RLC measurements for spark proof cables circuits;
- g) The protocol from operational tests of interlock system operation for the equipment with pressure casing as per LST EN 60079 and other associated European Union standards.

**7.2** Above-mentioned documentation should be delivered around 1 month before the date of planned final acceptance of the project.

**7.3** The commissioning and verification of the equipment made as explosion proof shall be carried out with the presence of OL specialists in order to eliminate eventual omissions, mistakes or other faults.

## **8. PREAMBLE GENERAL STRUCTURE**

**8.1** This Document defines technical requirements for instrumentation and control systems for production units.

**8.2** Each time prior to engineering commencement, CONTRACTOR shall agree with OL all technical requirements, related standards, standard drawings and / or formats included in this elaboration.

### **8.3 Ambient Conditions**

<b>8.3.1</b>	Temperature	min.	–36°C and	max.	+33°C
	– Winter – Minimum				–36°C
	– Minimum Design for Hot Piping				–28 °C
	– Minimum Design for Cold Piping				–36 °C
	– Coldest Average during 5 days				–23 °C
	– Summers Maximum				+33 °C

- 8.3.2** Relative Humidity (Design)
- |           |      |
|-----------|------|
| – Normal  | 63 % |
| – Maximum | 89 % |
- 8.3.3** Barometric Pressure (Design) 760 mmHg (1.01325 bar(a))

**NOTE:** For climatic data see also OL-TR-GR-000.

- 8.4** Instrumentation equipment and control system for the new or revamped unit shall be consistent with mandatory standards and law regulations in chemical industry and be manufactured according to the state-of-the-art.
- 8.5** Measurement equipment, control system and monitoring systems shall be located in separate technical rooms and in separation with electrical equipment. The control room and the control cabinet rooms ought to be located in one building, if possible.
- 8.6** The basic structure of the field instrumentation equipment consists of the following:
- DCS System;
  - ESD System based on PLCs;
  - Combustible and toxic gas monitoring system;
  - Fire monitoring system;
  - CCTV System;
  - Machine monitoring system;
  - Anti-surge system;
  - Dedicated PLCs, supplied within the packages;
  - Field instrumentation;
  - Integration with PI systems.

## **9. GENERAL DESIGN REQUIREMENTS**

**NOTE:** For general see OL-TR-GR-000.

- 9.1** Field instrumentation and control system shall be designed in conformity with the standards and law basic engineering and the OL requirements included in this elaboration.
- 9.2** Assumed control structures are to be designed for reliable functioning, ease servicing, low operation costs and maximum technical safe at low expenditures. The design, instrumentation and measurement systems and the equipment have to meet (but not be limited to) the following requirements:
- Continuous operation between turnarounds. The duration of this period is assumed as four years;
  - The plant / process operation parameters;
  - Optimum number of operation and servicing staff.
- 9.3** The underneath listed items shall be excluded from the instrumentation engineering (technical design) and included in mechanical design:
- By-pass valves on control valves and flow meters;
  - Nozzles for the field instrumentation;
  - By-passes and sampling points on the equipment and piping.
- 9.4** All materials used for instruments and accessories shall comply with process services and plant environments.

- 9.5** Match line between instrumentation and mechanical disciplines will be on all first isolation valves ended with the blind flange. It applies to all process and utility lines, vessels, columns and other equipment on which flow, level, pressure is measured and medium analyzed, etc., as well as for instrumentation air headers ended with isolation valve. The nozzle for temperature measurement shall be ended with the blind flange, without isolation valve. All isolation and drain valves ought to be included in mechanical design. In addition, detectors and measurement equipment directly installed in the line shall be included in mechanical design. Thermowell mounting and thermocouple for skin temperature shall be in mechanical scope. Supervision for temperature sensor mounting shall be in Instruments scope.
- 9.6** All located in instrumentation technical room AC devices with cables up to the power distribution and marshalling (intermediate) cabinets between electrical and instrumentation disciplines shall be included in electrical design.
- 9.7** Process variable switches for process pumps (e.g. for sealing system) shall be included in instrumentation design and other accessories in similarly (e.g. motor winding temperature and bearing measurement). Exception is made for MV Motor winding temperature measurement (6-30 kV). DCS protection against medium voltage from motor winding shall be done using two-stage (as minimum) protection:
- a) Primary protection – implemented by motor manufacturer;
  - b) Additional protection – implemented in measuring system.
- 9.8** Apply maximum standardization and unification of both the field instrumentation and control cabinet equipment during design works.
- 9.9** A free access to each instrumentation device shall be provided during start-up and normal operation of the plant.
- 9.10** Instrumentation equipment for potentially explosive areas shall be construed and selected in accordance with Directive ATEX100a of European Union and Lithuanian Standards coinciding with CENELEC.
- 9.11** The intrinsic safety execution of the field instrumentation is preferred (EExi) for BPCS. The flameproof safety execution of the field instrumentation is requested for Emergency shutdown (ESD) system.
- 9.12** In spite of hazardous area classification as zone 2, instrumentation equipment for zone 1 shall be used. These requirements shall be treated as a minimum.
- 9.13** Certificates for the equipment for potentially explosive atmospheres shall be issued in accordance with CENELEC Standards by one of registered certifying organizations, e.g.:
- a) Additional protection – implemented in measuring system;
  - b) PTB (Physikalische-Technische Bundesanstalt, Braunschweig – Germany);
  - c) BASEEFA Ministry of Technology SMRE Laboratories Hill-Buxton – (Great Britain);
  - d) Other certifying institutions registered in UE.
- The certificates shall be written either in Lithuanian or English language.
- 9.14** Documentation for potentially explosive atmospheres equipment, including certificates for Ex execution shall meet requirements of EU Directive ATEX 100a.
- 9.15** Equipment classified as pressure one shall conform to PED Directive 97/23/EC of European Union.

- 9.16** Calculation of instrumentation air consumption on the plant shall be performed using the safety coefficient “2”.
- 9.17** Linkage and couplings of measurement equipment will be made of stainless steel tubing like Swagelok type with double ferule connectors.
- 9.18** Pressure reducers with pressure gauges will be provided for measurement equipment consuming instrumentation air.
- 9.19** Due to the safety reasons, interlock initiators (position switches, level switches) will be equipped with devices for the line failure detection (LFD), directly connected to PLC.
- 9.20** Trip signals for the flow, pressure and temperature interlock parameters will be obtained from analogue signals (from independent flow, pressure and temperature transmitters) connected to PLC system.
- 9.21** ESD systems, including PLCs, are to meet **LST EN 61508**, LST EN 61511 Standards. SIL assessment will take into account Health and Safety, Environment, Economics (assets and production losses) consequence classes.
- 9.22** Field instrumentation shall be consistent with requirements of the basic design and HAZOP recommendations.
- 9.23** All measurement and instrumentation systems including PLC, DCS, and ESD will be powered from redundant UPS system. UPS batteries shall be sized for 0,5 hour.
- 9.24** Package units will have dedicated PLCs, of which the reliability requirements will be investigated and defined during the design stage basing on the recognized procedures (e.g. LST EN 61508 Standard, HAZOP Analysis). The OL will finally approve the application.
- 9.25** Measurement units:
- |    |                           |                          |
|----|---------------------------|--------------------------|
| a) | Temperature               | °C                       |
| b) | Pressure                  |                          |
|    | – gauge                   | bar(g)                   |
|    | – absolute                | bar(a), mmHg             |
| c) | Weight (mass)             | kg                       |
| d) | Volume                    |                          |
|    | – liquids                 | m <sup>3</sup>           |
|    | – gases                   | Nm <sup>3</sup>          |
| e) | Liquids Flow              |                          |
|    | – mass flow               | kg/h, t/h                |
|    | – volume flow             | m <sup>3</sup> /h        |
| f) | Gases Flow                |                          |
|    | – mass flow               | kg/h                     |
|    | – volume flow             | Nm <sup>3</sup> /h       |
|    | – flow of steam           | kg/h, t/h                |
| g) | Density                   |                          |
|    | – relative                | kg/m <sup>3</sup>        |
|    | – absolute                | kg/m <sup>3</sup>        |
| h) | Heat rate, duty           | Gcal/h                   |
| i) | Enthalpy                  | kcal/kg                  |
| j) | Power                     | kW                       |
| k) | Heat Transfer Coefficient | kcal/m <sup>2</sup> °C h |
| l) | Fouling factor            | m <sup>2</sup> °C h/kcal |
| m) | Viscosity                 |                          |

	– kinematic	cSt (centistokes)
	– dynamic	cP (centipoises)
n)	Level	mm, %
o)	Equipment dimensions	mm, m
p)	Pipe Length	mm, m
q)	Pipe diameter, flanges, nozzles	inches
r)	Equipment nozzle sizes	inches
s)	Nominal pipe sizes	inches
t)	Duct size	mm, m
u)	Plot Plan dimensions	mm, m
v)	Velocity	m/s
w)	Sound Pressure	dBA
x)	Sound Power	dBA

**9.26** The normalized conditions measurements are:

a)	Standard	760 mmHg,	15°C	(1,01325 bar(a))	(Sm <sup>3</sup> /h)
b)	Normal	760 mmHg,	0°C	(1,01325 bar(a))	(Nm <sup>3</sup> /h)

**10. STANDARD INSTRUMENTATION SIGNALS**

**10.1** Standard pneumatic signal – 0.2 to 1bar.

**10.2** Standard signal for electronic transmitters / control inputs: 4 mA to 20 mA DC in 2-wire 24V DC line. It is not applied to the thermocouple, resistive temperature detection (RTDs) and any other specific measurements.

**10.3** Instrumentation equipment shall enable communication consistent with HART Protocol.

**10.4** 24V DC discrete / Namur signals.

**10.5** Solenoid valves signals shall be – usually 24 V DC or 230 V AC in case of very long distances.

**10.6** MODBUS RTU serial communication with possible operation in multi-drop arrangement.

**10.7** Fieldbus Foundation OL will finally approve the application.

**10.8** Temperature measurement – TC / RTD.

**10.9** All electronic transmitter`s (SMART) analog output levels for Control and Safety systems must to conform NAMUR recommendation NE 43 (measurement range from 3,8mA up to 20,5mA ; fault signals ≤3,6mA and ≥22mA).

**11. SURGE PROTECTION**

**NOTE:** For general see OL-TR-IR-016.

**11.1** The surge phenomena can occur mostly during connections operations, in electrical circuits and during electrostatic discharges.

**11.2** Surges (overvoltage) are transferred between various systems by galvanic, induction and capacity couplings.

- 11.3** The surges can lead in most cases to the damages of electrical and electronic equipment mostly this phenomena leads to cable damages, electronic elements damages, junction damages and in some cases to serious plant damage.
- 11.4** In order to avoid the damages caused by above-mentioned phenomena the following surge protection elements for indoor and outdoor applications should be applied:
- a) Field surge limiters;
  - b) Stripe surge limiters;
  - c) Lighting Arresters;
  - d) Surge limiters.
- 11.5** The elements of surge protection elements should be selected according to the degree surge probability and applied equipment.

## **12. ELECTRICAL SHOCK PROTECTION**

**NOTE:** For general see OL-TR-ER-031.

- 12.1** Electrical shock protection system for the personnel, which operates of electrical, and equipment and electrical installations, as well as for the users of this type of equipment should be designed in such a way that in case of equipment of installation failures or faulty personal actions or faulty personal behavior the following must be assured:
- a) Limitation of shock currents flowing through the human body to the values which are considered as safe for a given conditions.
  - b) Limitation of the time of shock currents flowing by quick shut down of damaged equipment.
- 12.2** The following requirements for electrical shock protection should follow these basic requirements:
- a) Make Impossible to touch live parts which are under voltage at normal operating conditions;
  - b) Applying of proper low voltages which are not danger for health or life even in case of direct touching;
  - c) Quick equipment shut down system in case when unidentified currents, which are dangerous for health or life, could appear;
  - d) Limitation of touch voltages on accessible conductive parts in case when various failures could happen to the values which are considered as acceptable.
- 12.3** The elements of electrical shock protection system should be selected according to outside conditions and applied electrical equipment.

## **13. FIELD INSTALLATION OF THE EQUIPMENT**

**NOTE:** For general see OL-TR-IR-008 and OL-TR-ER-036.

- 13.1** Instruments shall either be in rigid fiberglass reinforced polyester type (with antistatic certificate) enclosure of manufacturer's standard execution or consistent with Vendor's standard. Field instrumentation shall have weather resistant seals. Where necessary the enclosure door ought should be equipped with a peep-hole enabling observation of being measured variable, settings, etc. Component of the equipment shall be made of appropriate materials for usage in refinery.
- 13.2** Field-installed interlock initiating and acting components shall be distinctly marked with red color.



- 13.3** Field-installed instruments shall have protection degree of at least IP-55, according to recommendations of LST EN 60529. Enclosures for the field instruments shall be of a high strength construction. Cables shall be protected from possible damage and if flexible tubing or conduit for this protection is selected the fitting and connectors to equipment and cable trays shall be used only with specific installation methods for which they are designed and listed. The flexible conduit and connectors should be installed as one part with easy disassembling possibility. Contacts of relay equipment shall be hermetically encapsulated to assure proper operation in environments of chemical works.
- 13.4** All accessories have to be installed in locations free of excessive vibrations and exposure to extreme temperatures, which could cause damage. Moreover, the accessories shall be installed neither below drains nor directly above vents.
- 13.5** When manual control is required, the transmitter shall be equipped with additional indication near to the control valve so that it could be seen from operator's position by the valve hand wheel. Each additional indication must be marked with the label bearing the tag number. The multiplier and engineering units shall be placed in the reading area.
- 13.6** Clamps, mount jigs, installation brackets shall be fixed to the permanent components of the construction. If it is impossible, they shall be fixed to the base by means of spreading plastic pins or special clamps for the process piping. Brackets shall not be welded to the process columns, vessels or piping.
- 13.7** Fixation to the hot piping shall be avoided. If it is impossible, then fixation point shall be moved away from the piping by providing any suitable construction. Where piping temperature exceeds 150 °C, then insulation pads of appropriate insulating material shall be inserted between the piping and fixation clamp.
- 13.8** If possible, fixation of the support construction to concrete walls and pillars shall be avoided. In specific cases, it shall be fixed by means of spreading plastic pins while avoiding any damage to the concrete base.
- 13.9** Pneumatic supply header for measurement and instrumentation purposes shall be made of galvanized pipes connected by thread connections. Manifolds (distributors) of compressed air (for 5 or 10 supply points) shall be horizontally placed on the pipe racks in easy accessible locations. An isolation valve has to be installed between the manifold and header.
- 13.10** Connection between the isolation valves on the manifolds and the instruments shall be made of stainless steel tubes like Swagelock type with double ferule connectors. Manifolds of compressed air and isolation valves shall have the appropriate descriptive plates. The underneath listed recommendations shall be followed during installation works:
- a) Avoid linking of tubes;
  - b) Avoid reducing of the tube cross-section;
  - c) All thread connections have to be sealed with PTFE tape.
- 13.11** Field instrumentation installed in explosion hazard areas shall be connected to the grounding system. It refers to the transmitters, junction boxes, analyzers, local control consoles. Parameters of the grounding system have to meet requirements of the Vendors of instrumentation equipment.
- 13.12** Generally, the measurement equipment and pulse tubes shall be electrical heat traced.



- 13.13** Electric power supply for heating purposes will be provided from distribution boards located in electrical substation. Electric heating loops shall have 2-pole break switch. Installation of the electrical heating system shall be done in such a way that disassembly of the appliances was possible without damaging of the heating components.
- 13.14** Field instrumentation installed in explosion hazard areas shall be connected to the grounding system. It refers to the transmitters, junction boxes, analysers, local control consoles. Parameters of the grounding system have to meet requirements of the Vendors of instrumentation equipment.
- 13.15** Interlock initiators and interlock actuators installed on field should be clearly marked by red color.
- 13.16** Every instrument and actuating element (the valve) should be equipped with the nameplate made of stainless steel, which is permanently fixed. This nameplate should contain full conditions parameters and instrument characteristic.
- 13.17** If more than one instrument is intended at the same location for measuring the same operating condition linked with ESD, these instruments have to be absolutely independent of each other and, preferably, based on different operating principles. The two shutdown systems must be independent and diverse; that is, operation of one system must not impair operation of the other system. This requirement must be met so that failure of one shutdown system cannot cause failure of both systems.

#### **14. ACCESS FOR FIELD INSTALLED INSTRUMENTS**

- 14.1** Field equipment and elements like measuring reducers, temperature sensors etc. as well as instrument cut off valves for insulation of these instruments from main lines or process equipment should be fully accessible from the platforms or eventually from the portable ladders.
- 14.2** To make instrument indications easy the field equipment should be located the level of 1,5m above the normal or service platforms. This does not apply to these instruments, which are equipment with indicators. The instruments should be always located in the places where access is easy. It is not allowed to locate the instruments in places with difficult access - under the ladders or stairs.
- 14.3** In order to provide easy maintenance junction boxes for multicore cables should be located in accessible locations at an elevation around 1,5m over the platform. Proper distance between these boxes and the structures to which these boxes shall be fixed should be assured. This distance should be established according to expected thermal or fireproof insulation thickness. All junction boxes should be described on outer side of closing cover and the marking should be placed on multipairs cables outgoing from the box.

#### **15. FIREPROOFING REQUIREMENTS – ELECTRICAL AND INSTRUMENTATION**

**NOTE:** For general see OL-TR-CR-003.

##### **15.1 Emergency Shutdown. Depressurizing Systems**

- 15.1.1** Some emergency shutdown and emergency depressurizing systems do not move to a safe position on loss of motive power or circuit continuity. Fireproofing shall be applied to electrical and instrumentation installations for all such systems.

- 15.1.2** Fireproofing shall be provided within unit battery limits for an onsite installation, or within the fire hazardous area for an offsite installation.
- 15.1.3** All electrical or pneumatic components necessary for safe manual actuation of these systems shall be fire proofed. Examples include manual initiators, valve actuators, enclosures, aboveground wiring, cable or conduit, and tubing.
- 15.1.4** Fireproofing shall be required within fire hazardous areas for other aboveground wiring systems. Such systems may include fittings, boxes, and other wiring devices as designated by the OL Engineer.
- 15.1.5** As an alternative to fireproofing individual cables, main banks of aboveground cable trays that carry wiring, conduit, and tubing may be fireproofed as a unit.

## **15.2 Block Valves**

- 15.2.1** Block valves, designated as "XVxxx ," located within 7,5m of the equipment being protected, and that do not meet the criteria of para 15.4 shall be fireproofed as follows.
- 15.2.2** Fireproofing shall be applied to the valve actuator enclosure, including the motor. The integral "open-stop-close" push-button shall be included within the fireproofed enclosure. Fireproofing shall not be applied to the valve body or hand wheel.
- 15.2.3** All aboveground power and control wiring associated with remote actuation (control room or field) and located within 7,5m of equipment being protected shall be fireproofed. Fireproofing shall be extended further where the fire hazardous area so demands.

## **15.3 Accessibility**

- 15.3.1** Fireproofing on instruments, valve operators and other equipment shall be removable for maintenance. Doors or removable covers shall be provided for access to terminal boxes, integral push buttons and status lamps, cable trays and pull points.
- 15.3.2** Actuator enclosures shall have readily separable joints or seams to permit removal without damaging the fireproofing. Unused conduit openings shall have removable plugs protected by the same fireproofing system.
- 15.3.3** Control devices mounted on fireproofed boxes or enclosures that must be accessible for non-emergency operations shall be designed to meet the fireproofing criteria.

## **15.4 Exceptions for Valve Actuators**

Fireproofing of valve actuators is not required for:

- 15.4.1** Piston driven valves which go to the safe position on loss of pneumatic or hydraulic pressure if they do not depend on a spring to be held in position.
- 15.4.2** Automatic deluge valves that are held closed by hydraulic or pneumatic pressure.
- 15.4.3** Diaphragm operated valves in vapor blowdown service, which fail open on loss of pneumatic or hydraulic pressure, if they do not depend on a spring to be held in position.

## **16. INSTRUMENT ENGINEERING DESIGN PACKAGE REQUIREMENTS**

Each class of Documentation shall be provided in separate volume or group of volumes:

## 16.1 Instrument Engineering Documentation

Engineering Documentation format, scope shall be discussed in detail during K.O.M. based on OL standards.

This set of volumes should contain:

- a) General requirements (standards, codes, regulations);
- b) Overall hardware configuration diagrams;
- c) Instrument index (for remote and local instruments);
- d) Process Data Sheets for instruments;
- e) Loop diagrams and data sheets;
- f) Functional block diagrams with detailed descriptions for each loop;
- g) Philosophy and strategy of Advanced Control;
- h) Sketches of Custom Displays (DCS) and graphic symbols;
- i) DCS reports definition;
- j) DCS History Groups;
- k) DCS Trending and Archiving;
- l) ESD, SIL loop calculation;
- m) Calculations for instrument air plant (IA);
- n) Intrinsic safety circuit calculations;
- o) Set point List for Interlock and Shutdown Systems;
- p) Set point List for Alarm System;
- q) Cause & Effect Diagrams;
- r) Interlock and Shutdown logic diagrams;
- s) Instrument Specifications segregated according to instrument types;
- t) Requisitions for supply of all instruments and installation materials according to status.

## 16.2 Installation and Erection Documentation

The set of volumes should contain:

- a) Instrument field layout;
- b) Instrument plot plan and location analyzer tapping points;
- c) Instrument process piping details;
- d) Instrument tracing details;
- e) Instrument air piping details;
- f) Specification of instrument protection box and instrument valves;
- g) Instrument air station (layout and details);
- h) Specification for instruments to process connection - piping, tubing and types fittings;
- i) Specification of junction boxes and details;
- j) Specification of Local Panel and Interface Cabinets;
- k) Specification of Signal and Power Cables;
- l) Specification of Instrument Cable Trays and Conduits;
- m) Bill off installation materials;
- n) Field Cable Trays Cross Section List;
- o) Instrument Cable List;
- p) Overall Interconnections diagram;
- q) Instrument mounting details;
- r) Miscellaneous field instrument supports;
- s) Drum management schedule;
- t) Specification of Analyzers and Accessories;
- u) Specification of flue Gas Monitoring;

- v) Specification of Control Valves;
- w) Cavitation calculation for control valves and measuring devices on the process lines;
- x) Specification of Flame Monitoring System;
- y) Specification of Vibration Monitoring and Speed Control for Turbine Compressor, Blowers;
- z) Isolation for Instrument piping and equipment.

### 16.3 Control Room, Technical Room and MCC Instrumentation

The set of volumes should contain:

- a) Overall configuration scheme;
- b) Control room layout - Auxiliary rooms layout;
- c) Console layout for DCS and auxiliary equipment (Telecom, Alarm Systems, Analyzer Systems, Gas Monitoring Systems);
- d) Control cabinets layout (Aux. Rooms, Control Room);
- e) Control room signal and interconnection cable routing;
- f) Auxiliary room signal and interconnection cable routing;
- g) Control room power distribution cable routing;
- h) Auxiliary room power distribution cable routing;
- i) Control room and Auxiliary rooms grounding systems;
- j) AC Connection diagrams to UPS (uninterrupted power supply);
- k) AC wiring diagrams;
- l) DC connection diagrams to UPS (uninterrupted power supply);
- m) DC wiring diagrams;
- n) Marshalling cabinet layouts;
- o) Controller cabinet layouts;
- p) PLC cabinet layouts;
- q) Interface interconnection wiring arrangements to Motor Control Centre and Auxiliary Rooms;
- r) Terminal connection list for analog and digital signals;
- s) Instrument loop diagrams;
- t) PLC overall configuration schemes;
- u) PLC software configuration drawings;
- v) System terminals, list terminals connections;
- w) DCS functional block diagrams with detail descriptions;
- x) DCS configuration data acquisition (for open loops);
- y) DCS configuration data for controller unit (for close loops);
- z) DCS data base;
- aa) DCS operator stations;
- bb) DCS interface connections (Host computer, RIS, Locate Terminals, Compressor Control and Monitoring Systems, F&G Monitoring System);
- cc) Software documentation for system software (configuration and development software, advanced software, interface software);
- dd) Calculation of capacity for air-conditioning and filtering system for technical, control room and MCC systems;
- ee) Air-conditioning and filtering system layout, wiring loop and working philosophy;
- ff) Bill of materials for DCS and PLC;
- gg) Application software documentation;
- hh) Calculation of fire & smoke detection system for technical, control room and MCC systems;
- ii) Fire & smoke detection system layout, wiring loop and working philosophy.

### 16.4 Vendor's Instrument Operating Instructions and Certifications

The set of volumes should contain:

- a) Procedures and instructions for erection and start-up;
- b) Specific procedures of tests (FAT, SAT) and maintenance cause;
- c) Complete set of explosion proof & intrinsic safety certificates and design calculations;
- d) Complete set of instrument material certificates;
- e) Calibration data, manufacturers' tests, quality reports;
- f) Authority Approval Certificates (TUV, LLOYD'S, DVGW, CLUDT etc.);
- g) Operation Manuals, Maintenance Manuals with full information about installation, application, fault indication, parts, calibration procedures and repairs;
- h) Inspection and verification tests at VENDOR'S workshop (e. g. DCS, PLC, alarm system, advanced programs, etc.);
- i) VENDOR calculation data sheets for orifice plates and control valves (final).