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1.0 INTRODUCTION

This specification gives directives for the design, selection criteria, methods, instructions and provides examples for instrument design scope of work. Specific design requirements for each type of instrument or instrument system are covered by the individual specification as per section 2.0 “References”.

2.0 REFERENCES

This document shall be read in conjunction with the following documents:

- U211-IC-SP-0002 Instrumentation - Requirements
- U211-IC-SP-0003 Instrumentation - General

3.0 CODES AND STANDARDS

The instrumentation shall be designed, constructed and tested in accordance with the requirements of this specifications and the edition of the applicable National and/or International Codes and Standards.

Where a conflict between the codes, etc., might exist, the most stringent requirements shall govern.

For list of codes and standards see section 3.0 “Codes and Standards” of document U211-IC-SP-0003 Instrumentation – General.

3.1 CE MARKING

Where applicable, all equipment, materials and components shall be CE certified, shall bear CE marking and shall be compliant to applicable EC directives.

3.2 SERBIAN AUTHORITY REQUIREMENTS

All equipment shall be in compliance with Serbian legislation and law requirements. Equipment vendors shall deliver all documentation requested by Serbian law (e.g. Serbian Ex Certificate) to be able to put equipment in operation in Serbia.

4.0 DEFINITIONS AND ABBREVIATIONS

Although various standards use different terminologies, one uniform terminology has been applied for this document as shown below:

Term	Definition
CR	Control Room
DCS	Distributed Control System
ESD	Emergency Shutdown System
LP	Local Panel
PLC	Programmable Logic Controller
P&ID	Piping & Instrument Diagram
TUD	Top Unheading Device
BUD	Bottom Unheading Device

5.0 INSTRUMENT MECHANICAL INSTALLATION REQUIREMENTS

5.1 INSTRUMENT TAGGING

Nameplates, showing tag number, will be of a permanent type, firmly fastened.

For Project instrument tagging philosophy reference is made to chapter 7.0.

5.2 INSTRUMENT MOUNTING

All instruments will be mounted as close as possible to the process connection, provided maintenance and accessibility requirements are taken into account. The length of the impulse line will be minimal, consistent with good practise and accessibility.

The location of instruments will be designed in such a way that direct drainage/vent of condensate, water, gas or process fluids from adjacent equipment has no adverse effect.

Field instruments and electronic transmitters will be mounted on independent pipe stands or attached by brackets to suitable steelwork and/or concrete structures. These instruments will be mounted with centreline at approximately 1300 mm (1800 mm maximum) above the platform or floor in a position accessible for operation and maintenance. Exception will be made for close coupled and inline instruments, these will be mounted on the pipe as per P&ID / isometric. Escape and maintenance routes shall be taken into account for the final design and installation.

Instrument supports, cable trays, conduits and other steel supporting materials will be hot dip galvanized.

Fasteners such as bolts, nuts and washers will at least be of corrosion treated steel (e.g. Galvanized or Stainless Steel). In any case, they will be resistant to the effects of the environment in which they are to be used.

For package unit cabling and tubing installation, interfaces boxes and bulkheads refer to applicable package unit specification.

5.2.1 ACCESSIBILITY

Accessibility identifies the effort required for a healthy human being to reach instruments such as measuring elements, instrument process connections, instrument utility connections, block valves or sampling points for the purpose of operational attention and/or maintenance. It includes the ability to reach such instruments with all tools required to perform operational attention or maintenance.

Instruments shall be accessible for operation and/or maintenance as follows:

- Accessibility from grade or platform shall be provided for:
  - Control valves, ON/OFF valves
  - In-line Flow meters (except orifice plates/venturi tubes)
  - Level transmitters
  - On-line analyzers
- Accessibility by a permanent ladder shall be provided for:
  - Level gauges
  - Pressure instruments
  - Temperature instruments
  - Analyzer sample take-offs
- Accessibility by a portable ladder - max. elevation 5 m - can be provided for:
  - first block valves of flow instruments, pressure instruments, level probes, pressure gauges, flow orifice taps
  - temperature elements, thermometers, thermowells
  - analyzer sample return points.

Limited accessibility of instruments shall always be consulted with instrument engineer.

Instruments connected to a protective system with a test interval of two years or less should be permanently accessible.

Local converters, amplifiers, switches, etc., should be installed near the corresponding instrument unless otherwise required.

Local indicating instruments will be readable from where the related equipment is operated or from where the primary instruments are to be tested or calibrated.

Instruments will not be mounted directly on handrails.

5.3 INSTRUMENT PROTECTION

5.3.1 INSTRUMENT ENCLOSURES

Electronic instruments located outdoors or in an open environment will be protected by the use of enclosures resistant to the effects of the environment in which they are to be used.

5.3.2 INSTRUMENT (HEAT) TRACING

In-line instruments (e.g. control valves, flow meters), and closely connected instruments (e.g. pressure gauges), which require (Heat) Tracing, will be traced using an extension of the process pipeline tracing.

Heat tracing of off-line instruments will be executed by applying electrical tracing and/or steam tracing as indicated on the P&ID's. Valve manifold block and instrument will be insulated by means of a protective housing.

Steam-tracing systems may be created using copper tubing for steam temperatures up to 200 °C. The tubing will be seamless copper tubing, solid drawn soft annealed size: ½" O.D. x 0.049" wall thickness.

5.3.3 INSTRUMENT SUNSHADES

In case of direct sun radiation which will cause unacceptable warm-up of the electronic instruments/local panels a sunshade will be installed.

5.4 INSTRUMENT CONNECTION TO PIPING AND VESSELS

The actual interface connection between piping and instruments is indicated in section 5.3.3 “Instrument / Process Connection” of document U211-IC-SP-0003 Instrumentation – General.

5.5 INSTRUMENT PROCESS PIPING AND TUBING

Tubing with compression type fittings (twin ferrule type) will be used for instrument impulse lines.

Instrument process impulse lines will be ½” O.D. x 0.065” wall thickness, stainless steel 316 annealed seamless. Fittings will be compatible with the tubing size and selected material will be equal or better than the tubing material specifications.

Tubing runs for instrument impulse lines will be kept as short as possible, consistent with good practise and accessibility.

At the instrument side of the first block valve, tubing will be used for instrument connections. Piping will provide flanges with ½” O.D. tube connector to accommodate instrument connection requirements.

Pressure gauges will be installed with direct mounted manifold. In case of inaccessible tapping point the pressure gauge will be remote mounted using ½” O.D. tubing.

Manifold will be mounted closed coupled to the transmitter as per below table:

Service	Type
Flow / Level / Differential Pressure	Block/Equalizing/Drain/Vent (5-valve manifold)
Pressure	Block/Drain (2-valve manifold)

Position of transmitters will preferably be as follows:

Phase	Under / Above tapping
Liquid	Under
Gas	Above
Vapor	Under
Steam	Under

Differential pressure instruments will be located above the taps for gas and non-condensable fluids. For liquids and condensable fluids mounting will be below the tapping point. Special conditions such as particles will be clearly defined.

All pressure instruments will be provided with a block valve and a drain/vent facility, except for those instruments with diaphragm seals, to provide the capability of depressurizing the impulse line.

For steam services, pressure gauges will be mounted with steam siphon. Condensate pots will be used in case of D/P level electronic transmitter hook-ups.

When instrument supports have to be fixed to fireproofed plant structures, these supports will be welded / bolted to the steel structure before the fireproofing is applied. In case of already applied fire-proofing, clamping will be considered.

Where the above tubing and fittings are not suitable for the process fluid or the process conditions and/or specific project requirements, other materials equal or better than the piping class specification will be used.

Instrument and capillaries will be plumb and level. Impulse lines which run at a slope will be continuously sloped in not less than one in ten except where otherwise specified. Direction of slope will be downward from the process for liquid service and upward from the process for gas service.

Tubing will be supported and protected from vibration and physical damage by means of tubing clamps.

No mechanical stress will be induced upon an instrument that will cause a malfunction or error in the readout. Tubing will not be secured directly to machinery or pipes but via supporting steel connected to columns, structure, steelworks, etc.

Tubing (1/2") should be supported at least every 1m.

Tubing will not be utilized to carry the weight of pressure gauges, seal pots etc. These items will be supported by nipples and fittings or suitable brackets.

5.6 INSTRUMENT AIR PIPING

Tubing with compression type fittings (twin ferrule type) will be used for instrument air piping lines.

Instrument (sub)-headers will be executed in accordance with the piping specification. Air take-off points from the (sub)-headers will be 1" unless otherwise specified.

The sizing of instrument air supply sub header will be based on following general rules:

Size		Number of users
½"	Pipe according to ANSI	1-5 users *
¾"	Pipe according to ANSI	6-10 users *
1"	Pipe according to ANSI	11-20 users *
1½"	Pipe according to ANSI	21-50 users *

* In case off large air consumers (on/off valves etc.) number of users will be adjusted as per actual consumption.

Individual instrument air supply and pneumatic transmission lines will be ½" O.D. x 0.065" wall thickness (or ¼" O.D. x 0.035" wall thickness where required), stainless steel 316 annealed seamless. Fittings will be compatible with the tubing size and selected material will be equal or better than the tubing material specifications.

Individual tube runs will be supported by existing structures and steelwork.

Tubing runs for instrument air lines will be kept as short as possible, consistent with good practise and accessibility.

The tubing runs will be kept clear from hot environments, potential fire risk areas, drainage points of condensate, water and process fluids.

Tubing will be supported and protected from vibration and physical damage by means of tubing clamps.

Tubing (1/2") should be supported at least every 1m.

5.7 INSTRUMENT HYDRAULIC TRANSMISSION

Instrument Hydraulic Transmission lines shall follow Equipment Manufacturer requirements.

Unless otherwise required, tubing with compression type fittings (twin ferrule type) will be used for instrument impulse lines.

Instrument hydraulic lines will preferably be ½" O.D. x 0.065" wall thickness, stainless steel 316 annealed seamless. Fittings will be compatible with the tubing size and selected material will be equal or better than the tubing material specifications.

Tubing runs for instrument hydraulic lines will be kept as short as possible, consistent with good practise and accessibility.

Individual tube runs will be supported by existing structures and steelwork.

The tubing runs will be kept clear from hot environments, potential fire risk areas, drainage points of condensate, water and process fluids.

Tubing will be supported and protected from vibration and physical damage by means of tubing clamps.

Tubing (1/2") should be supported at least every 1m.

6.0 INSTRUMENT ELECTRICAL INSTALLATION REQUIREMENTS

6.1 INSTRUMENT WIRING SYSTEM INSTALLATION

6.1.1 CABLING

Field mounted electronic instruments will be wired and connected to instrument boxes by means of single cables.

Instrument cabling between the instrument boxes/cabinets and instrument racks/marshalling cabinets in buildings will be by means of multicore cables.

In case of special signal transmission requirements for field mounted instrumentation, direct run (single) cables will be used.

Cable joints (splices) will not be used.

Instrument signal cables will comply with the following minimum requirements:

- By default all conductors will be stranded, in case of thermo-couple cable the conductors will be solid.
- Single cables will have a screening of metallic tape with a drain wire.
- All signal wires will be twisted in pairs or triads.
- Multi- pair, core or triad cables will have an overall screening of metallic tape with a drain wire. Special instrument signals (e.g. pulse) or when required by system manufacturer, multi-cables will be additionally foreseen with an individual pair/triad screening of metallic tape with drain wire.

In general, all field instrument cables will be provided with steel wire armour.

The cable wire insulation colour coding shall be as follows:

Signal designation	Polarity	Wire colour
Analogue/ digital signal cabling	+	black (numbered)
	-	white (numbered)
Thermocouple extension wires	+	IEC 60584
	-	
RTD temperature signal (3-wire)		black (numbered)
		white (numbered)
		red (numbered)
230 V AC power cable	L	brown
	N	blue
	PE	green / yellow
230 V AC solenoid control cable	L	black (numbered)
	N	black (numbered)
	PE	green / yellow
24 V DC power supply	+	red
	-	dark blue

- Pairs/Triads will be numbered along the length of each conductor.
- All cables will be water, oil and sunlight resistant, gas and vapour tight and at least flame retardant according to IEC 60332.
- Where required, cables will be fire resistant according to IEC 60331. Multi cables will be fire resistant according to IEC 60331 or insulated with fire resistance material as required per fire protection specifications.

All instrument signal cables will be installed and terminated observing the following details:

- Seller's instructions will be followed for installation and connection of special signals cables (such as coaxial cables, fibre optic etc.).
- For interconnection of cable screens the screening will be earthed such that multiple earthing does not occur.
- Cable glands on junction boxes/equipment in the field will by default be mounted at the bottom to prevent ingress of water.
- All cables used for intrinsically safe signals will be identified as such. These cables will have light blue colour.

Main types of Cables:

The number of different cable types will be restricted to a minimum.

Default Cable Colours	
Instrument Cables Non IS	Grey or Black
Instrument Cables IS	Light Blue
Thermocouple Cables	As per thermocouple type/Code (IS with blue strip)

Default Cable Colours	
Instrument Solenoid valve 230 V AC power cables	Black
Profibus DP cables	Violet
Fibre optic cables	Orange
Telecom Cables	Grey
Fire & Gas Cables	Red, Gray/Red strip, Black/Red strip

Note 1:

Fire resistant cables colour should be red or default colour as above with red strip.

Instrument Main Cable Sizes:

Single cables	
Electronic signals	1 x 2 x 1.5 mm²
	2 x 2 x 1.5 mm²
	4 x 2 x 1.0 mm²
	6 x 2 x 1.0 mm²
Thermocouple signals	1 x 2 x 1.3 mm²
	2 x 2 x 1.3 mm²
RTD and/or special signals	1 x 3 x 1.5 mm²
24V DC Solenoid valve signals	1 x 2 x 2.5 mm²
230V AC Solenoid valve signals	3 x 1.5 mm²
Profibus DP communication	1 x 2 x 0.64 mm²
Multi core/pair Cables	
Electronic signals	12 x 2 x 0.5 mm²
	16 x 2 x 0.5 mm²
	24 x 2 x 0.5 mm²
RTD and/or special signals	6 x 3 x 1.0 mm²
	12 x 3 x 1.0 mm²
24V DC Solenoid valve signals	6 x 2 x 2.5 mm²
	12 x 2 x 2.5 mm²
	24 x 2 x 2.5 mm²
230V AC Solenoid valve signals	12 x 1.5 mm²
	25 x 1.5 mm²

Note 1:

Cable types shall be verified and amended accordingly based on Project development requirements in line with instrument requirements and in accordance with package units design.

Note 2:

Conductor cross section will be adapted in case of instrument power consumptions and/or Seller requirements.

Note 3:

The size and maximum cable lengths will be verified with Ex i Loop calculations (if required) and voltage drop calculations for typical, worst case, scenarios only. Vibration signal attenuation for special signals from Machine monitoring system should be verified as well.

Instrument compensation cable as per IEC 60584-3 will be used for thermocouples with remote mounted transmitters.

6.1.2 CABLE IDENTIFICATION

The cable tag as indicated in the cable list will be used for cable identification at both ends of the cable.

All field single cabling will be coded with the applicable instrument tag number at both ends close to the instrument and to the box.

Aboveground cables will be identified by means of weather and UV resistant cable markers stamped with their cable number.

Underground cables will be identified with their cable number at each point where they enter or leave the surface. Underground cables will be marked at intervals of approx. 15m by means of stainless steel engraved/embossed strips.

Cables entering or leaving wall penetrations will be marked at both sides.

Wires of cables will be identified by means of printed identifiers.

6.1.3 CABLE GLANDS

Cable glands will be selected such that they suit the selected instrument cable and are suitable for the area classification concerned, as minimum Ex de / e protection will be used.

Thread of cable glands will be ISO metric in accordance with IEC 60423.

Cable gland will be nickel coated brass or stainless steel material and will be equipped with shroud.

6.1.4 JUNCTION BOXES

Boxes will be selected such that they suit the selected instrument cables and are suitable for the area classification concerned, as a minimum Ex e / Ex i protection will be used.

Junction boxes and local panels shall be made of glass-fibre reinforced plastic or stainless steel.

Colour of boxes:

- Gray or Black colour for glass-fibre reinforced plastic
- Natural colour for stainless steel material

Ingress protection class of junction boxes and local panels shall be IP 65 as minimum.

Junction boxes and local panels and accessories shall comply the ATEX directive 2014/34/EU.

Junction boxes and local panels shall have sufficient dimensions for installation of required equipment (cable glands, plugs, breathing glands, terminals, strips, rails, IE rail, PE rail and miscellaneous components). Special care shall be paid for access for maintenance.

All junction boxes and local panels shall have removable cover and shall be suitable for wall mounting. Where specified hinged front door shall be used.

Bolts, nuts and other fittings shall be made of corrosion resistant material (SST).

All cable entries will be provided at the bottom. All unused cable entries to be plugged off with certified blind plugs Ex e.

All boxes to be equipped with a certified breather/drain plug, Ex e.

All boxes will be provided with an internal and external earth bolt, minimum M8, for safety earth (PE) connection.

Where specified, the local panel controls shall be pre-wired to the terminal row. The panel internal wiring shall be bundled and routed to ensure the smooth panel opening.

All terminals and internal wiring shall be marked at both ends.

6.2 CABLE ROUTES, SUPPORTING AND FASTENING

6.2.1 GENERAL

Instrument cables will be installed overhead on cable trays, dedicated brackets/supports or in underground trenches.

Single cables in the field will be suitably supported and protected by means of cable trays, conduits, etc.

6.2.2 CABLE SEGREGATION

Instrument cables will be grouped according to the main signal types:

- Intrinsically safe signal cables
- Electronic signal cables
- Solenoid signals
- Telephone - intercom communication cables.
- Fire and Gas signal cables.

Power feeder cables will be handled as Electrical cables (> 50 VAC) and will be grouped according to main power levels.

Maximum filling of Cable trays or trenches will be 70%.

6.2.3 CABLE SUPPORTING

Cable supporting considers cable tray, closed trunking and dedicated steel profiles and can be divided in the following groups:

- Main cable supporting meaning cable tray racks with a minimum size of 300 mm
- Sub cable supporting meaning cable tray racks smaller than 300 mm.
- Secondary cable supports meaning dedicated heavy gauge steel profiles/conduits etc.

Default cable tray size selection will be 100 / 200 / 300 / 400 / 600mm, with a minimum height of 100mm.

Cable supporting installations will be adequately supported. Wherever possible the supports will be arranged such that cables can be laid sideways into the tray/trunking instead of pulling them through consecutive holes.

Free space over the tray, ladder racks, trunking shall allow easy cable laid down during construction.

Cable supporting installation will be joined by bolts and nuts (round head screws/bolts will be used). Bolts will be installed with the round head internally and the nut externally. All joints will be smooth finished, so that no damage to cabling and/or tubing will occur.

The cable supporting installation will not obstruct traffic, hoisting installations, nor interfere with accessibility or removal of process equipment such as pumps, motors and heat exchanger bundles, etc.

Redundant cables will be routed via different paths whereverpossible.

Single overhead cables will run in protective conduits.

Fasteners such as bolts, nuts and washers will be at least being of corrosion-resistant steel. In any case, they will be resistant to the effects of the environment in which they are to be used and adequate for the load to be imposed without undue stress or sagging. Fasteners will be of the same material as supporting, to avoid corrosion due to electrolyses.

Bends in cable supporting systems will be based on the minimum bending radius of the thickest cable as advised by the manufacturer.

Cable supporting will be of a rigid design and self-supporting between holding brackets without excessive deformation after the cables are installed. Cable supporting will at least be in accordance with manufacturer specification based on maximum load.

Cable supporting systems will be designed and installed to ensure electrical continuity throughout the run and such that water cannot collect or remain in any part of the system. Bonding wires with bolted connections at coupling points will be used for electrical continuity. Coupling plates of trays are assumed to provide proper bonding for the tray systems.

Cable supporting system for secondary cable routing will be adequately supported. Each piece will have a minimum of two supports, and will only be installed horizontally or vertically and parallel to the plant coordinates.

Conduits running through grade will extend min. 200mm above grade, and will be fitted with a bushing to avoid cable damage.

In case of stainless-steel cable supporting systems are used in combination with galvanized supports/brackets, isolating washers and/or strips will be installed as a galvanic separation.

Where cables are required to be installed through or across the edges of tray or other metal work, the edge of the lips will be smoothed, protected to the environment and lined with a protective sleeve to avoid cable damage.

Cable trays will be closed with removable covers.

Minimum of two straps/bands or equivalent will be installed per single piece of cable supporting cover.

In case of main routing, with several cable ladders being used for the same cable group, the cable trays racks can be filled up, the required spare per group may be fulfilled by additional (empty) trays.

Secondary cable supports will be manufactured from good quality heavy gauge steel, preferably “L” or “U” shaped profiles will be used.

6.2.4 CABLE FASTENING

To prevent stresses on cables in trays, cables shall be suitably fixed / clamped, especially in vertical trays.

Cables on cable trays shall be laid and fastened tightly and orderly.

In general cable clamps are used to anchor multi cables to panel frames.

6.2.5 CABLE ENTRY SEALING

Where cables have to be led through exterior walls or partitions with a fire blocking, water blocking or sealing function, properly qualified cable transits will be installed.

The spare space to be kept in the cable transits will correspond to the spare space on the cable ladders, but will be at least 30%.

All cable and cabinet entries through floors will be sealed where required. Sealing material will be fire resistant for a period of at least 60 minutes or more as per applicable project specifications.

6.2.6 CABLES IN TRENCHES AND/OR DUCTS

Underground cables will be laid at a minimum depth of 700 mm. The cables will be submerged in "clean" sand, such that the thickness of the sand under the cables is at least 100 mm and on top of the cables has a minimum thickness of 200 mm. This “clean” sand shall not contain debris or rocks. The cable bed will be covered with cable routing colored marking polyethylene tape under tiles of stone or PVC, before the excavated soil is returned. The track of the cables will always be marked.

Cables will be laid with sufficient slack (especially at rising points) to prevent stress, in particular where trenches are made in soft soil.

For road crossings, plastic conduit pipes (approximately Ø I.D. 160 mm) will be used.

- If there is a risk of damage from heavy traffic loads, the crossing will be provided with a concrete reinforcement or cable ducting.
- Inside the pipes there will be minimal 50% spare space after cable installation.
- When the cables have been laid in the crossing, the conduit pipes (including spare) will be closed with easily detachable material.
- If conduits are installed in more than one layer, cables will be installed in the lowest layers
- Spare capacity sleeves will be provided with a pull wire and covered with removable caps.
- All sleeves will be laid such that subsidence of the soil will not damage the cables by the pipe ends.

6.3 EARTHING

All earthing points/connections will be fitted with locking devices; crimp/compression type lugs will be used for bolted connections.

For earthing philosophy reference will be made to relevant electrical project documentation.

6.4 BOXES AND LOCAL PANELS INSTALLATION

Boxes will be mounted with centreline installed at approximately 1300 mm above grade/deck on rack or on columns.

All boxes/local panels will be installed with maintenance and accessibility requirements taken into account and in such a way that direct drainage/vent of condensate, water gas or process fluids from adjacent equipment has no adverse effect.

Boxes / local panels will be adequately supported.

Small connection boxes (e.g. Switches of valves) shall be adequately mounted close to/on their corresponding instrument.

6.5 CONSOLES AND CABINETS INSTALLATION

Handling and installation of cabinets and consoles shall be to manufacturer's specifications. The manufacturer's representative may be present on site for direct supervision during installation.

Before placing the cabinets/consoles in position, the frames required in the equipment room shall be completely installed and secured.

Holes required for cabinet cable transits shall be made to suit cable runs as indicated on the relevant drawings.

Cable entry to cabinets and consoles shall be preferably from the bottom. All opening remaining after entry of cables shall be sealed against the ingress of dust. The dust seals shall be easily removable to enable entry of future cables.

7.0 NUMBERING SYSTEM

7.1 INSTRUMENT IDENTIFICATION

All of instruments, valves and major control system software blocks shall be clearly & fully identified by means of unique tag number.

A functionally interrelated group of instruments, performing the basic operation like flow control or pump control and signalling must be identified by means of unique instrument loop number.

7.1.1 LOOP NUMBERING SYSTEM

Instrument loop shall be identified the following way:

UUUT-NNNNSS (e.g. 53P-1021A),

where the individual loop number components shall be as follows:

Component	Description	Format	Length
UUU	Unit number	Numeric	3
T	Functional identification	Character	1
-	Comma separator		
NNNN	Loop number	Numeric	4
SS	Loop suffix	Character	2

Unit number

Unit/area numbers, in accordance with the Pancevo refinery object identification code. The unit code shall not appear in instrument balloons on P&ID's.

Loop functional identification

The identifier shall cover the measured or initiating variable in accordance with the P&ID Instrumentation legends.

Loop number

Loop number numerical sequence shall be unique for the each of measured variable, so that loop numbers 53F-1001 and 53P-1001 may coexist. The loops shall be continuously numbered from 0001 .. 9999. The single local instruments like pressure gauges shall be numbered in the same sequential order, even if not part of a complex loop in order to avoid misleading tag concurrences.

The loop numbering sequence should be as follows:

Sequence	Designation
0001 .. 0999	Reserved for future use – mainly for control system auxiliaries, etc.
1001 .. 1999	Feed & Fractionation section
2001 .. 2999	Coker Heater & Firing system
3001 .. 3999	Coke drums & Coke cutting & Blowdown section
4001 .. 4999	Wet Gas Compressor & Product finishing
5001 .. 5999	Coke handling
6001 .. 6999	Utilities
7001 .. 7999	Reserved for future use
8001 .. 8999	Reserved for future use
9001 .. 9999	Reserved for fire and gas alarm system

Loop suffix

Intended to distinguish the different instruments installed on identical pieces of major equipment. Different loop number sequences for instruments having the same service, installed on the different equipment shall be avoided.

Different instruments installed on the same service shall have only one common loop number in order to be drawn on one loop diagram (e.g. 53LXT-1001A, 53LXT-1001B, 53LXT-1001C shall have a common loop number 53L-1001)

Loop number suffixes I and O shall not be used to avoid the confusion with 1 and 0 characters.

7.1.2 TAG NUMBERING SYSTEM

Instrument tag shall be identified the following way:

UUUTMMCCC-NNNNSS (e.g. 53PDXT-1024A),

where the individual tag number components shall be as follows:

Component	Description	Format	Length
UUU	Unit number	Numeric	3
T	Functional identification	Character	1
MM	Modifier	Character	0..2
CCC	Succeeding letters	Character	1..3
-	Dash / minus separator		
NNNN	Loop number	Numeric	4
SS	Tag suffix	Character	2

Tag number modifier

Intended to specify more precise the instrument designation.

The modifiers can be combined each other (53PDXT-1121 differential pressure transmitter on ESD service).

The level interface measurement and control shall be distinguished by modifier (53LDT-1012, 53LDV-1012, 53LDG-1413).

Tag number succeeding letters

Tag number succeeding letters provide the functional specification of the instrument.

Tag suffix

Tag suffix shall be in general the same as a loop suffix. In addition to, the tag number suffix can distinguish the different instruments installed on the same service, e.g. shutdown level transmitters arranged in 2 out of 3 voting.

The tag number suffix X shall be reserved to identify the package unit instrumentation – instruments to be delivered by equipment vendor.

Design notes

The DCS controllers shall always be combined with indicators (e.g. 53FIC-1001, not 53FC-1001).

The alarm function shall be used in conjunction with switches only to avoid confusions on the DCS system (53PI-1001, not 53PIA-1001). Alarms shall be configurable for each analog indicator or controller, so an additional suffix is unnecessary.

The flow, level, pressure and temperature switches shall be distinguished with alarm direction (e.g. 53PSL-1134, not 53PS-1134).

7.1.3 MOTOR CONTROL TAG NUMBERING

The loop components, intended for the motor control (loop function H) shall be defined as follows:

Tag number	Description	Signal
53YB-1001AR	Running status	Input
53YA-1001AF	Failure alarm	Input
53YB-1021AL	Local / Remote switch status	Input
53HS-1021AS	Start command	Output
53HS-1021AP	Stop command	Output

The motor controls, connected to the safeguarding system shall be distinguished by modifier X.

7.1.4 SAFEGUARDING / SEQUENCE LOGIC BLOCKS

The ESD safeguarding logic blocks and DCS sequential control structures shall be numbered as follows:

UUU-T-NNS (e.g. 53-I-03A),

where the individual block number components shall be as follows:

Component	Description	Format	Length
UUU	Unit number	Numeric	3
-	Comma separator		
T	Functional identification	Character	1
-	Comma separator		
NN	Logic block number	Numeric	2
S	Suffix	Character	1

Functional identification

The identification shall be:

Identification	Description
I	ESD safeguarding logic block
K	DCS sequential control or switching logic block

Unit number

The unit code shall not appear on P&ID's.

Suffix

Intended to distinguish the logic block driving the identical pieces of equipment.

7.1.5 CABLE NUMBERING SYSTEM

In general, the cable name should be in accordance with the source, where the cable is connected to.

The name of multi-core cables from the filed junction boxes to the control system cabinets shall be derived from the junction box/panel name, so that the cable 53Ei-007 is connected to the junction box 53JEi-007.

The name of single cables from instrument shall be identical to instrument tag number (e.g. 53FXT-1018A).

7.1.6 JUNCTION BOX NUMBERING SYSTEM

The field junction boxes shall be named as follows:

UUUJSi-NNN (e.g. 53JEi-007),

where the individual block number components shall be as follows:

Component	Description	Format	Length
UUU	Process unit engineering code	Numeric	3
J	Junction box symbol	Character	1
S	Type of signal	Character	1
i *	Intrinsic safe signals	Character	1
-	Comma separator	Character	1
NNN	Junction box sequence number	Numeric	3

The type of signal shall be distinguished in accordance with the following abbreviations:

Abbreviation	Signal designation
E	Current loop signals 4-20 mA
D	Binary status signals
V	Voltage vibration signals
T	Thermocouple mV signals
R	RTD signals
S	Solenoid valve drive signals
C	Communication links (e.g. ProfiBus)
X	Power supply distribution boxes

* The suffix “i” shall be used if the box is designed as intrinsically safe.

7.1.7 LOCAL PANEL NUMBERING SYSTEM

The field mounted local panels should be named as follows:

LP XX-UUNNS (e.g. LP GA-5301A)

The panel shall be identified by means of “LP” abbreviation, followed by the appropriate equipment name wherever practicable.

7.1.8 SYSTEM CABINET OR RACK NUMBERING SYSTEM

The all of cabinets, should be named in accordance with the following convention:

UUUDDD-NNNS,

where the individual block number components shall be as follows:

Component	Description	Format	Length
UUU	Control room number	Numeric	3
DDD	Cabinet designation	Character	3
-	Comma separator	Character	1
NNN	Cabinet sequence number	Numeric	3
S	Cabinet side identification	Character	1

The cabinet designation shall be abbreviated in accordance with the following table:

Abbreviation	Signal designation
DCS	DCS control system cabinet
ESD	ESD safeguarding system cabinet
FOC	Fibre optic cabinet / communication cabinet
PDC	Power distribution cabinet
MCD	Marshalling cabinet, intended for DCS system
MCE	Marshalling cabinet, intended for ESD system
IRD	Interposing relay cabinet, intended for DCS system
IRE	Interposing relay cabinet, intended for ESD system
PLC	Programmable logic controller cabinet (3rd party vendors)
MMS	Machine monitoring system cabinet (Bently Nevada)
AUX	Auxiliary cabinet (function not specified)

The cabinet shall be distinguished by means of suffix:

- Front side - F
- Rear side – R

7.1.9 INSTRUMENT AIR DISTRIBUTORS

Instrument air distributors shall be identified the following way:

UUUIAD-NNN (e.g. 53IAD-001),

where the individual tag number components shall be as follows:

Component	Description	Format	Length
UUU	Unit number	Numeric	3
IAD	Instrument air distributor	Character	1
-	Comma separator		
NNN	Sequence number	Numeric	3

7.2 INSTRUMENT INSTALLATION MATERIAL NUMBER SYSTEM

Each piece of installation material, as indicated on detailed documents/drawings, will be identified with a unique item number. The item numbers will be used on the detailed drawings, e.g. instrument process piping details, instrument air piping details, instrument installation details, etc.