

DEP SPECIFICATION

INSTRUMENTS FOR MEASUREMENT AND CONTROL

DEP 32.31.00.32-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the selection and specification of instruments used for measurement and control both in downstream facilities (e.g., refineries, chemical plants, gas plants) and exploration and production facilities.

The intended audience of this document are Shell staff, contractors, system integrators and manufacturers of instruments and instrument systems.

This DEP does not cover all possible types of instruments and measuring principles. It is intended to cover the most commonly used types only.

Control valves and accessories such as positioners, solenoid valves and limit switches are covered in DEP 32.36.01.17-Gen. Fire, gas and smoke detection systems are covered in DEP 32.30.20.11-Gen. Custody transfer is covered in DEP 32.32.00.11-Gen. and DEP 32.32.00.12-Gen.

This is a revision of the DEP of the same number dated February 2015; see (1.5) regarding the main changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicate a requirement.

The word **should** indicate a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific Definitions

Term	Definition
Modbus	Industrial networking system that uses serial master-slave communication links. Modbus is the most common protocol in the Process Control Domain (PCD) to interface between systems. Almost all (legacy) systems are provided with Modbus interface cards.
marine environment	Oceans, seas, bays, estuaries, and other major water bodies including the land up to one kilometre of the mean high water mark.
piping class	Assembly of piping components, suitable for a defined service and design limits, in a piping system. Ref DEP 31.38.01.11-Gen, DEP 31.38.01.12-Gen and DEP 31.38.01.15-Gen.
adjusted span	Algebraic difference between the Lower Range Value and the Upper Range Value (what the instrument is adjusted to measure). It is a value.
measuring range	Range defined by LRL and URL within which the limits of uncertainty of the measuring instrument are specified (the capability of the instrument).
uncertainty class	Code used to identify the type of application of a measuring instrument which determines the required uncertainty limit.
In-line instruments	All instruments and components that are directly mounted in process and utility lines or equipment (e.g. coriolis and vortex flow meters, primary elements of differential pressure flow meters).
On-line instruments	All instruments and components that are connected to process and utility lines or equipment via primary isolation valves (e.g. pressure transmitters, pressure gauges, level measurements using a measuring chamber, instrument impulse line components and analyser sampling systems)
Off-line instruments	All instruments and components that are not in direct contact with any process medium or which are not connected to any process/utility line or equipment (e.g. thermocouples and RTDs in a thermowell, clamp-on ultrasonic flow meters, nucleonic level measurements and local receiving indicators)

Where relevant, definitions are based on IEC 60050-300 and ISA 51.1.

1.3.3 Abbreviations

Term	Definition
AMS	Asset Management System
BPCS	Basic Process Control System
EMC	Electromagnetic Compatibility
FAR	Field Auxiliary Room
FGS	Fire and Gas System
GWR	Guided Wave Radar
HART	Highway Addressable Remote Transducer
IPF	Instrumented Protective Function, now known as SIF (Safety Instrumented Function)
LRL	Lower Range Limit
SIL	Safety Integrity Level
SIS	Safety Instrumented System
PAS	Process Automation System (consisting of BPCS, SIS and FGS)
PEFS	Process Engineering Flow Scheme
PLC	Programmable Logic Controller
RTD	Resistance Temperature Detector
URL	Upper Range Limit

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (14).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2015. The following are the main, non-editorial changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced use of shall/should/may for normative statements.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
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DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL REQUIREMENTS

2.1 SELECTION OF INSTRUMENTS

2.1.1 General

The selection of an instrument for a specific application is an iterative process, carried out as a joint effort of process and instrument engineers, with input where necessary from materials engineers, rotating equipment engineers and heat transfer engineers.

2.1.2 Required information

2.1.2.1 General

1. The Contractor shall gather information and produce data sheets containing sections describing general application data, process data, details on the instruments as per (2.1.2.2), (2.1.2.3) and (2.1.2.4).

The entered information might form part of database as described in DEP 32.31.00.35-Gen, if specified in project scope.

Project will generally specify a format for the data sheet to be followed.

2.1.2.2 Application

1. Application information shall include the following:
 - a. purpose of the instrument (intended use);
 - b. fluid description;
 - c. fluid phase(s);
 - d. flow rate: minimum, normal and maximum (turndown);
 - e. operating pressure and temperature: minimum, normal and maximum;
 - f. density and viscosity;
 - g. vapour pressure;
 - h. expected under normal as well as alternative operating modes and abnormal operating conditions such as start-up, commissioning, regeneration, emergency;
Expected conditions imply change in fluid properties like flow rate, operating pressure and temperature that may vary during alternative operating modes.
 - i. orientation of the line (horizontal or vertical);
 - j. direction of the flow;
 - k. specific application aspects such as possible bi-directional or pulsating flow, continuous/batch operation, vibration, pressure surges and hydraulic noise;
 - l. required uncertainty class as described in (4.1).

Additional information might be required (e.g., radar level transmitter, dielectric constant for the fluid) depending on the type of instrument.

2.1.2.3 Service conditions

1. Service conditions information shall include the following:
 - a. minimum and maximum Design pressures and temperatures as specified in (3.1);
 - b. ambient temperatures, based on the environmental conditions as specified in (6.1);
 - c. potential for dirt, wax, fouling;
 - d. corrosiveness, erosiveness, toxicity;
 - e. potential for polymerisation or formation of salty deposits;
 - f. potential for multiphase conditions, vapour breakout, condensation, foaming, decomposition, solidification and chemical reaction;
 - g. density variations;
 - h. conductivity.

Additional information might be required depending on the type of instrument (e.g., Dielectric constant).

2.1.2.4 Instrument requirements

1. Instrument requirements shall include the following:
 - a. orientation of instruments on vessels;
 - b. mechanical protection (e.g., vibration, radiation from hot process equipment, earthquake, wash down area, vicinity to corrosive atmosphere such as cooling water towers, chlorides and seawater);
 - c. electrical safety;
 - d. EMC requirements;
 - e. environmental conditions (e.g., winterization, tropical conditions);
 - f. requirements imposed by local or regional regulations;
 - g. instrument span to suit the application and service requirements;
 - h. type of signal transmission;
 - i. required response time.
2. Instruments shall be equipped with a double barrier between the process and electronics housing.

This prevents process fluids from entering the housing in case of failure of a wetted component.

2.1.2.5 Evaluation

1. Evaluation information will include the following:
 - a. measurement options for the particular measurement principle;
 - b. pros and cons of each measurement option.
2. Optimum solution will be selected, considering the following aspects:
 - a. coverage of and performance under the process conditions, listed in (2.1.2.2) and (2.1.2.3);
 - b. compliance with the aspects listed in (2.1.2.4);
 - c. additional hardware required for operation, such as calibration facilities or disposal systems;
 - d. specific maintenance aspects such as accessibility requirements, calibration aspects, self-diagnostic features, purging/flushing/disposal aspects;
 - e. achievable test coverage factors;
 - f. availability of spare parts, long term software and hardware support and vendor support.

2.2 UNITS OF MEASUREMENT

1. The ranges, spans and scales of instruments shall be in SI units, unless otherwise specified by the Principal.

2.3 INSTRUMENT NAMEPLATES AND WARNING PLATES

2.3.1 General

This section does not cover identification plates on equipment items detailing technical aspects such as materials, temperature and pressure ratings, certification, serial number. It also excludes nameplates on equipment cabinets and distribution frames used indoors.

1. All instruments and associated equipments (e.g., junction boxes, cabinets, panels) shall be provided with nameplates indicating the tag number and the service description (as applicable) for the instrument. Refer to drawing S 37.601.
2. Tag numbers and service descriptions shall be consistent with the instrumentation database and instrument data sheets.
3. Refer to DEP 30.00.60.21-Gen. for details of instrument nameplates such as material, character height, alignment, location, attachment height.
4. The text on nameplates for manual selector switches shall repeat the switch position markings and describe what each switch position represents.
5. The text on nameplates for push buttons shall describe what action results when the push button is activated.

The Principal will advise the language or languages to be used on nameplates.

2.3.2 Field-mounted nameplates

1. All field-mounted instruments shall be provided with nameplates (e.g., inline instruments, transmitters, local indicators, pressure gauges, level gauges, temperature gauges, converters, control valves, limit switches, solenoid valves and junction boxes).
2. Nameplates shall be attached to instrument supports or brackets by means of stainless steel screws or rivets.
3. No holes shall be drilled into instruments for fixing nameplates.
4. Transmitters used in an IPF of SIL 1 and higher shall have red nameplates with white lettering.

2.3.3 Abbreviations on nameplates

1. Where abbreviations are necessary, these shall be standardised and consistent for all nameplates.

2.4 INTEGRAL AND RECEIVING INDICATORS

Local indicators can be integral to the transmitter or they can receive a signal through a signal cable.

1. Blind transmitters should be used to reduce project costs.
2. The physical location of an indicator shall be selected so that it can be read from the location of the operator when manipulating that process value:
 - a. If an indicator integral to a transmitter cannot meet this requirement, a receiving indicator shall be applied.
3. Indicators should be placed at a height of between 1.39 and 1.59 m (4.5 to 5.2 ft).
4. Displays not used for normal operations and those not requiring accurate reading may be located at height of 1.12 m to 1.73 m (3.7 ft to 5.7 ft).
5. A receiving indicator may be connected to one of the following:
 - a. the signal cable of the transmitter;
 - b. a dedicated output signal from the PAS;
 - c. the Foundation Fieldbus segment block.
6. Failure or replacement of the receiving indicator should not cause disruption of the signal to the PAS.
7. Integral or receiving indicators shall present measurement information in engineering units as per section (1.7).
8. The character height on a receiving indicator should be a minimum of 20 mm (0.8 in).

Characters should be visible at ambient lighting level.

2.5 LOCATION AND ACCESSIBILITY

Accessibility identifies the effort required for a person to reach devices for regular maintenance and testing purposes.

1. Appendix C specifies the minimum accessibility requirements that should be met for different types of instrument locations.
2. Accessibility shall be addressed during the 3D-model review and optimized.

It may, for example, be feasible to relocate the piping take-off point during the engineering stage so as to change the accessibility level of a pressure transmitter from 'limited' to 'permanent' at no additional cost. Or, it may be feasible to locate a thermowell so that it is accessible from a nearby platform.

3. Instrument installation should follow the following guidelines:
 - a. mount on-line instruments on or in the direct vicinity of the instrument process connection(s);
Limited accessibility is acceptable for on-line instruments.
 - b. instruments should not be installed on lines subject to vibration and mechanical stresses (e.g., on suction or discharge lines of pumps or compressors);
 - i. For lines subject to vibration and mechanical stresses, instruments should be mounted on a grade or a platform.
 - c. instruments should not be exposed to temperatures beyond prescribed limit of manufacturer to avoid any impact on the measurement or the reliability of the instrument.

2.6 PROTECTIVE SHADES

1. Protective shades shall be applied for equipment that meets the following two criteria:
 - a. can be exposed to direct sun radiation;
 - b. can be adversely affected by heating effects of direct sun radiation.

Shades can reduce instrument housing temperature variations between day and night.

2. Protective shades shall not encroach into dedicated escape routes or operating access volumes.

2.7 LOCAL PANELS AND CUBICLES

1. Unless otherwise specified by the Principal, local panels shall not be used.
2. Local panels located outdoors shall be 316 stainless steel or fibreglass.
3. Local panels shall have an ingress protection class of IP66 as specified in IEC 60529 (in North America, NEMA-4X as specified in NEMA-250).
4. Local panels located in marine environments shall be secured to withstand the "worst-case" storm force as defined in the project premise for the site where they will be installed.
5. Local panels should be located away from steam outlets and dripping water such that steam outlets and dripping water does not affect the local panels.
6. Where the local panel or cubicle requires openings for ventilation, these openings shall be provided with screens to prevent the entry of animals or insects.
7. There shall be no direct process connections between process fluids and enclosed instrument panels.

Wherever necessary, transmitters should be applied.

8. Plastic tubing for pneumatic signals shall not be used inside local panels.
9. Cable entries shall be from the bottom.
10. All indication lamps on local panels shall be provided with test facilities in the vicinity of the lamp, so that one person can execute the test.
11. The test logic should be located in the BPCS or SIS/FGS where applicable and practical to do so.
12. Equipment panels located within FAR buildings and local cubicles shall be provided with lamp test facility.

3. MECHANICAL AND MATERIAL REQUIREMENTS

3.1 PRESSURE AND TEMPERATURE LIMITS OF PRESSURE-CONTAINING PARTS

The lower pressure limit is relevant for an instrument if its value is below atmospheric pressure such as systems where vacuum may occur.

1. Pressure and temperature limits of instrument pressure-containing parts shall conform to Table-1.

Table 1 Pressure and temperature limits

Instrument Type	Piping class item	Equipment without piping class (For example, vessels and equipment packages)
In-line	Upper and lower pressure and temperature limits specified on the line list	Upper and lower design pressure and temperature limits of the related equipment
On-line	Upper and lower pressure limits specified on the line list	Upper and lower pressure limits of the related equipment

2. Differential pressure type instruments that are connected to two different line sections; shall be capable of withstanding the highest difference between the upper and lower pressure limits from both line sections in either direction (positive and negative).

3.3 SELECTION OF MATERIALS OF WETTED PARTS

1. For in-line instruments, the selection of materials including the material of bolts and gaskets used in, or on, the instrument shall meet the minimum requirements of the piping class.
2. AISI 316(L) is suitable in systems with austenitic stainless steel or carbon steel equipment except for certain process environments such as chloride containing systems.
3. AISI 316(L) shall be resistant to intergranular corrosion in accordance with ASTM A262 Practice E.
4. If special stainless steel with increased Mo content, UNS N08825 or UNS N 10276 are used for the equipment and/or piping, the selected material of wetted parts of instruments shall be UNS N 10276.
5. Refer to DEP 31.10.11.31-Gen for instrumentation in oxygen service.

7. For materials of wetted parts for on-line instruments, refer to the descriptions in DEP 30.10.02.11-Gen. and DEP 30.10.02.13-Gen.
8. Advice from the Principal's materials and corrosion engineering technical authority shall be obtained for the materials selection of wetted parts.
9. For instrument impulse line material selection, refer to DEP 32.37.10.11-Gen.

3.4 INSPECTION AND CERTIFICATION

1. Material certification shall be provided for in-line instruments only.
2. For in-line instruments, the following requirements shall be in accordance with the piping class or equipment in, or on, which the instruments are installed:
 - a. the traceability and associated material certification for pressure retaining parts (including bolting on pressure retaining parts);
 - b. testing such as hydrotesting non-destructive testing (NDT).
3. The Contractor shall include the certification and testing requirements in the instrument data sheet.

3.5 INSTRUMENT PROCESS CONNECTIONS

1. For in-line instruments, only flanged connections shall be used.
2. For process connections of on-line instruments the following two options are acceptable, as determined by the piping classes:
 - a. flanged connection (e.g., on a primary isolation valve, level measuring chamber or nozzle on a vessel); or
 - b. threaded connection (e.g., monoflange).
3. Instruments shall be mounted either:
 - a. directly on the flanged or threaded connection; or
 - b. remotely using impulse lines.
4. Impulse lines connected to a flange shall use either:
 - a. a lap joint flange adaptor; or
 - b. an integral flange adaptor.
5. Impulse lines connected to a thread shall use either:
 - a. BSP parallel thread (ISO 228) to a compression fitting using a sealing ring in accordance with DIN 3852-2; or
 - b. NPT thread (ANSI/ASME B1.20.1) to a compression fitting.

4. INSTRUMENT PERFORMANCE SPECIFICATION

4.1 UNCERTAINTY

1. The required uncertainty of a measurement is determined by the application as per Table 2.
2. The default requirement shall be uncertainty class C.
3. The Contractor shall indicate the uncertainty class in the instrument data sheet.

Table 2 Uncertainty class vs application

Process variable	Uncertainty class A	Uncertainty class B	Uncertainty class C	Uncertainty class D
Application	Custody transfer (see Note 1). Critical reactor (ratio) feed control.	Enhanced monitoring and control. Internal accounting.	Regular monitoring and control.	Coarse monitoring and control.
Flow (refer note (4.a) below)	<u>Liquid</u> : better than 0.25% of reading. <u>Gas/steam</u> : better than 0.5% of reading.	<u>Liquid</u> : better than 2% of reading. <u>Gas/steam</u> : better than 3% of reading.	Better than 5% of reading.	Better than 10% of reading.
Level (refer note (4.b) below)	Better than 2 mm (0.08 in) (absolute).	Better than 10 mm (0.4 in) (absolute).	Better than 5% of adjusted span.	Better than 10% of adjusted span.
Pressure	To be assessed on a case-by-case basis to site specific requirements.	Better than 0.25% of adjusted span.	Better than 1% of adjusted span.	-
Temperature	<u>TC type K/N</u> : IEC 60584-1 tolerance class 1: $1,5 \text{ or } 0,004 \times t $ over the temperature range of $-40\text{ }^{\circ}\text{C}$ to $1000\text{ }^{\circ}\text{C}$ (see Note 2) For E, J and T refer to table 1 in IEC 60584-1 <u>RTD</u> : IEC 60751 tolerance class A ($0.15 + 0.002 t $ $^{\circ}\text{C}$) (see note 2) <u>Others</u> : To be assessed on a case-by-case basis to suit specific requirements.	<u>TC type K/N</u> : IEC 60584-1 tolerance class 2: $2,5 \text{ or } 0,0075 \times t $ over the temperature range of $-40\text{ }^{\circ}\text{C}$ to $1200\text{ }^{\circ}\text{C}$ (see Note 2) <u>RTD</u> : IEC 60751 tolerance class B ($0.3 + 0.005 t $ $^{\circ}\text{C}$) (see note 2) <u>Others</u> : Better than 1% of adjusted span.		

NOTES

1. For acceptable uncertainties of custody transfer applications refer to the standards mentioned to in (1.1).
2. $|t|$ is the modulus of the temperature in degrees Celsius without regard to sign.
3. Uncertainty requirements in Table 2 include linearity, hysteresis, repeatability, static pressure, and temperature effects on the instrument.
 - a. The uncertainty requirements apply under all normal conditions, including alternative operating modes.
 - b. In case the result of the measurement is based on a calculation using more than one instrument, the Contractor shall prepare a calculation demonstrating that the calculated result meets the uncertainty class under all normal and abnormal operating conditions and environmental conditions.
 - c. In case the uncertainty requirements cannot be met during abnormal operating modes, such as start-up, commissioning, regeneration and emergency operation, the Principal's approval shall be obtained.
4. If a liquid flow measurement of uncertainty class B is to be presented in mass flow units, the net uncertainty of the presented mass flow figure shall be better than 2% of the reading:
 - a. If a flow sensor is used that measures a volumetric flow, pressure/temperature and/or density measurements might be required to achieve the 2% net uncertainty requirement on the 'presented' mass flow figure.
 - b. When several instruments are used to infer a process variable that cannot be measured directly, the uncertainty of the individual instruments shall be able to achieve the required uncertainty class of the result.

For certain applications it might not be possible to combine all normal and abnormal operating conditions in one measurement at the required uncertainty. An analysis will disclose whether additional instruments are required or the uncertainty requirements and/or operating window may be relaxed. It might be acceptable to present measured values during some of the abnormal operating cases at a higher uncertainty or it might be justifiable for the measurement not to produce a sensible signal under some of the abnormal process conditions during start-up, commissioning, regeneration and emergency conditions.

4.2 ELECTROMAGNETIC COMPATIBILITY (EMC)

1. Instruments shall meet EMC compatibility to performance level B of IEC 61000-6-2.
2. Where instrument signal cables enter housings of field instruments, metal cable glands (in accordance with EN 62444) providing an equipotential bonding to metallic layer(s) shall be used.
3. Non-metallic cable glands shall not be used on field instruments.
4. Unless otherwise specified by the Principal, cable glands shall be installed at site and are not in the scope of supply of the instrument Manufacturer/Supplier.
5. For construction and installation details of cables and cable glands, refer to DEP 32.37.20.10-Gen. and DEP 33.64.10.33-Gen.
6. Surge protection devices should be considered for instruments located in EM Zone 3 as defined in IEC 61000-2-5 and for instruments connected to cables that are routed through EM Zone 3 as defined in IEC 61000-2-5.

This requirement is particularly important for:

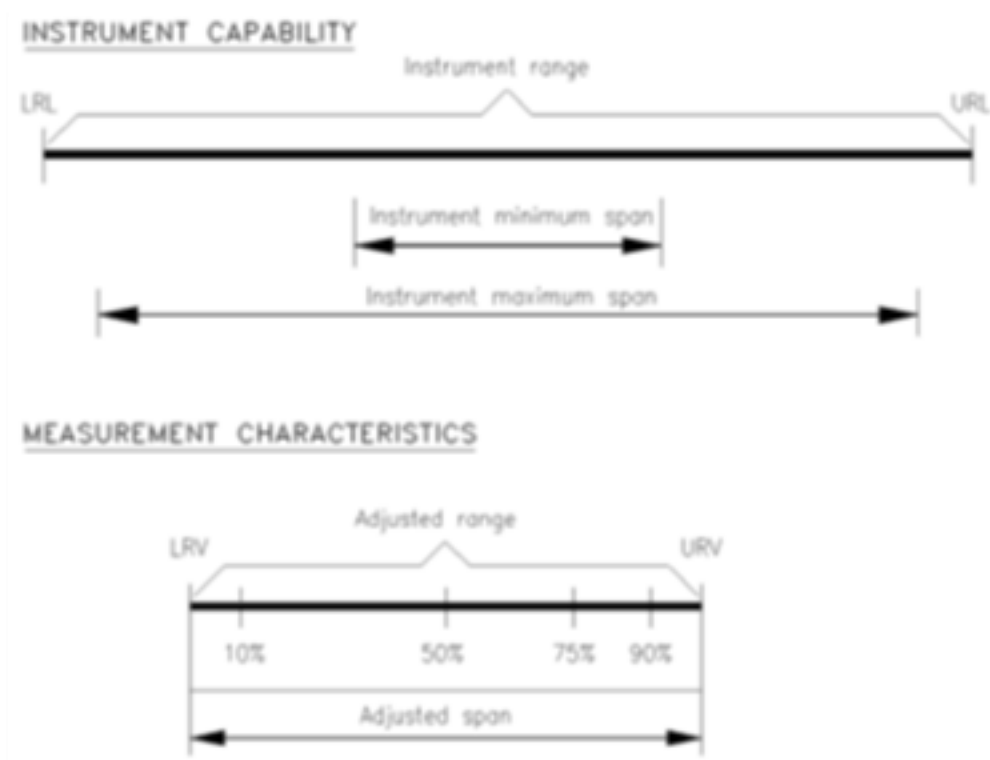
- *Instruments installed on exposed locations (tank farms, high locations, flare areas);*
 - *Sites with a high lightning strike frequency (>10 strikes/km²/year).*
7. Surge protection devices may be integral to the instrument or externally mounted components to the instrument.

5. INSTRUMENT FUNCTIONAL SPECIFICATION

5.1 RANGE AND SPAN OF ANALOG INSTRUMENTS

1. The span of analog instruments shall be adjusted to cover the operating window which includes applicable abnormal operation and alternative operating modes (such as start-up and shutdown).
2. The normal process value should be between 50% and 75% of the adjusted span.

Figure 1 Range and span



2. IPF transmitters shall have the same adjusted range and uncertainty class as corresponding process control transmitters in order to facilitate measurement validation and comparison (MVC).
3. For acceptable trip settings, refer to DEP 32.80.10.10.-Gen, section 6.3.3.2 (except where the actual trip point cannot be reliably measured with an instrument with the same adjusted range as used in the BPCS).
As an example, the specific gravity varies significantly and thus a dP or displacer level measurement of the physical level will vary significantly. In this example, the span should be narrowed or a different measurement technology used.
4. The Lower Range Value should be selected so that the displayed result represents the zero or sub-zero value of the process variable.
5. Suppressed zero range should not be used.
6. Only elevated zero ranges should be selected, including the Lower Range Value as zero.

5.2 SIGNAL TRANSMISSION AND POWER SUPPLY

5.2.1 Signal transmission

1. Only electronic instruments shall be used for signal transmission.
2. Signal transmission between field instruments and PAS shall use one of the following technologies:
 - a. Foundation™ Fieldbus.
 - b. Analog 4-20 mA with HART.
 - c. Wireless.
 - d. Modbus.
3. Foundation™ Fieldbus communication technology is the standard for connecting the field devices with the BPCS and shall be used on major projects and major expansions. Foundation™ Fieldbus design and configuration requirements are specified in DEP 32.30.20.13-Gen.
4. For an existing plant where it is not practical or justifiable to use Foundation™ Fieldbus due to the installed base, the signal type already utilized at the plant should be used.
5. Analog 4-20 mA current loop with 'HART' protocol shall be used for devices connected to the SIS.
6. Wireless communication may be used where it meets DEP 32.30.20.13-Gen. and DEP 32.01.20.12-Gen. but is subject to the approval by the Principal.
7. Modbus communication protocol over serial or Ethernet links may be used for communication between BPCS and other digital sub-systems, including analyser systems and PLCs, subject to approval of the Principal.
8. Systems used for machine monitoring, fire, gas and smoke detection, tank gauging and sub-systems for motor operated valves shall comply with additional signal transmission requirements according to Manufacturer/Supplier standards.

5.2.2 Pneumatic signal transmission

1. Unless otherwise specified by the Principal, pneumatic signal transmission shall not be used:
 - a. If the Principal specifies pneumatic signal transmission, the signal span shall be 20-100 kPa (ga) [3 psig to 15 psig].
2. No gas other than instrument air shall be used to power pneumatic instruments, control valves or actuators. Refer to DEP 32.36.01.17-Gen. and DEP 32.36.01.18-Gen. for specific requirements.

5.2.3 Power supply

1. All instruments shall be powered from an uninterruptible power supply. Refer to DEP 33.65.50.31-Gen. for further specifications.