# SPECIFICATION FOR INSTRUMENTATION DESIGN

(PROJECT STANDARDS AND SPECIFICATIONS)

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1.0 SCOPE

1.1 The Purpose of this specification is to provide the minimum mandatory requirements for the design of the Instrumentation for the projects.

1.2 Any conflicts between this specification and other application shall be resolved in writing by the Instrument Team of PROJECT.

2.0 REFERENCED CODES AND STANDARDS

Referenced Industry Codes and Standards

The industry Codes and Standards referenced in and/or applicable to this document are listed below. The latest revision number and/or issue date of each referenced industry Codes or Standards is relevant if later than those indicated below.

ISA : Standards and Recommended Practices for Instrumentation
ISO-5167 : Orifice Metering of Natural Gas
ANSI-B16.5 : Pressure and Temperature Ratings
ANSI-B16.104 : Control Valve Seat Leakage
ANSI-B31.3 : American Standard Code for Pressure Piping
ISA-MC96.1 : Temperature Measurement Thermocouples
ISA-S5.1 : Instrumentation Symbols and Identification
ISA-S5.2 : Binary Logic Diagrams for Process Operations
ISA-S5.3 : Graphic Symbols for DCS/ Shared Display Instrumentation Logic and Computer Systems
ISA-S5.4 : Instrument Loop Diagrams
API : Manual of Petroleum Measurement Standards
Chapter 4 – Proving System

Chapter 5 – Metering

API-2531 : Mechanical Displacement Meter Provers


Part I : Process Instrumentation and Control

Section 1 : Flow
Section 2 : Level
Section 3 : Temperature
Section 4 : Pressure
Section 5 : Automatic Controllers
Section 6 : Control Valves and Accessories
Section 7 : Transmission Systems
Section 8 : Seals, Purges, and Winterizing
Section 9 : Air Supply Systems
Section 10 : Hydraulic Systems
Section 11 : Electrical Power Supply
Section 12 : Control Centres
Section 13 : Alarms and Protective Devices

Part II : Process Stream Analyzers

Part III : Fired heaters and Inert Gas Generators

Part IV : Steam Generators
AGA 7 : Measurement of Fuel Gas by Turbine Meter
ASME : Boiler and Pressure Vessel Code
ASME Section VIII : Rules for Construction of Pressure Vessels
API-RP-520 : Design and Installation of Pressure Relieving Systems in Refineries
ISA-RP-12.6 : Wiring Practices for Hazardous (Classified) Location Instrument
Part I : Intrinsic Safety
ISA-S75.01 : Flow Equations for Sizing Control Valves
ISA-575.03 : Uniform Face-to-Face Dimensions for Flanged Globe Style Control Valve Bodies
IEC 331 : Fire Resisting Characteristics of Electrical Cables
IEC 332 : Test on Electric Cables Under Fire Conditions
API 607 : Fire Test for Soft-Seated Ball Valves
NFPA 70 : National Electrical Code
NFPA 496 : Purged and Pressurised Enclosures for Electrical Equipment
EN50020/ 50039 : Intrinsically Safe Electrical Apparatus and Circuits for Use in Explosive Atmosphere
ANSI/ISA 584.01 : Application of Safety Instrumented Systems for the Process Industries
IEC-61511 : Functional Safety Instrumented Systems for the Process Industry Sector
ISA S50.02 : Fieldbus Standard for Use in Industrial Control Systems
3.0 BASIC OF DESIGN AND FABRICATIONS

3.1 Instrument Terminology and Symbols

3.1.1 Instruments, controls and systems required to measure, monitor, control, and protect the process are to be shown on the Piping and Instrument Diagrams (P&ID’s) in sufficient detail to fully identify and illustrate each instrument loop and its components, using instrument symbols with identification tag numbers and/ or symbols with identification tag numbers and/ or symbols in accordance with ISA S 5.1.

3.1.2 Vendors of packaged equipment and systems shall furnish similar to P&ID’s to show the instrumentation that they are to furnish.

3.2 Design Documents

3.2.1 All instrumentation for the PROJECT will be listed in an Instrument Index that as a minimum will include tag number, service description, P&ID number, equipment or line number, specification number, instrument location drawing number, installation detail numbers, interconnection wiring diagram number and etc.

3.2.2 Instrument Loop Diagrams, when required, are to be prepared in accordance with the ISA S 5.4 format.

3.2.3 Logic Diagrams when required, to show emergency shutdown systems, interlock systems, and other discrete input logic systems are to be prepared in accordance with ISA S 5.2.

3.2.4 Instrument Location Plan drawings are to be prepared to show the physical location of field instrumentation

3.2.5 Instrument Installation Details are to be prepared to show process piping details and relative location of the instrument to the process connection, instrument mounting, pneumatic and electrical connection, and insulations details.
3.2.6 Instrument Interconnection Diagrams are to be prepared to define the point to point physical wiring between field instrument, junction box, and control room instrument wiring terminations.

3.3 Package Units

3.3.1 Instruments which are furnished as part of a proprietary or standardized equipment package are to be complied with this specification.

3.3.2 Local control panels and special monitoring and control systems for local and/or remote mounting, such as, combustion control, surge control, and vibration monitors for package units are to be furnished by the package Vendor and are to be tested with the unit wherever possible.

3.3.3 Refer to Summary of Instrument & Control System for Package system for the PROJECT. (Attachment No. 1)

4.0 MATERIALS OF CONSTRUCTION

4.1 General

4.1.1 Wetted Parts of all Instruments are to be suitable for the specified process service conditions and related Piping Class with the Piping Material Specification.

4.1.2 Special requirements for materials of construction for high or low temperature service, corrosive and/or erosive service, etc., when required, are to be as defined in the Piping Material Specification.

4.1.3 Materials for gaskets and bolts, when they are to be furnished by instrumentation vendors, are to be in accordance with the Piping Materials Specifications.
5.0 DETAILED SPECIFICATION

5.1 General

6.1.1 Instrument Tagging

1) An identification tag showing the instrument tag number assigned on the Instrument Data Sheet is to be attached to each piece of instrumentation by the equipment vendor.

2) Tags for instruments located in the field are to be stainless steel or other equally weather resistant material, permanently fastened to the equipment with stainless steel wire, screws or pins.

6.1.2 Painting

1) Vendor’s standard colors are to be used for all field instrumentation and local control panels, unless other requirements.

2) Instrument mountings, junction boxes, and other field located material are to be primed and painted in accordance with the Vendor recommendation.

6.1.3 Electrical Equipment and Enclosures

Electrical or electronic instruments and their enclosures are to be suitable for the area electrical classification.

6.1.4 Signal Transmission Systems

1) Fieldbus type signal to be used for transmitters and valve positioned in general.

2) Electronic transmitters and controllers are to be designed for a proportional output signal of 4-20 milliamps into a 600 ohms minimum loop resistance when powered at 24 volt DC over a two conductor signal/power transmission circuit.

3) Pneumatic transmitters are to be desired for a proportional output signal of 0.2 – 1.0 kg/cm²g when powered a 1.4kg/cm²g air supply pressure.
4) Temperature signals may be direct wired from thermocouple/ RTD’s to temperature transmitters and analogue (4-20mA) signal to be connected to Control Room. In case of package system, temperature signals can be wired from thermocouples/ RTD’s to Control Panel as Vendor recommendation.

5) Ex’d type for Hazardous Area to be used and certified by the appropriate agency either as individual pieces and/or for use in complete instrument.

5.2 Flow Instrumentation

5.2.1 Primary Elements

1) Concentric, sharp edge, paddle type orifice plates fabricated in accordance with ISO 5167 and others

2) If type stainless steels are not suitable for the process condition, other materials may be substituted as required by the Piping Materials Specification.

3) Orifice plate data is to be stamped on the upstream side of the paddle

4) Orifice plate thickness are to be as follows:

<table>
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<th>Thickness</th>
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<tr>
<td>1-1/2 inch to 6 inch</td>
<td>3 mm</td>
</tr>
<tr>
<td>6 inch to 16 inch</td>
<td>6 mm</td>
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<tr>
<td>18 inch to 24 inch</td>
<td>9 mm</td>
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5) Special conditions may dictate the use of other flow measuring devices such as the following:
   a) Quadrant edge plates or segmental wedges are to be used for high viscosity or low Reynolds number conditions.
   b) Venturi-tubes, low-loss flow tubes, or flow nozzles are to be used to minimize the non-recovered pressure loss and/or the upstream and downstream straight lengths of pipe, or for dirty services.
   c) Averaging pitot tubes may be considered for applications in very large lines and utility supply lines.
   d) Meter run shall be followed as per Vendor Requirements.