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Sample Transport and Sample Conditioning Systems for Process Stream Analyzers

GP 15-08-02

Scope

[I] This Global Practice (GP) covers the design, installation, and inspection of sample transport systems and sample conditioning systems for process stream analyzers.

[I] An asterisk (*) indicates that a decision is required by the Owner's Engineer or that additional information is furnished by the Owner's Engineer.

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1. Required References

[I] This Section lists Practices and Standards that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 18-10-01	Additional Requirements for Materials
GP 20-01-01	Inspection of Equipment and Materials

1.2. ASME–American Society of Mechanical Engineers

ASME B31.3	Process Piping
ASME Y32.11	Graphical Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries R(1998)

1.3. ISA–The Instrumentation, Systems, and Automation Society

ISA 5.1	Instrumentation Symbols and Identification
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2. Additional Requirements

* [I] The following Practices and Standards shall be used with this Practice as specified by the Owner's Engineer.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 03-02-07	Manual Sampling Systems
GP 03-06-01	Piping for Instruments
GP 03-18-01	Piping Fabrication Shop or Field
GP 04-03-03	Shelters for Process Analyzers
GP 14-01-01	External Insulation
GP 15-08-01	Process Stream Analyzers
GP 16-09-01	Low Voltage AC Motors Up to 200 HP (150 kW)
GP 18-10-01	Additional Requirements for Materials



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2.2. API–American Petroleum Institute

API SPEC 5L	Specification for Line Pipe
API RP 555	Process Analyzers

2.3. ASME–American Society of Mechanical Engineers

ASME SEC VIII D1	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 1
ASME B1.20.1	Pipe Threads, General Purpose (Inch)

2.4. ASTM–American Society for Testing and Materials

ASTM A 53/A 53M	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 106	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A 312/A 312M	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
ASTM D 4177	Standard Practice for Automatic Sampling of Petroleum and Petroleum Products IP Designation: MPMS Chapter 8.2
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials

2.5. IEC–International Electrotechnical Commission

IEC 61115	Expression of Performance of Sample Handling Systems for Process Analyzers
IEC 61285	Industrial-Process Control - Safety of Analyser Houses
IEC TR 61831	On-Line Analyser Systems - Guide to Design and Installation

2.6. ISA–The Instrumentation, Systems, and Automation Society

ISA 5.4	Instrument Loop Diagrams
ISA 51.1	Process Instrumentation Technology

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2.7. Other References

Exxon Chemical Process Analyzer Requirements Company Handbook- 97 CENGT 2141

3. Definitions

Term	[I] Description
Analyzer validation/calibration system	All the facilities required for introducing a standard reference sample into the analyzer for the purpose of validation or calibration.
Sample conditioning system	A combination of components installed directly upstream of an analyzer inlet used to prepare process samples for analysis. Examples of components that are used commonly in sample conditioning systems include filters, vaporizers, reducing regulators, separators, scrubbers, and temperature controllers.
Sample disposal system	A combination of components installed to dispose of sample as per project specifications. The disposal may be having an accumulator with automatic level control to pump the fluid to a designated point or it may be as simple as a vent to atmosphere.
Sample tap	A connection point used for taking a sample from a process stream.
Sample transport system (fast loop)	A piping/tubing system used to transport the sample from the sample tap to the sample conditioning system and where applicable, return the sample to the process.

4. Documentation

4.1. Proposal Information

[O] Bidder's proposal information shall include:

- 1) Total equipment list, including description of each item, function, size, capacity, and utility requirements. Where Vendor has a standard sample conditioning system, it shall be quoted separately as an option.
- 2) Materials of construction.
- 3) Schematic flow diagram.
- 4) A copy of analyzer specification sheet, including process condition specifications.

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4.2. Instruction Manuals

* [R], [M] Instruction manuals shall be supplied by Vendor for each sample transport and conditioning system. The number of copies and delivery schedule shall be specified by the Owner's Engineer. These manuals shall cover all components, and shall include the following:

- 1) Interconnecting diagram indicating all connections and shielding requirements. Markings for wire color coding and numbering and for terminal identification shall be identical to those actually on the systems.
- 2) A schematic flow diagram and assembly drawing for all systems supplied.
- 3) A bill of materials for all systems showing manufacturer catalog numbers of all major components.
- 4) Specifications and drawings for all major components such as vessels, regulators, filters, pumps, flow indicators.
- 5) Detailed installation instructions.
- 6) Complete parts list.
- 7) Recommended spare parts list for start-up and 2 years' operation.
- 8) Trouble-shooting procedure.
- 9) A copy of factory inspection data including pressure tests and materials certificates.
- 10) All documents shall be identified by the tag number, serial number, purchase order number, and Vendor reference number.
- 11) Actual flow calculations based on process conditions specified in analyzer specification sheet.

4.3. Software

- 1) [R], [M] Where available, all drawings shall additionally be provided in software/CAD format. Vendor shall specify software package used.
- 2) * [R], [M] If applicable, the original diskettes/CDs containing software required to operate or interact with the system shall be provided by Vendor. The number of copies and the delivery schedule shall be specified by the Owner's Engineer.

5. Materials

5.1. Piping and Tubing

- 1) * [S] Material shall be either stainless steel pipe Type 316 or 304, carbon steel pipe or stainless steel tubing Type 316 or 304, unless a special material is required for the process or utility fluids handled. Tubing is preferred.
- 2) [S] Tubing fittings. Compression fitting ferrules shall have a hardness greater than the connective tubing.
- 3) [S] Low melting alloys shall not be used in lines handling hydrocarbon or other flammable substances.

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- 4) [S] Copper or copper bearing alloys shall not be used in ammonia service.
- 5) [O] When the measurement is for low amounts (<30 ppm) of moisture, sulfur compounds, ammonia, or similar materials which readily attach to metals, the tubing shall be electropolished or fused silica lined. In addition, such lines will be heat traced.
- 6) * [O] When the sample is a flue gas, the tubing shall be PTFE, PTFE lined, or fused silica lined. In addition, such lines shall be heat traced subject to approval by the Owner's Engineer.
- 7) [S] If non-metallic materials are used for hydrocarbon lines, they shall be routed and suitably supported in metallic tubing or pipe.
- 8) [S] Carbon steel shall not be used for pipe subject to shock chilling where the fluid temperature is below -50°F (-45°C).
- 9) [S] If nonmetallic materials are used for hydrocarbon lines, they shall be routed and suitably supported in metallic tubing or pipe.

5.2. Analyzer System Process Sample Pumps

[S] Steel or alloy casings are required for any pumps located within process unit areas that handle any flammable or toxic materials.

6. Sample Tap/Sample Return Connections

- 1) [O] Sample taps shall be located at least 12 pipe diameters from the junction of two streams to ensure proper mixing. Sample taps shall be at least 12 pipe diameters downstream of a pressure reducer where two phase flow can exist.
- 2) [O] Sample tap locations shall be on vertical sections of process piping. If this is not practical, then for horizontal sections of piping, sample taps for gas or vapor samples shall be located on the top of the pipe and for liquid samples they shall be located on the side of the pipe.
- 3) [O], [R] For process line sizes less than 2 in., a tee shall be used as the sample tap.
- 4) * [O], [R] For process line sizes 2 in. and above, a sample take-off probe shall be provided. A typical probe design is detailed in Figure 1. Use of special design probes such as an isokinetic probe shall be considered where appropriate subject to the Owner's Engineer's approval. The stress calculations shall be performed at design conditions and shall be submitted for review and approval by the Owner's Engineer.
- 5) * [R] Provision shall be made for rodding out the sample probe unless agreed otherwise by the Owner's Engineer.
- 6) [M], [S] Sample taps and associated valves not located at grade shall be accessible from a permanent platform, portable platform (e.g., cherry picker), or ladder. Retractable probes or probes which have vaporizing regulators or other sample conditioning components located with them must have permanent platform access.
- 7) * [I] In all cases, probes shall conform to local process line and small bore piping regulations. Final probe design shall be approved by the Owner's Engineer.

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