Engineering Standard

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Sample Conditioning Systems for Process Analyzers

Document Responsibility: Instrumentation Standards Committee

Saudi Aramco DeskTop Standards

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1 Scope

This engineering standard defines and mandates the requirements on sample take off, sample transportation and design & construction of process on-line analyzer sample conditioning systems and disposal of process sample effluent.

2 Conflicts and Deviations

2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs) or industry standards, codes and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Process and Control Systems Department of Saudi Aramco, Dhahran.

2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure SAEP-302 and forward such requests to the Manager, Process and Control Systems Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references below, unless otherwise noted.

3.1 Saudi Aramco References

Saudi Aramco Engineering Procedure

SAEP-302	*Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirements*

Saudi Aramco Engineering Standards

SAES-A-112	*Meteorological and Seismic Design Data*
SAES-B-054	*Access, Egress, and Materials Handling for Plant Facilities*
SAES-J-003	*Instrumentation-Basic Design Criteria*
SAES-J-502	*Analyzer Shelters*
SAES-N-001	*Basic Criteria, Industrial Insulation*
SAES-P-100	*Basic Power system Design Criteria*
SAES-W-011	*Welding Requirements for On-Plot Piping*

3.2 Industry Codes and Standards

American National Society Institute/International Society for Automation

ANSI/ISA 76.00.02 *Modular Component Interfaces for Surface-Mount Fluid Distribution Components--Part 1: Elastomeric Seals*

American National Standards Institute/National Fire Protection Association

ANSI /NFPA 70 *National Electrical Codes (NEC)*

American Society for Testing and Materials

ASTM A269 *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*

American Society of Mechanical Engineers

ASME B31.3 *Process Piping*

International Electrotechnical Commission

IEC 60079-0 *Electrical Apparatus for potentially Explosive Atmospheres – General Requirements*

International Organization for Standardization

ISO 15156 *Petroleum and Natural Gas Industries – Materials for Use in H_2S Containing Environments in Oil and Gas Production*

4 Definitions

Fast Loop: High velocity, continuously operation sample loop bringing fresh sample in close proximity to the analyzer sampling system. Synonymous with by "Bypass sample" or "Slip Stream"

LNG: Liquefied Natural Gas

Piping Class: An assembly of piping components, suitable for a defined service and design limits, in a piping system.

Process Line: The piping used to transport of fluids (other than sample lines).

Representative Sample: A portion extracted from total volume that contains the constituents in the same proportion that are present in the total volume.

Sample Probe: A device (usually in the form of a special tube or pipe) that is inserted in to a defined point in the bulk of the process stream to extract small portion as sample.

Sample Pre-Conditioning: A system consists of one or more devices that condition the sample (pressure, temperature, flow and change of state) so that it is transported to the sample conditioning system.

Sample Line: The tube or pipe used for transporting the sample.

Sample Conditioning System: The system which conditions the representative sample enough to enable the analyzer to reliably perform its application unattended.

Sample Recovery System: System that recovers the spent sample and returns it to the process.

Sample Take-Off Connection: The point where the sample is extracted from process, i.e., the location of the tip of the sample probe or the pipe wall connection from where the sample fluid leaves the process piping. It may also be a point referred to as "sample connection", "sample nozzle", or "process tap"

Single Line Sample Transport: The sample transport system which does not employ fast loop sampling.

5 General Requirements

5.1 Piping and Tubing

Piping and tubing shall be designed for maximum operating pressure specified on Instrument Specification sheet. The piping shall be designed, fabricated, and tested accordance with SAES-W-011 in addition to ANSI/ASME B31.3. Standard specification for seamless tubing shall be as per SAES-J-003.

5.2 Electrical

All electrical and electronic equipment in hazardous areas shall meet listing/certification requirements specified in SAES-P-100 and the NEC.

5.3 Environment

The sample conditioning system shall be suitable for installation in the applicable environmental conditions specified in SAES-J-003 and shall be designed for contaminant levels specified in Ambient Air Quality section of SAES-A-112.

5.4 Insulation

The insulation of sample system enclosures as well as sample lines shall as per

SAES-N-001.

6 Materials

The process conditions and nature of the fluid shall be taken into consideration while selecting materials. Sample transport line material shall be selected to minimize the effects adsorption/desorption, e.g., moisture or chemical contaminants. In addition, heating (tracing) may be considered to avoid adsorption/desorption problems.

Unless otherwise specified, AISI 316 shall be used for all wetted parts of sampling systems as minimum. Sample lines in piping shall be in accordance with piping class. In case of corrosive conditions, the material may have to be upgraded in consultation with P&CSD/PID. Sample transport lines for products in which traces of reactive compounds (such as Hydrogen chloride, Hydrogen Sulfide, Mercury) are to be measured, shall be treated to minimize chemical reaction between sample and tube. The use of non-metallic materials requires prior approval from P&CSD/PID.

7 Sample Take Off Point and Sample Probes

7.1 The sample point shall be selected to obtain representative and timely information on the composition of the process stream. The process temperature, pressure and, other conditions shall be as close as possible to the required conditions specified for the analyzer. Sampling equipment shall be accessible for maintenance. The locations where there is a possibility of contamination and locations with two phase samples shall be avoided. The sample take-off point shall be 3-5 pipe diameters downstream from any flow disturbance, mixing equipment, or 90 degree bends. Unless otherwise specified, AISI316 shall be used for sample take off assemblies sample probes.

7.2 When the sample point is selected sample return point shall also be selected. Tapping across a control valve shall be avoided since differential pressure will vary with valve opening. The tapping across an orifice shall be avoided as it will negate the flow rate measurement in the process line. Typical good return locations are the suction of a pump or to flare header, if sample to be returned is of low pressure and low volume.

7.3 When gases/vapors are sampled, the sample tap shall be located at the top of the process line to help exclude suspended solids and collection of liquids from the sample. When liquids are sampled, the sample tap shall be located at the horizontal side of the process line. This provides best protection from solids and gas bubbles in the process liquid. Installation of sample tap at the pipe bottom shall be avoided. Samples taps can also be located on vertical pipe lines with due consultation with supplier.

7.4 When installing a sample tap, the bore size shall be the same as that of nozzle size and the internal edge radiused to remove burrs. If the nozzle penetrates the pipe wall, it shall be set so that its end is in line with the pipe wall. This precaution reduces the accumulation of deposits that tends to build up at sharp edges in the sample path. Sample tap shall be fitted with a full port ball valve or gate valve. If a sample probe is necessary, it can be inserted through the valve.

7.5 The purpose of a probe is to ensure representative sampling. The sample probe shall extend into the process line at least 1/3rd of pipe internal diameter. The probe must be designed in such a way to force the sample to turn through 180 degrees at the point entry to preclude particles that cannot make the turn because of their inertia.

7.6 Sample points shall be accessible from grade or permanent platforms for safe installation and maintenance and/or isolation of process sample. Special care shall be exercised in the area of personnel safety when the process is toxic and/or at high temperature and high pressure.

7.7 The mechanical design and construction of the sample probes shall comply with the same code as process piping. Unless otherwise specified, a sample probe shall not be used for process lines less than 3.5 inches or less. The probe internal diameter shall be designed keeping in view sample hold up time and overall response, viscosity of the process sample, and particle size of the contaminants of the process sample. Sample probes for special applications such as Continuous Emission Monitoring (CEM), and Sulfur Recovery Plant analyzer applications, shall be designed in consultation with supplier as a complete package.

7.8 Sample lines, sample take off and return valves, pumps and all other accessories shall be identified with the service and shall be tagged.

8 Sample Pre-Conditioning

8.1 The preconditioning system components shall be enclosed in a SS316 box as minimum, with all the components accessible for maintenance. Sample taken from process may require pre-conditioning such as cooling, heating, pressure reduction or pressure increase, to meet the analyzer sample inlet condition requirements.

The components shall be installed in a heated box, if required by the application. All components in the pre-conditioning shall be rated for the relevant process conditions. Pressure relief valve shall be installed downstream of the pressure reducing valve. The relief valve vent shall be returned to process or connected to flare or to the drain system. The pressure relief valves shall be tested or replaced every 3 years.

8.2 Pressure reduction of gas and vapor samples shall be done as close as possible to the sample take-off point. Pressure reduction at sample take off reduces the overall distance-velocity (dv) lag time of the sample.

8.3 For cryogenic services, the pre-conditioning cabinet shall be kept at a constant elevated temperature. The sample transport line downstream of the pressure reducer may require heat tracing, depending on the sample dew point at ambient conditions.

8.4 Vaporizing pressure reducer may be used, if the liquid sample has to be analyzed in the vapor phase. The volume of sample between sample take off and the vaporizer shall be minimum in order to avoid long sample lag time.

8.5 Vaporizing pressure reducer is required if, condensation is expected upon pressure reduction. The sample shall be heated well above the maximum temperature at which the sample exists in vapor phase.

8.6 A pump shall be used in the following situations:

- If the pressure at the sample take-off point is too low or if the sample may flash in the sample system.
- If the distance between the samples take-off point and analyzer is too long to create sufficient velocity in the line due to low differential pressure between samples take off point and return point.

9 Sample Transportation System

9.1 The design objective of the sample transportation system is to transport the sample to the analyzer at satisfactory, acceptable sample transport time. Typical transportation time from the sample take-off point to the analyzer shall be 90 sec, unless otherwise specified. Typically, 60 sec for the sample transportation fast loop and 30 sec for sample conditioning system. However, the lag time requirements shall be as per Instrument Specification Sheet and shall not exceed 3 minutes.

9.2 Liquid samples shall be transported to the vicinity of the analyzer though a high velocity fast loop system with a self cleaning filter (SirlKleanTM or equal). Slip stream shall be taken for further conditioning of the sample. Volatile liquids shall be transported under pressure and cooled as necessary. After cooling the pressure may be reduced to be suit analyzer requirements.

9.3 Flushing Fluid Connection

Sample transport lines shall have flushing connections for sample transportation system for applications where the pour point of the sample is above minimum

ambient temperature. The flushing arrangement shall be provided on all streams where sample has viscosity greater than 500 cP at 100°F, where solidification is possible by reaction or polymerization. The flushing medium inlet connection shall be downstream of the sample-take off point. Block and bleed valves shall be provided to avoid contamination of the process medium.

9.4 Piping and Tubing

9.4.1 Liquid fast loops shall be ½ inch schedule 80 pipe. Vapor transport lines generally shall be ¼ in stainless steel AISI 316. Liquid transport lines shall be generally 3/8 in stainless steel AISI 316 tubing. Piping and tubing runs containing flammable or toxic material shall have only welded joints. However, if viscosity of the sample is more than 10 poise (1 Pa.s) at 86°F, the size of the transport line shall be 1.0 inch minimum to avoid clogging. If the highly viscous samples such as Bitumen and Asphalt typically require 2.0 inch sample lines.

If a particular application demands different tubing sizes than specified above, necessary approvals shall be obtained from Supervisor, PID, P&CSD.

9.4.2 Sample lines in piping shall be terminated at the analyzer shelter with a welded flange with a suitable cover flange. Sample lines in tubing are directly connected via union or bulkhead to the corresponding sample condition system and the analyzer shelter. Dual ferrule compression fittings shall be used for sample line. Tubing shall be supported by ladder frame, routed along the structural steel, with sufficient support.

Stainless steel sample transport lines shall not come in to contact with any galvanized pipes or galvanized structure support to avoid corrosion. Number of joints in sample transport line shall be kept minimum. The location of joints in insulated sample transport lines shall be clearly identified on the outside of the insulation. Steam tracing of long sample transport line shall have steam traps at intervals of approximately 50 meters. Each steam traced line shall end with its own steam trap. Preinsulated steam traced bundles are preferred over conventional insulation.

10 Heating/Cooling Process Sample

10.1 Heat tracing by steam or electricity shall be applied to the sample take-off point, the pre-conditioning system and the sample transportation lines, if condensation of gaseous samples may occur at specified ambient conditions. The sample temperature shall be at least 10°C higher than the highest possible dew point of the sample. Heating may also be applied for:

- Evaporation of liquid,
- To reduce adsorption/desorption effects of trace components by the wetted surfaces of the sampling transportation lines.
- To control the sample temperature as specified for the analyzer or sample conditioning system.

10.2 The choice between electrical and steam trace heating shall be governed by the required heating capacity and precise control of temperature as per application requirements. If steam traced sample lines are used, a downward slope shall me maintained at all points to drain condensate. Typical slope shall be more than 0.15 inches per foot. The electrical heating components shall meet the area classification of the area in which they are installed.

10.3 Applications that contain free sulfur shall be provided with sample lines having sulfur knock out arrangement at the sample take off point so that liquid sulfur shall be returned back to the process through the return point. The sample lines shall be kept as short as possible and at least 10°C above the process sample temperature through electrically heated and controlled sample lines.
No restrictions shall be placed on the sample transport lines.

10.4 Cooling shall be applied at the sample take off point, the pre-conditioning system, or at secondary sample system to control the sample temperature and to coalesce liquids to improve separation. The cooling also keeps volatile liquids in liquid phase.

10.5 Pressure Rating

The pressure rating of the selected components shall cope with the design conditions. If pressure in the lines exceeds design pressure, relief valves shall be used. The fluid relieved shall either returned to process or to the flare line. These relief valves shall be installed at sample take off or near the analyzer location, based on the process pressure. The relief valve setting shall be 10% less than the pressure rating of the lowest rated accessory in the sampling system.

10.6 Single line sample transport system shall be considered, if suitable return point in the process is not available. The sample lag time and the sample bypass flow shall be considered during design.

10.7 Fast Loop Systems

Transport line lag time calculations shall be provided by the designer. Fast loop may be installed across plant equipment or pumps with relatively constant differential pressure.

Fast loops shall not be applied across flow meters and control valves. There shall be 50% pressure differential between sample take off and sample return pressure.

The number of joints in sample transport lines shall be kept at minimum so that continuous flow is obtained.

Pumps shall be employed in case of insufficient pressure. If the vapor pressure of the sample is close to the process line pressure, pump shall be installed close enough to the process line to prevent cavitations at the suction end.

11 Sample Conditioning Systems

11.1 General

The sample conditioning systems shall be designed to supply the sample at the analyzer inlet while meeting the conditions as specified in the analyzer technical specifications. It shall be designed in such a way that none of the process sample analytical properties are changed between sample extraction and analyzer inlet. Utility connections (e.g., air, cooling water, calibration gas, carrier gases, etc.) shall be taken into consideration in the design of sample conditioning system.

Sample conditioning system shall be custom-built for the application for which it is required. Typical system shall have all the components required for conditioning and delivery of compatible process sample to the analyzer.

11.2 Sample conditioning system shall be enclosed in a stainless steel AISI 316 box. If application demands the box shall be heated to the required temperature. These sample conditioning systems may be located in the field or outside the analyzer shelter designed as per SAES-J-502, depending on the location of the analyzer. Sample tubing and cable shall enter the box from side of the box.

11.3 Sample conditioning system from the manufacturer shall be preferred. If the sample condition system is from other supplier, the system integrator shall take approval from the analyzer manufacturer for the compatibility of such sampling system with analyzer, and shall take full responsibility for the performance of the complete analyzer system.

11.4 ANSI/ISA 76.00.02 compliant modular sampling systems shall be used only for clean process streams where the particulate matter is less than 10 microns.

12 Sample Conditioning System Components

12.1 All components selected shall be rated for the process conditions. All wetted parts shall be stainless steel AISI 316 for general applications. The sample

conditioning system components shall be from Saudi Aramco approved sources.

12.2 Dual ferrule compression fittings shall be used for sample line. The tubing shall be in accordance with ASTM A269. The sample conditioning systems shall be provided with a relief valve for high pressure samples. The relief valve setting shall be 10% less than the pressure rating of the lowest rated accessory in the sampling system.

12.3 Sample conditioning system shall have facilities for flushing, venting and/or drain valve(s). The vent/drain outlets shall be connected to a vent or drain system.

12.4 Steam heating systems for heat tracing of sample line or heated box shall normally be 1/4 in or 3/8 in diameter SS tubing with compression fittings and components. The steam heating system must be equipped with steam trap(s) to drain off condensate. Copper tubing shall not be used.

12.5 Instrument air lines and pneumatic signal lines shall normally be made from stainless steel AISI 316 tubing with compression fittings unless otherwise specified by proponent.

12.6 Pressure gauges for sample fluids shall have 2 inches dial and provided with a ¼ in NPTM threaded connection. The type of thread shall be as per the requisition. The pressure gauges shall be positioned in the sampling system to avoid dead legs. If required, suitable isolation and venting facility shall be provided for the pressure gauges.

12.7 The instrument air and nitrogen supply lines shall be provided with filter reducer complete with pressure gauge and back flow protection.

12.8 Solenoid valves shall be used only for switching instrument air and nitrogen. Pneumatically operated valves in combination with a solenoid valve shall be selected for all other process fluids. Pneumatic actuator shall be provided with a direct coupled mechanical position indicator.

Glass components or parts shall not be used for toxic and flammable fluids. If glass components are to be used due to non availability of stainless, such glass components shall be rated for 2.0 times the maximum operating pressure of the related system.

Relief valves shall be installed to protect the components which have limited pressure rating. The relief pressure shall be connected to a vent or drainage or flare system as required.

12.9 Flow of Fluid to Analyzers

The flow of flammable fluids to the analyzers shall be limited to maximum 30 NL/hr or as recommended by the manufacturer. Liquid flow rate shall be as specified by the analyzer manufacturer.

12.10 Cooling/Heating Process Samples

If the process fluid temperature is required to be within specific limits, cooling or heating as appropriate shall be provided in the sample conditioning system. Fresh water from the main cooling systems shall be used. Sea water shall not be used as cooling medium. If the cooling water temperature is too high, cooling by means cold air from vortex tube or by refrigeration cooling shall be considered. The refrigerated cooler shall have an electric motor with single phase power supply.

12.11 Physical Property Analyzers-Calibration

A calibration tank shall be provided for certain physical property analyzers that require liquid samples for testing and calibration. The capacity of the tank is sized such a way that frequent filling is not required and the test sample lasts for 4 months depending on the stability of the test sample.

If viscosity of the sample is required to be lowered, steam may be applied around the tank through stainless steel AISI 316 tubing. If steam is not available electrical heating tape of self regulating type shall be used. These heating systems shall be sealed against water ingress in order to prevent chloride stress corrosion. If nitrogen is used as pressurizing medium, the pressure shall not exceed 7.0 PSI.

12.12 Sample Conditioning Components Enclosures

All components shall be installed on AISI 316 stainless steel mounting plate and enclosed in AISI 316 stainless steel box. The components shall be attached to the mounting plate with bolts and nuts, the nuts being permanently fixed to the mounting plate. Components such as filters, coalescers, and flow cells/electrodes that require frequent maintenance shall be mounted at suitable height and easily accessible. Access platforms shall be provided for maintenance and operation as per SAES-B-054. An identification tag or name plate made of stainless steel AISI 316 shall be attached to the equipment securely with stainless steel or Monel fasteners.

All incoming and outgoing connections shall be identified with engraved name plates. All components shall also be provided with name plates showing the

respective settings. The tubing shall be arranged so that the removal of one component does not require the dismantling of other parts.

13 Applications

13.1 General

Certain applications require provisions in additions to, or in deviation from those mentioned such as special materials and or components and heating or both.

13.2 Sour and Toxic Services

The sour service is a fluid containing water and hydrogen sulfide in excess of limits prescribed in ISO 15156. This type of service may cause sulfide stress cracking of susceptible materials. All components installed in sour services shall comply with requirements of ISO 15156.

The vent from toxic services shall be connected to a flare system. All drains shall be directed to a drainage vessel or a covered pit allocated to receive toxic effluent.

13.3 Corrosive Service

Wherever stainless steel is not suitable, preference shall be given to materials such as Monel, Hastelloy or Incoloy.

13.4 Continuous Emission Monitoring System (CEMS)

There are two types of sampling techniques used for Continuous Emission Monitoring. One is extractive and the other is in-situ. CEMS shall be designed to meet the performance specification laid down by the local authority. The sample conditioning system shall be supplied by the CEMS supplier as a total package.

- **Extractive Method**

  The gas sample shall be continuously extracted from the stack, filtered, and water vapor removed for dry measurement or heated to retain the water vapor to provide a wet measurement. Dilution technique may also be employed, if based on specific application.

  The extractive measurement shall use valves, aspirator, chiller or heater, dilution device, sample tubing, heat traced sample lines, filters and other components needed for gas transport and conditioning so that process sample is presented to analyzer in clean state and at standard temperature and pressure. The sample is conditioned in such a way that the sample is maintained in hot/wet condition to provide wet measurement or in cool/dry condition to provide dry measurement.

- **In-situ Method**

  The analyzer is directly inserted into the stack does not require sample conditioning system.

13.5 Chromatographs

Vendor designs of Sample Conditioning Systems (SCS's) shall be self-contained and shall incorporate at least these features:

- Shut-off (block) valves for source and return lines;
- Bypass valve on the process side of the block valves;
- A control valve and an associated flow meter to adjust the fast loop flow;
- A control valve and an associated flow meter to adjust the analyzer inlet flow;
- Pressure gauges on the upstream and downstream sides of pressure reducing or flow adjusting stations;
- Pressure gauges which incorporate chemical gauge protectors on hazardous materials streams;
- Armored flow meters for high pressures or hazardous materials;
- Filters positioned so that their elements are accessible for replacement;
- Drain and vent connections for emptying lines and components of process fluids prior to performing maintenance.

13.6 Moisture Analysis

Vendor designs of sample conditioning systems (SCS's) shall be self contained and shall incorporate at least following features:

- The sample conditioning system shall be in the field near to the sample take off point Needle valve shall be used on sample inlet line to the sample conditioning system to avoid exposing the moisture sensors to pressure shock. Armored flow meters shall be used for high pressures and flows. Pressure tight fittings shall be used to minimize penetration of atmospheric moisture.
- Sample gas shall be returned to process after analysis, to create a closed-loop system to eliminate access of atmospheric moisture. If spent gas is to be vented to atmosphere, back diffusion of atmospheric moisture shall be minimized with coil of small diameter tubing and maintaining the flow rate as high as practical.
- Off gassing of metals shall be minimized by operating the sample system at process pressure or highest possible pressure.

- A back pressure regulator shall be used on applications where dew point is engineering output. Position the regulator after the sensor and the flow meter.

- Maintain Sample temperature at 10°C above dew/frost point. Inlet sample lines above 3 meters in length require heat tracing to minimize the off gassing of metals known as diurnal effect. Sample conditioning cabinets require heaters/coolers to minimize diurnal effects of off gassing.

- When application calls for quantitative analysis and the sample contains corrosive constituents (H_2S), an all stainless steel AISI 316 inlet and outlet regulator is required. The sensor shall be operated at lowest pressure possible to increase life expectancy of the sensor. Inlet filters shall be made of stainless steel AISI 316.

13.7 Tail Gas Analysis

The sulfur removal from the process sample shall be done at the sample take off point. Steam jacketed valves shall be used for sample isolation for sample line and return line. Electrically heat traced lines must be used for sample and return lines to achieve precise control of temperature control. The steam jacketed valves must be properly insulated to avoid any cold spots which result in sulfur condensation.

13.8 The sample conditioning system for the density/specific gravity analyzers shall be field mounted with its sample transport line as short as practicable.

14 Sample Disposal Systems

14.1 Process Samples

Process samples, both liquids and gases shall be returned to process streams wherever possible. If process liquid sample cannot be returned to process due to non-availability of low pressure return points, suitable liquid recovery system shall be used. The recovery system shall have a vent for lighter hydrocarbons and the vent shall be equipped with device to oxidize the vent gases.
The process gas sample shall be returned to flare system or sample recovery system. Gases or vapors which are returned to flare system shall be routed to a vent header and flare system using a pressure controlling device to isolate analyzer from fluctuating outlet pressures.

Waste samples of the process analyzers shall not be discharged to atmosphere. The column vents of gas chromatograph and other analyzers shall be routed to atmosphere through a device to oxidize vented samples, while maintaining an atmospheric pressure reference. This oxidizing device shall be suitable for

installation in hazardous areas and shall meet listing/certification requirements specified in SAES-P-100.

14.2 Liquid Disposal to Effluent System

Aqueous fluids from analyzers using reagents shall be discharged in to contaminated effluent systems of the plant.

14.3 Vent and Drain Systems

Stainless steel AISI316 shall be used for vent and drain systems. The minimum size for piping for vent header is 2.0 inches and for liquid headers is 3.5 inches. The interconnecting piping shall be ½ in minimum.

15 Heating / Insulation of Enclosures

15.1 General

A prefabricated thermal insulating enclosure with heating facilities shall be provided to house the sampling components. Insulating pads shall be provided for the locations where the sample lines enter or leave the heated box to avoid metal to metal contact with the enclosure. Steam at 50 PSIG shall be used for heating the sample conditioning enclosure.

If steam is not available or if precise control of heating is required electric heating shall be applied. Proper installation/insulation procedures shall be applied for the heat traced sample lines to avoid ingress of rain water. Electric components such as solenoid valves, switches and timer devices shall not be installed inside the enclosure.

15.2 Insulation and Enclosure

The insulation requirements for sample systems, precondition equipment and sample lines shall be as per SAES-N-001. Sample conditioning systems provided with heating facilities shall have enclosures that are constructed from stainless steel AISI316 plates insulated with mineral wool. The enclosure shall meet requirements of IP65 to prevent dust/water ingress. The enclosure shall be provided with a door with a glass viewing window in the front. A caution plate shall be provided on the front door, if the box is heated.

16 Electrical and Electronic Equipment

Electrical components or devices which are intended for operation in locations classified as hazardous shall comply with requirements of NFPA 70 and National Electrical Code, Article 505, and shall be third party certified (labeled) by any of these

agencies UL, FM, CSA, or any recognized European third parties certified with full requirements of IEC EN 60079-0. The stainless steel enclosures shall be provided with earthing bolt and all electrical equipment shall be connected to plant earth by an insulated wire for personnel protection.

17 Documentation

A set of documentation shall be prepared by the supplier indicating the position of components, interconnections and installation details, and list of materials.

General drawing indicating the complete schematic from sample take off, preconditioning, transportation, sample conditioning, analyzer, vent/drain and return lines shall be provided. Information on stream switching valve operation, process conditions, line sizes, and connections shall be included on the drawing.

Manufacturer/System Integrator shall supply procedures for start up, operation and maintenance of the sample conditioning system. Manufacturer/System Integrator shall obtain approval from proponent before start of manufacturing of sample handling system.

Revision Summary

1 December 2010	New Saudi Aramco Engineering Standard.
17 January 2012	Editorial revision to correct 90 degree bends in paragraph 7.1.