Attachments

1 SCOPE

1.1 Purpose

The purpose of this specification together with the referenced Saudi Aramco Standards and Specifications, and project documents is to describe the minimum functional and technical requirements for Analysers, Analyser Shelters and Local Analyser Panels.

1.2 Facilities Overview

The Rabigh Phase II Petrochemical Project will integrate with the existing Rabigh Phase I Plants and provide the Refinery and Petrochemical Complex. The proposed project will provide a new refinery and petrochemical complex at the adjacent site of the existing Rabigh Phase I Plants.

1.3 Operating Areas

For operability and maintenance reasons, the plant has been divided into Operating Areas. This provides logical plant areas which are represented by major portions of plant within the Process.

Segregation of equipment within these Operating Areas provides a measure of isolation between principal Sections of plant and equipment.

When Process Interface Building covers two or more Operating Areas, equipment contained within these rooms shall be separated to isolate the Operating Areas. All PCS I/O together with its related process control equipment and any other control equipment for each of the Operating Areas shall be totally independent of each other.

This applies to analysers as follows:

- Analyser I/O for different Operating Areas from a common location (e.g. from the same analyser shelter.) shall be segregated accordingly and the respective destinations of the I/O shall be clearly identified on the analyser datasheets and within the data exchange / SPI database.
- PIB mounted analyser controllers shall be segregated in accordance with the Operating Area philosophy.
- A significant volume of GC analyser process data is transferred to the PCS via GC network gateways in the PIB. Separate gateways shall be provided in separate cabinets for different Operating Areas. Note: GC networks for different Operating Areas shall be linked together at a higher level to a common GC maintenance workstation, one to be located in each CCR.

1.4 Detailed Analyser Specification

Specific requirements for each analyser shall be given in the individual analyser data sheets. Refer to Section 10.1.2 for further details.

2 DEFINITION

Refer to APPENDIX A.

3 APPLICABLE DRAWINGS, SPECIFICAIONS, AND CODES AND STANDARDS

S-PM-G000-1140-0003	EQUIPMENT AND INSTRUMENT NUMBERING PROCEDURE
S-PM-G000-1222-0001	BASIC ENGINEERING DESIGN DATA
S-PM-G000-1222-0103	APPLICABLE CODES AND STANDARDS TO EPC CONTRACTORS
S-PM-G000-1241-0002	GENERAL SPECIFICATION FOR FIRE AND GAS ALARM SYSTEM
S-PM-G000-1340-0001	GENERAL SPECIFICATION FOR BUILDING DESIGN
S-PM-G000-1370-0001	GENERAL SPECIFICATION FOR INSTRUMENTATION
S-PM-G000-1370-0002	SPECIFICATION FOR P&ID SYMBOLS AND IDENTIFICATION

S-PM-G000-1371-0008	SPECIFICATION FOR CONTROL AND MARSHALLING CABINETS
S-PM-G000-1375-0002	SPECIFICATION FOR ANALYSER SAMPLING SYSTEM
S-PM-G000-1378-0002	SPECIFICATION FOR INSTRUMENT CABLE
S-PM-G000-1378-0003	SPECIFICATION FOR INSTRUMENT INSTALLATION
S-PM-G000-1386-0001	GENERAL SPECIFICATION FOR TELECOMMUNICATIONS SYSTEMS
S-PM-G000-1410-0002	RECOMMENDED VENDORS LIST
SAES-J-502	ANALYZER SHELTERS
SAES-J-902	ELECTRICAL SYSTEMS FOR INSTRUMENTATION
34-SAMSS-511	CHROMATOGRAPHS
34-SAMSS-512	OXYGEN ANALYZERS
34-SAMSS-515	MOISTURE ANALYZERS
34-SAMSS-517	DENSITY METERS
IEC 61000-4	ELECTROMAGNETIC COMPATIBILITY (EMC)
IEC 60079	EXPLOSIVE ATOMOSPHERES
IEC 61285	INDUSTRIAL-PROCESS CONTROL - SAFETY OF ANALYSER HOUSES
ISA S18.1	ANNUNCIATOR SEQUENCES AND SPECIFICATIONS
NFPA 496	STANDARD FOR PURGED AND PRESSURIZED ENCLOSURES FOR ELECTRICAL EQUIPMENT

4 ORDER OF PRECEDENCE OF DOCUMENTS

The order of precedence shall be:

- This Specification
- Project drawings and specifications
- Applicable Saudi Aramco Standards
- Applicable International Codes and Standards

5 DEVIATIONS AND CLARIFICATIONS

Any deviations or clarifications from this specification require COMPANY approval under the Waiving and Clarification Procedure S-PM-G000-1131-0007.

6 GENERAL REQUIREMENTS

The Analyser shelter and local panel is to be designed in accordance with the Saudi Aramco Standard SAES-J-502. However, the requirements in this document will take precedence over SAES-J-502. Any conflict between these documents shall be resolved by the COMPANY.

6.1 Analyser System Philosophy

6.1.1 Analyser System Package Design

Refer to S-PM-G000-1378-0003 SPECIFICATION FOR INSTRUMENT INSTALLATION for general requirements of instrument installation and selection.

Analyser systems, shelters and panels shall be supplied pre-assembled and pre-tested to ease installation, reduce field labour and improve consistency that accurate and reliable process analytical signals are available for the control system with a minimum of on-site commissioning. Entire shelters, specific control room mounted equipment and local analyser panels shall be

assembled and fully functionally tested as a complete system at the analyser shelter Vendor's factory prior to shipment to site. COMPANY shall witness selected analyser tests. All analyser FAT and appropriate intermediate testing shall be witnessed by CONTRACTOR. Analyser shelters may contain a number of analysers supplied by different analyser manufacturers.

The analyser shelters and local analyser panels shall be designed for installation upon a pre-prepared site. Major modular components shall not require removal for shipping and re-assembly on site unless there is no alternative due to transport or site plot restrictions. Site re-assembly shall be kept to a minimum and shall be subject to COMPANY approval. Major modular components include: HVAC unit, sample conditioning system cabinets, external headers or connections for utilities, signal and power cables, sample and return lines etc.

Roof canopies, HVAC ducting, and Sandboxes may require removal for shipment and re-assembly on site. However, these items should be pre-assembled by the Analyser System Vendor for witness at FAT of the analyser shelter.

6.1.2 Analyser System Battery Limit Connections

All site connections for services, utilities, etc shall be on the outside of the analyser shelters.

Power panels and junction boxes for connecting power and signal cables shall also be located on the outside of the analyser shelters.

Fibre Optic cables transit the analyser shelter wall via transit frames and shall be connected to a patch panel inside the analyser shelter.

Consideration shall be given to the utilities required at site with respect to identification of utilities at analyser location and confirmation that services are available and suitable for purpose.

6.2 Site Conditions

The equipment and design shall be suitable for continuous operation in the coastal salt laden environment of the Red Sea.

Specific environmental conditions are detailed in specification S-PM-G000-1222-0001 "Basic Engineering and Design Data".

Vortex coolers, as required, may be provided for standalone analysers, these shall be powered from the plant air system.

6.3 Hazardous Area Classification

Field instruments location shall follow the electrical hazardous area and field instruments shall have the certification accordingly.

Analysers, instruments and other electrical equipment shall be certified as flameproof enclosure EEx d II for the installation in Zone1 and 2 areas. Equipment certified as non-incendive is acceptable for the installation in Zone2 area.

Installation locations of analyser shelters are normally considered as Zone 2 unless otherwise specified for other classification.

Increased safety apparatus EEx e II is permitted for use such as junction boxes and illuminations in Zone2.

Purged and pressurised protection is not generally acceptable. If deemed necessary, the design shall be submitted for approval by the Purchaser/'Company and the design shall comply with NFPA 496.

Equipment certified by CENELEC (ATEX) is only considered acceptable. CSA, FM, UL certified equipment can only be applicable, under COMPANY's approval, if CENELEC (ATEX) certified equipment is not available.

Intrinsically safe instruments shall not be used. If no other alternative is available, the use of intrinsically safety instruments (IS) shall be subjected to approval of COMPANY.

Electrical connection of field instruments shall be suitable for ISO metric cable gland, generally M20 1.5mm pitch except for cases where bigger connection is required. Connections for power cables distributed from the Electrical System shall be NPT.

Equipment for use in potentially hazardous atmospheres shall be selected in accordance with IEC 60079, and shall be certified to CENELEC standards. Use of ATEX certified equipment is therefore acceptable but not mandatory providing the equipment complies with CENELEC standards.

Equipment certification to UL and FM approvals shall be subject to approval by COMPANY.

Refer to SAES-J-502 for additional requirements relating to electrical area classification and electrical system design.

Instrument enclosures shall match with the Area Hazardous Zone where they are installed in, as required by S-PM-G000-1370-0001 GENERAL SPECIFICATION FOR INSTRUMENTATION.

6.3.1 Intrinsically Safe

IS equipment shall be used in Zone 1 and 2 areas only in cases where no viable alternative exists and require COMPANY approval. When used galvanic "active" type barriers are preferred. Zener type barriers shall not be used without COMPANY approval. CONTRACTOR shall be responsible for checking whether Zener barriers are specified within the analyser system hazardous area certificate for the selected analyser, and shall ensure that an appropriate earth connection is available for any such equipment approved for use by COMPANY.

IS calculations shall be for the worst case scenario for each type of IS loop. Each installed loop shall be compared against these calculations and the discrepancy shall not exceed the worst case scenario.

6.3.2 Requirements for Analyser Shelters

This Section only applies to analyser shelters located in a Zone 2 hazardous area or located in "Safe" area with internal sources of flammable materials. Analyser shelters located in unclassified, "Safe" areas and with no internal source of release of flammable material are not hazardous area installations, and so do not require hazardous area certified equipment. The overpressure requirements therefore do not apply to "safe-area" analyser shelters but the forced ventilation requirements may remain; this is dependent on whether a potential source of release of toxic or asphyxiating gas is present in the analyser shelter. Flammable gas detection is not required in "safe-area" analyser Shelters but toxic gas detection requirements remain unchanged.

When analyser shelters are located within Zone 2 areas or contain an internal source of release of flammable substances, the area classification for the interior shall be a minimum of Zone 2 IIB T3 (Class I Zone 2 groups C, D T3). The actual classification of the area, gas group, and temperature class of the interior shall be based on the plant area and the material/samples handled within the shelter; this classification shall be subject to COMPANY approval.

Analyser shelters shall not be installed in Zone 1 or 0 hazardous areas.

Analyser shelters shall be forced ventilated with fresh air. The air shall be drawn from a safe area, drawn from Class I Zone 2 area (SAES-J-502 Section 7.4) may be accepted with COMPANY approval. A positive overpressure shall be maintained to prevent ingress of potentially flammable gases.

Analysers and electrical equipment that are required to remain in operation during abnormal conditions in the analyser shelter, including failure of the ventilation or overpressure, shall be certified to Zone 1.

The amount of flammable material entering shelters shall be restricted to the small sample flow required by the analysers and the flow of any flammable carrier gases to the analysers.

To ensure maximum safety and operability, the following guidelines shall be adhered to, for equipment located within analyser shelters: -

All equipment shall be classified Zone 1. However, those equipment shall be classified Zone 2 if they are power cut-off upon ventilation failure or flammable gas detection within the shelter. This is

because continuous ventilation is expected to maintain Zone 2 within the shelter via a dual HVAC system according to Para 9.3.1.

Analysers designated as "critical" that are not available in a certified version shall be installed in a cabinet with a standard purge system wherever required to maintain operational availability and safety. Purge systems shall be provided in accordance with CENELEC EEx'p' protection or NFPA 496, and issued with an appropriate certificate or appropriate marked listing to verify the installation.

Sockets may also be provided as appropriately certified versions but shall be used in accordance with the recommendations within IEC 61285.

The following equipment may be provided as safe area or unclassified versions if the shelter is ventilated with air from a safe area or otherwise monitored location. The installation shall be in accordance with IEC 61285 or NFPA 496 articles 5, 7 & 9:

- Any analyser where suitably certified versions or alternatives are not available and power interlock of the analyser is deemed not to impact operational availability or safety.
- Electrical Outlet Sockets
- Recorders
- Printers
- PC Workstations and PC Network Equipment

This equipment will be shut down instantaneously on HVAC failure or flammable gas detection within the shelter.

All electrical equipment mounted outside the analyser shelters shall be certified suitable for use in the plant area in which they are installed. Common equipment types that are used by the Vendor both inside and outside the shelter shall be standardised with certification suitable for use in either location (switches, junction boxes, cable glands, etc.)

A battery back-up module on the light fitting near each emergency door is required; however, no special power supply is required.

6.4 Maintenance Tools

Maintenance tools and configuration tools shall be supplied for all analysers, HVAC and safety system for shelters as applicable. Including all software licenses and manuals as required.

6.5 Enclosure Environmental Protection

All field instruments shall be protected to IP65 as a minimum and be finished to the manufacturer's standard suitable for the environmental conditions where they are installed.

6.6 Tag Numbers

All analysers and instruments in common use on the plant (e.g. gas detectors) shall be identified by unique tag number in accordance with the project wide standard tagging philosophy.

Sample system components and instrument types specific to the analyser shelter shall be uniquely tagged by the CONTRACTOR, subject to COMPANY approval.

All instruments shall be identified in the field with the tag number and a service. Tags shall be laminated plastic-type with white ettering on black background.

Refer to specification S-PM-G000-1370-0002 SPECIFICATION FOR P&ID SYMBOLS AND IDENTIFICATION for details on the tag convention for analysers, analyser streams, and analyser signals (hardwired and serial data signals.) All tag numbers shall be issued in accordance with this specification.

6.7 Electromagnetic Compatibility Requirements

The analyser equipment shall comply with IEC 61000-4, parts 1 to 6 as identified in Appendix B of

S-PM-G000-1370-0001 GENERAL SPECIFICATION FOR INSTRUMENTATION.

6.8 Labeling Requirements

All analysers and major components within the analyser systems shall have the following identifying information on a permanently fastened name plate:

- Identification number
- Pressure rating of pressure parts
- Manufacturer name, model, serial number and operating range
- Manufacturer internal (job reference) number
- Voltage, watts and frequency

Electrical distribution panels shall have permanently fastened labels with screws to clearly identify function with name and tag number of connected equipment.

All terminal strips and wiring connections shall be numbered and permanently tagged. The numbers shall be indicated on the associated wiring diagrams and schematics.

All cables shall be numbered and tagged at the shelter transits and equipment entry points. S-PM-G000-1378-0003 SPECIFICATION FOR INSTRUMENT INSTALLATION shall be followed for the numbering and marking.

All piping and tubing shall at entry and exit points both inside and outside the shelter walls and sample system cabinets have permanently fastened labels defining product stream and destination.

All valve components and indicators, within the shelter systems and sample systems shall have permanently fastened labels describing their function e.g. sample flow to analyser.

All sample system panels shall have a permanently fixed label on the door giving the associated analyser tag number and a brief service description of the analyser.

All labels and tags shall be in the English language.

All sample take-off and return points from the main process lines shall have permanently fastened labels to identify their function.

7 ANALYSER INSTALLATION

7.1 General

During the detailed engineering phase the installation method required for individual analysers shall be determined and be subject to COMPANY approval.

Analyser shelter and local analyser panel locations shall provide good accessibility and safety for maintenance. Analyser shelters must not be located underneath process equipment or pipe racks and must be at least 7.5 metres from possible sources of toxic or flammable releases e.g. process pumps and compressors.

For the site installation of the analyser shelters, local analyser panels, field mounted sensors, sample transport lines and sample probes with site assistance from the Vendor as required. The Vendor shall provide installation instructions as part of an installation, operation, and maintenance manual.

Vortex coolers, as required, may be provided for standalone analysers, these shall be powered from the plant air system. Temperature control shall be provided.

All terminal strips and wiring connections shall be numbered and permanently tagged. The numbers shall be indicated on the associated wiring diagrams and schematics.

All cables shall be numbered and tagged at the shelter and equipment entry points.

All piping and tubing shall at entry and exit points both inside and outside the shelter walls and sample system cabinets have permanently fastened labels defining product stream and destination.

All valve components and indicators, within the shelter systems and sample systems shall have permanently fastened labels describing their function e.g. sample flow to analyser.

All sample system panels shall have a permanently fixed label on the door giving the associated analyser tag number and a brief service description of the analyser.

All labels and tags shall be in the English language.

All sample take-off and return points from the main process lines shall have permanently fastened labels to identify functionality.

7.2 Local Analyser Panels

When an analyser is proposed for installation at a local analyser panel, consideration shall be given in the design phase, to the operation, maintenance, ambient conditions and technical requirements. Details of local analyser panel requirements are contained within this specification. The design of local analyser panels shall be suitable for duty and in accordance with this specification.

Local analyser panels should generally only be considered for single analysers in remote locations. Local analyser panels should not be used if this causes maintenance of the analyser to become impractical. Where multiple analysers are located within geographic proximity of each other, common analyser shelters shall be used to house these wherever possible, and should not use multiple local analyser panels.

S-PM-G000-1378-0003 SPECIFICATION FOR INSTRUMENT INSTALLATION shall be followed for the numbering of local analyser panels.

7.3 Analyser Shelters

Where the installation of analysers within a purpose built fully enclosed analyser shelter is justified, the requirements for analyser shelters contained within this specification shall be followed. Analyser shelters shall be used as a convenient location for maintenance and the environmental protection of several process analysers. The decision whether to implement an analyser shelter shall be based on the number and type of analysers in a given plot area. Further guidance is given in Appendix B.

S-PM-G000-1378-0003 SPECIFICATION FOR INSTRUMENT INSTALLATION shall be followed for the numbering of analyser shelters.

7.4 Analyser Sample Systems

Refer to S-PM-G000-1375-0002 SPECIFICATION FOR ANALYSER SAMPLING SYSTEM for details of analyser sample systems. Where required these shall be located close to the associated analyser at the same local analyser panel or analyser shelter as appropriate.

7.5 Field Mounted Analysers

Where appropriate, field mounted analyser sensors/transmitters shall be used.

The selection and installation of such devices shall ensure that maintenance; testing and operation can easily be undertaken. All field mounted devices shall be suitable for the hazardous area and ambient conditions in which they are installed.

General installation shall follow S-PM-G000-1378-0003 SPECIFICATION FOR INSTRUMENT INSTALLATION.

7.6 Analyser Equipment within the Rack Room in PIB

Where required, analyser electronics racks only may be installed within analyser cabinet(s) in the appropriate Rack Room in PIB with the remaining associated equipment located in the field.

8 LOCAL ANALYSER PANEL DESIGN

Wiring inside the panels shall be to S-PM-G000-1371-0008 SPECIFICATION FOR CONTROL AND