

DEP SPECIFICATION

ANALYSER HOUSING

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design, construction and climatic conditioning of analyser housing.

Laboratories are outside the scope of this DEP.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 - Application of Technical Standards.

This DEP is a revision of the same number dated February 2016; see (1.5) regarding the 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 authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to refineries, upgraders, chemical plants, gas plants, exploration and production facilities and supply/distribution installations. 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** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

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

1.3.2 Specific definitions

Term	Definition
Adequate ventilation	A shelter which is provided with at least six airchanges per hour can be considered as adequately ventilated.
Alarm	A notification that either a Critical or Standard limit has been exceeded. The occurrence of an alarm requires a defined action to be taken to deal with the exceedance. If no action is required, the notification is called an alert
Analyser cabinet	A small enclosed housing in which analysers are installed singly or grouped together. Maintenance is carried out from outside the cabinet with the door(s) open
Analyser case	An enclosure forming part of the instrument
Analyser shelter - closed	Analyser shelter with artificial ventilation but without pressurisation. The area classification of the interior is typically classified. The maintenance of the analyser is normally performed in the protection of the shelter
Analyser shelter - open	Analyser shelter with one or more sides open or extensive openings in the upper and lower portion of the walls allowing for natural ventilation. The maintenance of the analyser is normally performed in the protection of the shelter
Analyser shelter - pressurised	Analyser shelter with artificial ventilation, and pressurisation. The area classification of the interior is general purpose (i.e., unclassified) under normal operating conditions. The maintenance of the analyser is normally performed in the protection of the shelter
Analyser shelter	Dedicated shelter with several complex analysers connected to process lines by individual fast loop with sample conditioning systems and associated instruments, electrical equipment and auxiliary safety devices
Area classification	Method of classifying areas where flammable atmospheres may occur so as to facilitate the proper selection and installation of equipment to be used safely in that environment
Artificial ventilation	Method of mechanical movement of air to reduce the potential concentration of flammable gases or vapours in the analyser shelter. Such ventilation may also be used to maintain the pressure inside the analyser shelter above the external ambient pressure
Instrumented Protective Function (IPF)	Function comprising the initiator function, logic solver function and final element function for the purpose of preventing or mitigating hazardous situations. In IEC 61508 and IEC 61511, an IPF is referred to as a Safety Instrumented Function (SIF).
Lower Flammable Limit (LFL)	Volume ratio of flammable gas or vapour in air below which an explosive gas mixture will not be formed
Oxygen service	For the purposes of this DEP, "oxygen service" is considered to be a service with an oxygen content greater than 21 vol% with the balance being inert

Term	Definition
Panic bar	A device for unlocking a door during emergency conditions
Purging	Operation of passing a quantity of air or inert gas through an analyser case, an analyser cabinet or the analyser room of a pressurised analyser shelter by associated ducts, in order to reduce any concentration of flammable or toxic gas or vapour which may be present to a safe level, or to prevent gas or vapour from entering the housing
Total cost of ownership	A type of cost calculation designed to assess both direct and indirect costs and benefits related to the purchase of goods and services
Ventilation failure	Situation where the required air flow and, if applicable, the required pressure cannot be maintained inside the analyser housing
Ventilation system	Complete installation required to produce artificial ventilation
Very toxic (substances)	Refer to DEP 01.00.01.30-Gen. for definitions of "very toxic - acute", "very toxic - chronic", and "very toxic - environment"

1.3.3 Abbreviations

Term	Definition
CCR	Central Control Room
CEMS	Continuous Emission Monitoring System
EMC	Electro Magnetic Compatibility
FAR	Field Auxiliary Room
GRP	Glass reinforced polyester/plastic
LEL	Lower Explosive Limit
MCB	Miniature Circuit Breaker
MCT	Multiple Cable Transit
PGC	Process Gas Chromatograph
UPS	Uninterruptible Power Supply

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 (15).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2016. The only changes are to DEP cross-references to reflect changes in the DEP library in 2017.

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.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
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

2.1 INTRODUCTION

The main purpose of an analyser housing is to ensure that analyser systems have high reliability, continuity of operation and maintainability by providing an improved operating environment by protecting them from outside ambient conditions.

This DEP distinguishes between the following types of installation of analysers:

- *Analyser case;*
 - *Analyser cabinet;*
 - *Analyser shelter - open;*
 - *Analyser shelter - closed;*
 - *Analyser shelter- pressurised "p".*
1. Analyser housing type shall be determined by using a total cost of ownership approach considering the following:
 - a. area classification;
 - b. analyser case suitability for environmental conditions, mainly temperature, dust, saliferous ambient air and humidity;
 - c. maximum analyser response time;
 - d. required reliability;
 - e. sample handling, conditioning and recovery;
 - f. anticipated maintenance; and
 - g. commonality of utility requirements (e.g., power, instrument air, carrier gases, flare connection).
 2. When the analyser is suitable for the environment and area classification, the analyser may be field mounted close to the sample tap in the following cases:
 - a. when sample handling problems are to be expected, e.g., waxy samples, trace components;
 - b. when time lags as defined in DEP 32.31.50.10-Gen. cannot otherwise be met;
 - c. for transmitter type analysers, e.g., pH and conductivity.
 - d. when the cost of centralisation would be disproportionate to the expected advantages, as determined by the Principal.
 3. Analysers may be field mounted individually or grouped together to reduce the installation costs associated with providing power, utilities (instrument air, carrier or detector gases, cooling water), climatic conditioning and access to disposal systems such as oily water sewers or flare lines.
 4. The size of analyser housings should be optimised for the required number and type of analysers, including spare requirements in accordance with (2.3).
 5. Environmentally controlled analyser shelters should be used for complex analysers or for analysers where the improved climatic conditioning significantly improves reliability such as Continuous Emission Monitoring System (CEMS), Process Gas Chromatographs (PGCs) and mass spectrometers.

As analyser shelters of pressurised design are complex and expensive to construct and maintain, they contribute significantly to the Total Cost of Ownership.
 6. Analyser shelters of pressurised design shall only be selected when required.

7. The decision tree in Appendix A shall be used for the selection of the type of housing.
8. Per DEP 32.80.10.14-Gen., anything identified as an alarm in this document shall include the definition of required actions to be taken when the alarm occurs.

2.2 ANALYSER HOUSING TYPES AND SELECTION

2.2.1 Analyser case

1. Analysers such as pH and conductivity meters may be installed directly in the open; (enclosed only by transmitter case) provided they comply with hazardous area classification and environment specifications.

2.2.2 Analyser cabinet

Analyser cabinets provide a low cost of improving environmental protection for analysers.

1. Analyser cabinets shall be designed to perform maintenance with the door(s) open.
2. Analysers may be installed singly or grouped in cabinets provided that the equipment is installed in accordance with the hazardous area classification within the cabinet.

This will depend on the location of the cabinet, its construction, the degree of ventilation and whether internal sources of release are present within the cabinet.

3. Climate conditions in the cabinet shall comply with the analyser specifications.
4. Heating and cooling shall be installed when required.
5. Where possible, natural ventilation shall be used.
6. Pressurised purging shall be applied to the cabinet where the use of a non-certified analyser is unavoidable.
 - a. Purging shall meet the requirements of the applicable regional codes and standards such as IEC 60079-13 or NFPA 496, where applicable.

2.2.3 Analyser shelter – open

1. Open analyser shelters may be used to group analysers that comply with the hazardous area classification of the location and the environmental conditions as per analyser Manufacturer's/Supplier's specification.

Analyser shelters may be open on one side or may have significant openings in the lower and upper parts of the walls. Open analyser shelters are naturally ventilated and adopt the area classification of the area in which they are installed.

2. The use of open analyser shelters shall be subject to the approval of the Principal.

2.2.4 Analyser shelter – closed

1. Closed analyser shelters may be used when the analysers are grouped together and the installed equipment complies with the hazardous area classification of the location.

Closed analyser shelters are deemed to be unmanned buildings.

2. If climate conditions in the shelter do not comply with the analyser specifications, heating and/or air conditioning shall be installed using the decision tree in (Appendix B) to select the type of heating/cooling.

2.2.5 Analyser shelter – pressurised “p”

1. The pressurised analyser shelter shall only be provided where analysers are not suitable for the area classification of a closed analyser shelter.
Pressurised analyser shelters are deemed to be unmanned buildings.
2. If climate conditions in the shelter do not comply with the analyser specifications, heating and/or air conditioning shall be installed using the decision tree in (APPENDIX B) to select the type of heating/cooling.
3. Hazardous situations created by external "very toxic-acute" or "very toxic-chronic" gas atmospheres shall be dealt with on a case-by-case basis.
4. Pressurised analyser shelters shall have forced ventilation systems.
5. The use of “analyser shelters – pressurised” shall be subject to the review and approval of the Principal.

2.3 BASIC DESIGN REQUIREMENTS

1. Unless otherwise specified by the Principal, the design life of analyser housings shall be at least 20 years.
2. Material to be used for pre-fabricated analyser shelters shall be as specified on the analyser cabinet/shelter data sheet.
3. Analyser shelters should have a minimum 20 % spare space for future analysers rounded up to ensure a minimum of 1 additional spare analyser.
 - a. The spare space allocation should be representative of the larger sized analyser models installed in the shelter.
 - b. Final space allocation should be subject to the review and approval of the Principal.
4. Refer to DEP 34.17.10.32-Gen. for the fire resistance of the analyser shelters.
5. Fire resistance requirements shall include wall penetrations and openings in shelter walls.
6. Requirements specific to the site or project shall be detailed in the analyser cabinet/shelter data sheet.
7. The analyser cabinet/shelter data sheet shall be subject to the review and approval of the Principal.
8. If a blastproof enclosure is required, the detail of the overpressure shall be detailed in the shelter data-sheet.

2.4 HEALTH, SAFETY AND ENVIRONMENTAL (HSE) CONSIDERATIONS

1. The quantity of flammable materials entering the interior of the shelter shall be minimised by limiting the flows of flammable or hazardous samples into the shelter as per DEP 32.31.50.10-Gen.
2. Systems containing flammable or hazardous materials shall be designed and operated in such a manner as to be leak free during normal operating conditions (i.e., no open drains, vents and made of the appropriate materials).
3. With the exception of the situation where the process fluid is non-hazardous, not "very toxic" per Part III of DEP 01.00.01.30-Gen., and nonflammable (e.g., boiler feed water, biotreater effluent), the following shall apply:
 - a. Sample conditioning systems shall be located in sample conditioning cabinets mounted on the exterior of the shelter.
 - b. Calibration and carrier gases shall be stored outside the shelter.
 - c. Calibration samples which require temperature controlled storage shall be stored in a separate shelter or cabinet partition.
4. Systems shall be provided for the safe disposal of waste material and all attempts will be made to return process streams to the process and not to the flare.
5. The following standards shall apply in conjunction with this DEP for cabinets and non-pressurised closed shelters:
 - a. For outside North America: IEC 61285
 - b. For North America: API RP 500 and API RP 505

3. LOCATION OF ANALYSER HOUSING

1. The following shall be taken into account when selecting the location of analyser housings:
 - a. required analyser response times;
 - b. distance to potential sources of "very toxic-acute", "very toxic-chronic", "very toxic-environment" or flammable release;
 - c. likelihood of accumulation of "very toxic-acute", "very toxic-chronic", "very toxic-environment" or flammable gases;
 - d. presence of water and process liquids due to spills;
 - e. vibration levels;
 - f. road access for compressed gas bottles;
 - g. radiant heat;
 - h. access for maintenance;
 - i. escape routes;
 - j. accessibility to utilities such as power, steam, water, flare, compressed air (as applicable);
 - k. area classification;
 - l. location master plan;
 - m. impact on constructability of the plant.