

DEP SPECIFICATION

ANALYSER HOUSING

DEP 32.31.50.13-Gen.

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DESIGN AND ENGINEERING PRACTICE



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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 is a revision of the DEP with the same number dated January 2010; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in 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 may 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 regard 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 which carries out all or part of the design, engineering, procurement, installation, and commissioning or management of a project or operation of a facility. The Principal may sometimes undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for it. The Principal may also include an agent or consultant, authorised to act for the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific abbreviations and definitions

Term	Definition
Alarm	Audible and/or visible signal to warn that appropriate action is necessary.
Analyser Case	An enclosure forming part of the instrument.
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.

Term	Definition
Analyser Shelter - Pressurised	Building with a specific closed room with artificial ventilation, and pressurisation containing one or more analysers, together with associated electrical equipment and auxiliary devices. 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 - Open	A naturally ventilated structure with one or more sides open or extensive openings in the upper and lower portion of the walls, in which one or more analysers are installed. The maintenance of the analyser is normally performed in the protection of the shelter
Analyser Shelter - Closed	Building with a specific closed room with artificial ventilation but without pressurisation containing one or more analysers together with associated electrical equipment and auxiliary devices. The area classification of the interior is typically classified. The maintenance of the analyser is normally performed in the protection of the shelter.
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
CCR	Central Control Room
EMC	Electro Magnetic Compatibility
FAR	Field Auxiliary Room
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
MCT	Multiple Cable Transit
MT	Magnetic particle (examination)
Lower Flammable Limit (LFL)	Volume ratio of flammable gas or vapour in air below which an explosive gas mixture will not be formed
PGC	Process Gas Chromatograph
PT	Liquid penetrant (examination)
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.
Upper Flammable Limit (UFL)	The volume ratio of flammable gas or vapour in air above which an explosive gas mixture will not be formed
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
Toxic (Substances)	See DEP 01.00.01.30-Gen.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section is shown in brackets (). Other documents referenced by this DEP are listed in (14).

1.5 SUMMARY OF MAIN CHANGES

This is a revision of the DEP of the same number dated January 2010. The following are the main, non-editorial changes.

Old Section	New Section	Change
2.3	2.3	Spare requirement added to shelter design.
3	3	Deleted restriction to locate shelters under pipe bridges and other structures.
4.1.3.2	4.1.3.2	Not allowed to install equipment on the roof.
5.3	5.3	Spares added to power distribution.
8.2	8.2	Only SS 316 allowed for valves, tubing, fittings, etc.
8.3	8.3	Requirement for N2 header added.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using the DEP Feedback Form by:

- Entering comments directly in the DEP Feedback System on the Technical Standards Portal <http://swwww.shell.com/standards> (mandatory for users with access to Shell Wide Web);
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- Requesting a copy of the DEP Feedback Form from the Administrator at standards@shell.com (for users without access to Shell Wide Web).

For the last two options, the completed DEP Feedback Form can be attached to an email and submitted to the Administrator at standards@shell.com. Only feedback that is entered into the Feedback Form will be considered.

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.

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.

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;
- g) commonality of utility requirements (e.g., power, instrument air, carrier gases, flare connection, etc.).

The size of analyser housings shall be optimised in accordance with this DEP.

As analyser shelters of pressurised design are complex and expensive to construct and maintain, they contribute significantly to the Total Cost of Ownership. They shall therefore only be selected when strictly required, and only if approved by the Principal.

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.

Field mounting using analyser cases in the proximity to the sample tap is preferred:

- 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 simple analysers where the anticipated maintenance is low, e.g., conductivity,
- d) when the cost of centralisation would be disproportionate to the expected advantages,
- e) when the analyser is suitable for the environment and area classification.

Analyser shelters are preferred where the analysers share common utility and sample disposal requirements.

Environmentally controlled analyser shelters are recommended for complex analysers or for analysers where the improved climatic conditioning significantly improves reliability such as CEMS, GCs and mass spectrophotometers.

The design of closed and pressurised analyser shelters shall:

- provide remote analyser access via data links wherever practical,
- be premised on the basis of shop versus shelter repairs.

(Appendix A) shall be used for the selection of the type of housing.

2.2 ANALYSER HOUSING TYPES AND SELECTION

2.2.1 **Analyser case**

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.

The advantages of this method are that the area around the case is naturally ventilated so there is no risk of accumulation of an explosive atmosphere outside the casing. This is the lowest cost method of installation. The disadvantages are that there is no environmental protection for equipment or maintenance personnel.

Equipment shall be carefully specified to minimise corrosion attack.

This method of housing is generally unsuitable if analysers require heating, or if wide temperature swings will impact reliability, or if extensive maintenance is required.

2.2.2 **Analyser cabinet**

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 which in turn 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.

As climate conditions in the cabinet need to comply with the analyser specifications, heating and/or air conditioning might be required.

(Appendix B) shall be used for the selection of the type of heating/cooling.

Installed equipment shall be easily accessible for maintenance.

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

Where possible, natural ventilation shall be used.

The advantage of a naturally ventilated method is that ventilation is permanent and independent of mechanical failure. However, natural ventilation (if adequate) will at best only maintain the surrounding hazardous area classification and, where flammable gases or vapours are present, is typically one (1) zone (division) more severe.

When using natural ventilation and where use of a non-certified analyser is unavoidable and the cabinet is to be installed in a hazardous area, additional protective measures, such as pressurised purging, need to be applied to the analyser or cabinet to prevent any flammable materials entering the cabinet coming into contact with potential sources of ignition inside the analyser. Purging shall meet the requirements of the applicable regional codes and standards such as ISA 60079-2.

The disadvantages of cabinets are:

- a) It is difficult to make the analysers easily accessible other than from the front for maintenance;
- b) There is a practical limit on the size of analyser installed;
- c) No protection is provided for maintenance personnel, which may impact analyser maintenance;
- d) Without HVAC, analyser(s) involved could experience wide temperature swings which can impact their reliability.

2.2.3 **Analyser shelter – open**

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.

This construction may be used when the analysers comply with the hazardous area classification of the location and the environmental conditions comply with the analyser Manufacturer's specification.

The advantages of open shelters are:

- a) it facilitates the grouping of analysers to reduce installation costs;
- b) it allows easy access for maintenance;
- c) it affords some protection for maintenance personnel;
- d) it affords permanent natural ventilation;
- e) it does not require ventilation for dispersion of toxic or flammable substances

The disadvantages of open shelters are:

- it does not allow the hazardous area classification to be changed
- it affords only minimum environmental protection, which makes it difficult to perform maintenance in inclement weather and may reduce the reliability of the analyser due to ambient temperature effects.

2.2.4 Analyser shelter – closed

Closed analyser shelters have four walls and utilize forced ventilation to achieve adequate ventilation and in doing so maintain the area classification of the surrounding area inside the shelter.

Closed analyser shelters are deemed unmanned buildings.

Climate conditions in the shelter shall comply with the analyser specifications, so heating and/or air conditioning might be required.

(Appendix B) shall be used for the selection of the type of heating/cooling.

The advantages of a closed analyser shelter are:

- a) it facilitates the grouping of analysers to facilitate connections to power, signal wiring, utilities and waste disposal;
- b) it allows easy access for maintenance;
- c) it affords some protection for maintenance personnel;
- d) it improves analyser reliability by providing a climate controlled environment for the analysers.

The disadvantages of a closed analyser shelter are:

- higher total cost of ownership;
- increased analyser response time by centralisation

2.2.5 Analyser shelter – pressurised

The pressurised analyser shelter has the highest cost and shall only be provided by exception for those rare cases where analysers are not suitable for the area classification of a closed analyser shelter. As an alternative to selecting a pressurised analyser shelter, other ways of making individual analysers suitable for the closed analyser shelter area classification shall be considered (e.g., analyser case purge).

See also (Appendix A).

The pressurised analyser shelter is usually only utilised for applications for which there are no other viable alternatives such as moving the analyser to a location with a less stringent area classification or providing a purged enclosure.

The advantages of pressurised analyser shelters are identical to those of closed analyser shelters plus the ability to utilise an analyser which is not certified.

The disadvantages of pressurised analyser shelters are significantly higher fabrication and operating costs and complexity (i.e., safeguarding).

As climatic conditions in the shelter need to comply with the analyser specifications, heating and/or air conditioning might be required.

(Appendix B) shall be used for the selection of the type of heating/cooling.

This DEP specifies the design and construction of pressurised analyser shelters with respect to:

- a) maintaining a non-hazardous area;
- b) providing protection in the event that the means to maintain the non-hazardous area fail;
- c) procedures for maintaining the installed electrical safety protection measures;
- d) maximum and minimum limits for climatic conditioning;
- e) verification and testing of installed instrumented protective systems.

NOTE: Hazardous situations created by external toxic gas atmospheres shall be dealt with separately in each individual case.

Requirements and recommendations are given for the design, construction and operation of systems for artificial ventilation of pressurised analyser shelters, their associated equipment such as air ducts, and the auxiliary devices necessary for providing and maintaining the required pressure above ambient.

NOTE: For the purposes of this DEP, pressurised analyser shelters are assumed to have forced artificial ventilation systems. Induced ventilation systems shall not be used.

2.3 BASIC DESIGN REQUIREMENTS

Analyser housings shall meet all applicable codes and standards as well as the requirements of this DEP.

The design life of analyser housings shall be at least 20 years.

Material to be used for pre-fabricated analyser shelters shall be as specified on the analyser cabinet/shelter data sheet.

Analyser shelters shall have a minimum 20 % spare space for future analysers with a minimum of 1 additional spare analyser.

Analyser housings shall be suitable for the area classification and climatic conditions specified on the analyser cabinet/shelter data sheet

Safety is improved by limiting the amount of hazardous and/or toxic fluids entering an analyser housing.

Analyser shelter fire rating shall be detailed in the analyser cabinet/shelter data sheet. If a fire rating is required, the detailed fire rating shall apply to shelter, door(s) and window(s) in door(s).

Application specific requirements shall be detailed in the analyser cabinet/shelter data sheet. The data sheet shall be approved by the Principal.

2.4 HEALTH, SAFETY AND ENVIRONMENTAL (HSE) CONSIDERATIONS

2.4.1 Analyser shelter – closed

For non-pressurised analyser shelters, there are no requirements for dual ventilation fans, ducts drawing ventilation from a non-hazardous area and interlocks of analyser power.

The quantity of flammable materials entering the interior of the shelter shall be kept to a minimum. This shall be achieved by applying DEP 32.31.50.10-Gen.

Systems containing flammable or hazardous materials shall be designed and operated in such a manner to be leak free during normal operating conditions (i.e., no open drains or vents, appropriate materials and maintenance).

With the exception of the situation where the process fluid is relatively non-hazardous or non-toxic (e.g., boiler feed water, biotreater effluent) or non flammable, sample conditioning systems shall be located in sample conditioning cabinets mounted on the exterior of the shelter. Calibration and carrier gases shall be stored outside the shelter. Calibration samples which require temperature controlled storage, shall be stored in a separate shelter partition.

Provision of systems for safe disposal of waste material shall be provided.

2.4.2 Analyser shelter – pressurised

The following HSSE measures shall be taken to ensure that the interior of the pressurised analyser shelter can be classified as non-hazardous under normal operating conditions:

- The quantity of flammable materials entering the interior of the analyser shelter shall be kept to a minimum. This shall be achieved by applying DEP 32.31.50.10-Gen.
- An efficient air ventilation system shall be provided to continuously dilute accidental internal releases of flammable gases or vapours, if any, to a maximum level of 20 % LFL.

NOTE: To ensure that electrical equipment does not create a hazardous condition if the ventilation system fails, additional precautions shall be taken. See (5.1).

The following standards shall apply in conjunction with this DEP:

- IP 15 for ventilation requirements of pressurised analyser shelters and adjacent sample conditioning areas;
- IEC/TR 60079-16 for the procedures to achieve a safe area inside the analyser shelter that satisfies IP 15.
- IEC 61285 for maintaining the integrity of the analyser shelter and its surrounding.