

DEP SPECIFICATION

HVAC FOR OFFSHORE INSTALLATIONS (AMENDMENTS/SUPPLEMENTS TO ISO 15138)

DEP 37.76.10.10-Gen.

February 2011

(DEP Circular 51/12 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

DEM1



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PART I INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and provides guidance for the design, installation, testing and commissioning of Heating, Ventilation and Air-conditioning (HVAC) systems for offshore installations of the petroleum and natural gas industries.

This DEP is based on ISO 15138:2007. The design of HVAC systems will be particular to each installation therefore this DEP is written to provide both requirements and guidance in a similar way to ISO 15138:2007.

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 not applicable retroactively.

Variations from this DEP may be necessitated by regional requirements and/or industrial practices applicable to particular projects. Where this applies, such variations and requirements shall be clearly identified as additional Specific Project Requirements (SPR).

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 authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to offshore exploration and production facilities. Application in other facilities may also apply.

When DEPs are applied, a Management of Change (MOC) process should 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.

1.4 CROSS-REFERENCES

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

1.5 SUMMARY OF MAIN CHANGES

This is a new DEP.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

1.7 DUAL UNITS

Amended per

Circular 51/12

Dual units have been incorporated throughout this DEP.

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.

Note that some conversions may not correspond to standard US HVAC practice, such as sheet thickness and gauge. Appendix F has not been converted to USC units because it would make them incompatible with the formulae as presented.

PART II GENERAL

Part III of this DEP is written as amendments and supplements to ISO 15138:2007. Wherever reference is made to ISO 15138, it shall be understood to mean ISO 15138:2007 as amended/supplemented by this DEP.

For ease of reference, the clause numbering of ISO 15138 has been used throughout Part III of this DEP.

Clauses and Annexes of ISO 15138 which are not mentioned in this DEP shall remain valid as written.

PART III AMENDMENTS/SUPPLEMENTS TO ISO 15138:2007

2. NORMATIVE REFERENCES

Add:

EN 14986, Design of Fans Working in Potentially Explosive Atmospheres

Area Classification Code for Installations Handling Flammable Fluids. Part 15 of the IP Model Code of Practice in the Petroleum Industry.

HVCA DW144, Specification for sheet metal ductwork, low, medium & high pressure/velocity air systems

EN 13779, Ventilation for buildings, performance requirements for ventilation and air-conditioning systems

SMACNA HVAC Duct Construction Standards – Metal and Flexible

4. ABBREVIATED TERMS

Add:

CBM condition-based maintenance

CFC chlorofluorocarbon (refrigerant gas)

HCFC hydro-chlorofluorocarbon (refrigerant gas)

HVCA heating and ventilation contractors' association

IPF instrumented protective function

MS mild steel

RSA rolled steel angle

SMACNA sheet metal and air conditioning contractors' national association

TEWI Total Equivalent Warming Impact

5. DESIGN

5.2.1 Orientation and layout

Add new sub-clause:

5.2.1.4 Interfaces

HVAC design, procurement and construction shall be fully coordinated to ensure that all disciplines' requirements are understood and allowed for. This shall include all design and operational interfaces and spatial coordination.

The design and function of HVAC systems SHALL [PS] enable the related safety-critical objectives of other discipline requirements and standards to be achieved. These include:

- technical safety philosophies
- compliance with DEP 80.80.00.11-Gen
- design and operation of fire, gas and smoke detection systems, DEP 32.30.20.11-Gen.

5.2.2 Hazardous area classification and the role of HVAC

5.2.2.2 Functional requirements

Add new paragraph:

The design and function of HVAC systems SHALL [PS] comply with area classification requirements and the selected governing classification standard. Refer to DEP 80.00.10.10-Gen. and DEP 80.00.10.13-Gen. as applicable.

5.2.5 Selection of controls philosophy

5.2.5.3.3.3 Fire/gas damper controls

Add new text after paragraph 'Where several fire/gas dampers.....the others':

TR fire/gas damper controls shall be arranged to facilitate the testing of TR boundary dampers independently where necessary to satisfy requirements for routine fire damper testing and IPF testing.

5.3.2 Mechanical ventilation

5.3.2.3.4 Inlets and outlets

Delete 2nd paragraph 'Gas dampers.....covered'.

Delete 4th paragraph : 'Air from.....hazardous area' and substitute new text:

Air outlets from ventilated non-hazardous areas shall be exhausted to a non-hazardous area where reasonably feasible to do so. If this would involve disproportionate measures, such as long or difficult duct routes, air outlets may be in a hazardous area provided that the ventilated non-hazardous area shall be pressurised to maintain non-hazardous classification and there shall be reliable means of sealing the exhaust outlet at the module boundary if pressurisation is lost.

Add new paragraphs at end:

Inlet and outlet ducts may require gas and/or smoke detectors in accordance with Fire & Gas design and DEP 32.30.20.11-Gen

The design of inlet ducts that require gas detection shall be coordinated with the design of Fire & Gas detection system to ensure that gas will not by-pass the detectors and that gas cannot enter the module at unacceptable concentrations.

At inlet ducts with gas detection, the time delay between gas detection and closing of the gas damper could allow gas at low concentration to enter the module served. Large-volume intake ducts can be used to compensate for the time delay but are only required if there is a demonstrable risk of gas entering the module via the intake at unacceptably high concentration following initial detection either at the duct or elsewhere.

5.3.2.3.2 Differential Pressure

Add to end of 2nd paragraph:

Where necessary, modules can be leak tested as described in Annex F.

Add new paragraph

Non-hazardous modules, including living quarters, shall be pressurised during normal operation to a nominal design value of 50 Pascals (0.2" wg) relative to outside atmosphere or adjacent hazardous areas in order to provide protection against major incidents. Pressurisation shall be safety-critical if a ventilated non-hazardous area is adjacent to a hazardous area and is not segregated therefrom by gas-tight structure.

5.3.2.3.5 Duct systems

Amend last paragraph to read:

Duct systems shall include balancing dampers at each main duct branch and at each air terminal (supply and extract) except for supply systems fitted with constant-volume control valves.

Add new sub-clause 5.3.2.3.6:

5.3.2.3.6 Fresh Air

Design fresh-air (outdoor air) flow rates shall be based on functional requirements such as that required for personnel, pressurisation, heating or cooling (it is not necessary to attain notional airchange rates). For pressurisation, the fresh-air flowrate shall be based on what is necessary to overcome fabric leakage reliably during the installation's operation. Fresh

air requirements shall be minimised in regions having warm and/or humid climates where mechanical refrigeration is necessary to cool and/or dehumidify fresh air.

For personnel, the minimum fresh air flow rate shall be 10 litres per second (21 cfm) per person to meet the lower value of the 'medium' classification range IDA2 in accordance with EN 13779. Local standards and requirements shall be adhered to.

5.3.3 Secondary ventilation systems

5.3.3.2 Functional Requirements

Replace last paragraph with:

Secondary ventilation system air intakes shall be located in a non-hazardous area where possible or otherwise in a location that is less likely to be affected by a gas release, such as the module perimeter.

5.3.3.3 Detailed requirements

Correction to 4th paragraph 'There are two methods....'. Delete 'two' and insert 'three'.

Add new paragraph:

Design drawings for secondary ventilation systems shall show air nozzle locations and orientations to ensure that the systems are installed to achieve the required air movement effect. Ducts in open, naturally ventilated modules may be exposed to wind forces and shall be of adequate strength with rigid, laterally-restrained supports.

Add new clause:

5.3.4 Cooling systems

The use of refrigerated cooling systems requires careful consideration because of equipment cost, maintenance requirements and the potential environmental impact of refrigerant gases. The selection of equipment and refrigerants shall comply with:

- The Montreal Protocol
- any other regulations applicable to the region in which the system will operate.

The following approach shall be adopted:

- a) Avoid refrigeration where possible by use of alternatives such as cooling by means of fresh air or seawater
- b) Check the requirements of current regulations and any in the course of preparation that may apply during the installation's life-cycle
- c) Use systems that have the most favourable TEWI during the installation's life.
- d) Consider the possibility of using natural refrigerants that have low ODP and GWP and which are not governed by refrigerant gas regulations
- e) Use systems where the quantity of refrigerant and the likelihood of leakage is minimised. Consider using water circuits for air cooling and for condenser heat rejection.
- f) Ensure that systems are designed to prevent leakage.
- g) Ensure that maintenance is carried out on a planned basis by competent personnel and in accordance with manufacturer's instructions and applicable regulations.

Add new clause:

5.3.5 Equipment sparing

The arrangement of HVAC plant to meet system design duties shall be based on system criticality, failure consequences and reliability and repair times.

HVAC systems that are safety- or production-critical generally need to be capable of continuous operation unless HVAC down-time can be accepted by introducing mitigation

measures. Continuous HVAC availability requires spare capacity which can be arranged in various ways such as providing 100% spare capacity or a 'n'+1 arrangement, where 'n' is the number of equipment items required to satisfy design requirements. Fans, for example, could be arranged as 2 × 100% units or 3 × 50% units.

Refrigeration plant should be arranged with minimal standby capacity where possible (subject to operational criticality and consequences of failure) because of equipment cost and refrigerant gas considerations. It may be possible to arrange plant as say, 2 × 60% units, where the effect of one unit being unavailable may be tolerable until it can be put back into use. Smaller systems that are operationally critical may have to be arranged with standby units, but operation should be rotated to ensure that equipment does not lie idle for too long.

5.4.2 Living quarters

5.4.2.2 Functional requirements

Add new paragraph at end:

DEP 37.17.10.10-Gen refers to the general design of offshore living quarters.

5.4.2.3.1 General

Amend 1st sentence to read:

In the absence of local legislation or code of practice, the requirements given in 5.2.3 shall apply, except that the design minimum relative humidity level at winter design temperature shall be 35%.

Amend 2nd paragraph to read:

Fresh air flow rates shall be in accordance with section 5.3.2.3.6.

Add to end of 3rd paragraph 'The main supply.....emergency operation':

Recirculation of 'clean' air shall be used where feasible because of the substantial reduction in energy demand. Extract air that is likely to be foul or contaminated, such as toilet, smoking area, galley, or laundry extract shall not be recirculated. Any smoking areas must be clearly defined and served by an appropriate extract system.

5.4.2.3.3 Heating, cooling and humidification

Add to last paragraph:

The humidity control set point shall be set for 40% relative humidity. The rationale is to attain a minimum of 40% for the majority of the time but to accept that it could fall to the minimum design value of 35% during the coldest weather.

5.4.2.3.4 Galley systems

Add new paragraph at end:

The galley hood extract duct shall be kept as short as possible. The preferred arrangement is for the galley to be located at the module boundary with extract fans located externally as close as possible. The galley hood extract duct shall be provided with a sufficient number of access doors spaced to permit manual cleaning. The duct access doors shall be easily accessible and unobstructed by other services.

5.4.2.3.5 Laundry systems

Add new paragraph at end:

The laundry extract duct shall be kept as short as possible. The preferred arrangement is for the laundry to be located at the module boundary with extract fans located externally as close as possible. The objective is to minimise the potential for build-up of lint or other flammable material within the system. Similarly, tumble drier exhausts should be arranged to facilitate cleaning.