

## Heating, ventilation and air-conditioning

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## Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for existing and future petroleum industry developments.

The NORSOK standards are prepared to complement available international standards and fill the broad needs of the Norwegian petroleum industry. Where relevant NORSOK standards will be used to provide the Norwegian industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

These standards are developed according to the consensus principle generally applicable for most standards work and according to established procedures defined in NORSOK A-001

The preparation and publication of the NORSOK standards is supported by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Manufacturing Industries). NORSOK standards are administered and issued by NTS (Norwegian Technology Centre).

## Introduction

NORSOK standard H-001, rev. 3, July 1998 was the base document for the international development of ISO 15138 "Petroleum and natural gas industries - Offshore production installations - Heating, ventilation and air-conditioning", published November 2000. This NORSOK standard, rev. 4, is therefore completely rewritten to fully align with the new ISO standard and now only includes the requirements and guidelines considered necessary to add to the ISO standard for the broad needs of the Norwegian petroleum industry. This NORSOK standard must therefore be read together with ISO 15138.

This revision of NORSOK Standard H-001 together with ISO 15138 replaces H-001 rev. 3, July 1998

## 1 Scope

The scope for this NORSOK standard is as defined in ISO 15138.

## 2 Normative references

The following standards include provisions (additional to ISO 15138), which through reference in this text, constitute provisions of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognised standards may be used provided it can be shown that they meet or exceed the requirements of the standards referenced below.

|                  |                                                                                                                                                             |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AMCA 201         | Fan application manual.                                                                                                                                     |
| API RP 505       | Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2 |
| API 4589         | Fugitive Hydrocarbon Emissions from Oil and Gas Production Operations                                                                                       |
| AT 444           | Klima og luftkvalitet på arbeidsplassen. (Order no. 516, Climate and air quality in the workplace)                                                          |
| BSRIA            | Application guide 3/89.1                                                                                                                                    |
| CIBSE            | Commissioning codes, series A, Air distribution systems                                                                                                     |
| EN 288           | Specification and qualification of welding procedures for metallic materials                                                                                |
| EN 378           | Refrigerating systems and heat pumps - Safety and environmental requirements                                                                                |
| HVCA DW 144      | Specification for sheet metal ductwork                                                                                                                      |
| ISO 15138        | Petroleum and natural gas industries -- Offshore production installations -- Heating, ventilation and air-conditioning                                      |
| NVG Bull M 83:11 | Methods for measurements of air flow rates in ventilation systems                                                                                           |
| Norsk kuldenorm  | Kuldehåndboken (Skarland Press / Norsk Kjøleteknisk forening).                                                                                              |
| NORSOK S-002     | Working environment                                                                                                                                         |
| SMACNA           | Rectangular industrial duct construction standard                                                                                                           |
| SMACNA           | Round industrial duct construction standard                                                                                                                 |

## 3 Abbreviated terms

|     |                                                            |
|-----|------------------------------------------------------------|
| AT  | Arbeidstilsynet (Directorate of Labour Inspection, Norway) |
| NVG | Nordic Ventilation Group                                   |

## 4 Design / Technical requirements

### 4.1 Introduction

The ISO 15138 applies in full, except that the recommendations of ISO 15138 including its annexes shall be understood as requirement for design, testing, installation and commissioning for HVAC systems, unless otherwise noted in this NORSOK standard.

A plan demonstrating how to verify compliance with the specified functional requirements described in this standard, shall be provided at the start of the design process, currently updated and used in the commissioning phase.

### 4.2 ISO 15138 additions

Note: The following paragraphs of this clause are numbered to match the structure of ISO 15138.

#### To Clause 5.2.1 Orientation and layout

Location of air intakes shall be evaluated for availability for HVAC systems during emergency events.

#### To Clause 5.2.3 Environmental conditions

For design of the HVAC systems the following ambient temperatures shall be used:

|         |                                                                                           |
|---------|-------------------------------------------------------------------------------------------|
| Summer: | The temperature that in average is not exceeded more than 50 hours per year.              |
| Winter: | The medium of the lowest temperatures for three following days over a period of 30 years. |

For normal operation reference is made to NORSOK standard S-002 for internal room temperatures. Specific temperature requirements for equipment shall be met based on manufacturers requirements.

For occupied areas the minimum and maximum temperatures shall be suitable for the actual areas/rooms (Ref. AT 444).

Humidification shall be avoided. Local humidification may be considered if required for equipment operation.

### **To Clause 5.2.5 Selection of controls philosophy**

For the event of internal fire in a non-hazardous area with low fire risk, the strategy is to keep ventilation system serving area running. Ref. ISO 15138 guidance A.5.2 Philosophy 1. The background for this strategy is to provide maximum protection for personnel and equipment by removing smoke from fire area and escape ways.

A room is defined to have low fire risk when generation of combustion gases from a fire and thermal expansion of room air is lower than ventilation air extract and hence the fire will generate no spreading of smoke through ventilation ducts. With fire in such a room, the requirement for gas tightness for ducts penetrating fire-rated partitions will be maintained by operation of ventilation without installation of fire dampers. Actual low risk areas for an installation shall be identified and used for HVAC design.

Typical low risk areas:

- Living Quarter Areas excl. Kitchen and Laundry
- Local Control Room
- Central Equipment Room
- Transformer room
- UPS/DC/AC Converters
- Instrument Room
- Telecommunication Room
- Cable Voids
- Engine Rooms without hydrocarbons
- Workshop/storage without fire potential
- HVAC Rooms

Non-hazardous areas with high fire risk shall be equipped with fire dampers in ventilation ducts penetrating fire-rated partitions. For the event of internal fire in such areas, strategy is to isolate area by closing of fire dampers. These areas are normally protected by dedicated fire fighting systems. Actual high risk areas for an installation shall be identified and used for HVAC design.

Typical high risk areas:

- Diesel engine rooms with fuel storage tanks
- Diesel treatment/separation rooms
- Kitchen areas
- Laundry

Based upon above strategies for operation of ventilation systems, fire-rating for ventilation ducting and partition penetrations shall be evaluated and designed to meet the following requirements:

- Ducting penetrating fire-rated partitions shall normally not be equipped with fire dampers when involving areas with low fire loads as defined above. Fire insulation of penetration sleeves shall meet classification requirements.
- For operation of ventilation with fire in an area, it is required that the integrity of ventilation ducting must be maintained so that all areas will be continued served by ventilation. A duct passing through a fire area must retain its integrity during the fire with consequence that ventilation to areas served by the duct is shut down. Ductwork fire-rating must be evaluated based upon above functional requirement.
- Ducting penetrating A60 rated partitions shall be equipped with fire dampers or ducting shall be fire-rated through area. Fire insulation of ducts, penetration sleeves and fire dampers shall meet classification requirements. A60 partitions are normally used for high risk areas. For deletion of a fire damper in a duct penetrating an A60 partition, a safety risk evaluation shall be performed.

- H rated partitions shall normally not be penetrated by ducts. If done this shall be based on a safety risk evaluation.

**To Clause 5.2.6 Operating and maintenance philosophy**

Ventilation requirements for actual modes of operation to be specified and served, i.e. for normal operation, different emergency operation situations and black start situation. Necessary availability of ventilation systems including power supply shall be ensured.

**To Clause 5.3.1 Natural ventilation**

Natural ventilation in hazardous module areas is from a safety point of view considered sufficient when an average ventilation rate of 12 AC/h in areas is met for 95 % of the year.

Potential stagnant zones shall be evaluated and precautions taken where considered necessary from safety risk analysis.

If required by project specific risk analysis or to optimise working environment conditions, adequate ventilation requirements in a hazardous area can be calculated for dilution of estimated fugitive emissions. The quantity of air can be calculated from data in API 4589 using the methodology given in API RP 505.

**To Annex A.1 Guidance to 5.2.1**

The possibility for transfer of smell from fuel burning equipment, vents etc to air intakes shall be evaluated.

**To Annex A.8 Guidance to 5.2.8**

Maximum fan or system pressure with no air flow shall be evaluated with respect to any system or area consequence this may have to safety.

**To Annex A.15.4 Galley systems**

The kitchen shall have a separate extract system including hood. Frying equipment shall have an air curtain from below to improve the working environment for the kitchen personnel.

**To Annex B.5 Cooling coils and fan coil units**

Water condensate on cooling coils and droplet eliminators shall be properly drained. Water condensate shall not be transferred into the ductwork. The design shall be based on the extreme ambient conditions regarding temperature and humidity.

**To Annex B.7 Fans**

Fans shall be direct driven, however belt driven fans can be evaluated if shown to be technically attractive. To secure the availability of stand-by fans, both fans shall have approximately the same running hours.

Fans extracting from contaminated areas should be duct connected on both suction and discharge side.

**To Annex B.9 Fire dampers**

When a fire damper also is used as gas tight damper, the leakage requirement shall be maximum 300 m<sup>3</sup>/m<sup>2</sup>h with a differential pressure of 2000 Pa across blades.

**To Annex B.13 Refrigeration packages**

Where refrigeration machinery is used for cooling, requirements as stated in EN 378 and "Norsk kuldenorm, kuldehåndboken" shall be complied with.

**To Annex B.15 Ducts***Clearance and accessibility*

All equipment and ducting shall be arranged to provide required headroom and clearances for installations, operation, inspection, maintenance and dismantling with the minimum interference or removal of ducting and equipment (ref. Norsok, S – 002, Annex B).

*Ducting*

Circular ducts shall be preferred.

All duct elements shall be of aerodynamic design.

Special attention shall be paid to ductwork connections to fan inlets and outlets in order to maximise the fan performance. See AMCA publication 201 or equal.

Measuring stations shall be installed in all main ducts/ductbranches.

*Inspection doors/access*

Inspection doors shall be located such that the system can be cleaned. The maximum distance between doors should not exceed 30 metres, for mud and kitchen extract maximum 6 metres. In addition fire-dampers, heaters and shut-off dampers shall have inspection doors if inspection is not possible otherwise.

All inspection doors in heavy gauge ductwork (duct class A and D) shall be hinged.

Duct class C may be used externally if protected from mechanical strain. Ductwork similar to duct class C with additional fire rated seals fitted next to the rubber seals may be used as fire rated ductwork providing it has passed required tests and been accepted.

*Ductwork design*

Stiffening of light gauge ductwork shall be according to HVCA DW144, while stiffening of heavy gauge ductwork shall be according to SMACNA.

*Welding*

All welding shall be carried out in accordance with a WPS established in accordance with EN 288 or equivalent.

The throat thickness of the weld shall be defined on WPS, drawing or equivalent. All welds shall be visually examined and show evidence of good workmanship.

**To Annex C.2 Commissioning**

The balancing of system(s) shall be carried out in accordance with the proportional method as described in CIBSE Commissioning codes, series A3.2.2. As an alternative to air flow measurements described in BSRIA Application guide 3/89.1 the Nordic Ventilation Group Bulletin M 83:11, Methods for measurements of air flow rates in ventilation systems, may be used.

**To Annex E Data sheets**

The following data sheets are reproduced from ISO 15138 (with permission from ISO Central Secretariat) in order to make them electronically available on the Internet (Ref. URL: <http://www.nts.no/norsok>)

| Data sheet reference | Component description                 |
|----------------------|---------------------------------------|
| E.1                  | Louvres                               |
| E.2                  | Moisture separators and filters       |
| E.3.1                | Fluid heating coils                   |
| E.3.2                | Electric heating coils                |
| E.3.3                | Unit heaters                          |
| E.4.1                | DX cooling coils                      |
| E.4.2                | Fluid cooling coils                   |
| E.4.3                | Fan coil units                        |
| E.5                  | Humidifiers                           |
| E.6                  | Fans                                  |
| E.7                  | Sound attenuators                     |
| E.8                  | Fire dampers                          |
| E.9.1                | Mechanical dampers                    |
| E.9.2                | Manual dampers                        |
| E.10                 | Grilles and diffusers                 |
| E.11                 | Air handling units                    |
| E.12                 | Refrigeration packages                |
| E.13                 | Constant-volume terminal reheat units |
| E.14                 | Measuring stations 1)                 |
| E.15                 | Dehumidifier, sorption type 1)        |

Note 1) This data sheets applies in addition to those given in ISO 15138.



