



Mechanical equipment

**OFFSHORE TECHNOLOGY REPORT
2001/065**



Mechanical equipment

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FOREWORD

This document provides technical information previously contained in the Fourth Edition of the Health and Safety Executive's '*Offshore Installations: Guidance on Design, Construction and Certification*' (1990 edition plus amendments)⁽¹⁾. The 'Guidance' was originally published in support of the certification regime under SI289, the Offshore Installations (Construction and Survey) Regulations 1974⁽²⁾. However, SI289 was revoked by the Offshore Installations (Design and Construction, etc) Regulations, 1996, which also introduced the verification provisions into the Offshore Installations (Safety Case) Regulations, 1992. The 'Guidance' was formally withdrawn in its entirety on 30 June 1998 (see HSE OSD Operations Notice 27⁽³⁾).

The withdrawal of the 'Guidance' was not a reflection of the soundness (or otherwise) of the technical information it contained; some sections (or part of sections) of the 'Guidance' are currently referred to by the offshore industry. For this reason, after consultation with industry, relevant sections are now published as separate documents in the HSE Offshore Technology (OT) Report series.

It should be noted that the technical content of the 'Guidance' has not been updated as part of the re-formatting for OTO publication, although prescriptive requirements and reference to the former regulatory regime have been removed. **The user of this document must therefore assess the appropriateness and currency of the technical information for any specific application. Additionally, the user should be aware that published sections may cease to be applicable in time and should check with Operations Notice 27, which can be viewed at http://www.hse.gov.uk/hid/osd/notices/on_index.htm, for their current status.**

1. INTRODUCTION AND SCOPE

This Offshore Technology (OT) Report provides technical information on fixed and mobile mechanical equipment and systems installed or erected on an Offshore Installation, whether initially or at a subsequent date. It is based on guidance previously contained in Section 42 of the Fourth Edition of the Health and Safety Executive's 'Offshore Installations: Guidance on Design, Construction and Certification'⁽¹⁾ which was withdrawn in 1998. As discussed in the Foreword, whilst the text has been re-formatted for Offshore Technology publication, the technical content has not been updated. The appropriateness and currency of the information contained in this document must therefore be assessed by the user for any specific application.

2. DESIGN, MANUFACTURE AND INSTALLATION

Equipment should be suitable for its intended purpose. All equipment, including any foundation or fixing, should be of sound construction, suitable material, adequate strength and free from patent defects. It should be designed with regard to its intended use with or near other equipment and for its safe use under all known operating conditions, including overload if anticipated. Equipment should have efficient control systems, guards, fences and shields.

Equipment should, so far as reasonably practicable, be protected, installed and disposed to limit noise and vibration. Consideration should also be given to requirements for ventilation. OT Reports OTO 2001 066 and OTO 2001 068 provide information on these aspects.

It is suggested that all equipment should be manufactured to a relevant standard, code or specification and written confirmation of this, together with appropriate test certificates, should be obtained from the manufacturer (see also Section 3 of this report).

It is essential that each item of equipment should be installed properly. Particular consideration should be given to the effectiveness of mountings for cranes, fixed lifting appliances and derricks (including any drilling derrick); the safe fixing of air intakes and exhausts of engines and compressors; the safe placing of equipment in relation to the electrical system; the segregation of piping systems, particularly pressure systems; and the inclusion of master controls for stopping machinery, shutting off fuel supplies and closing combustion spaces.

Equipment should be located with safety in mind. It should be suitably protected for use in its intended environment, particularly if it is to be located in an area where a flammable atmosphere could develop.

The disposition of each item of equipment should also be considered in relation to other items so as to reduce to a minimum any potential danger to the Installation and the people on it.

3. INTERNAL COMBUSTION ENGINES

3.1 GENERAL REQUIREMENTS FOR INTERNAL COMBUSTION ENGINES

Efficient spark arresters should be fitted to exhausts on all engines unless it can be demonstrated that the exhaust discharges into a safe location. If water cooled spark arresters are fitted, they should be provided with an adequate amount of water and a device or devices arranged so that an alarm will be activated should the supply of water fail.

Air intakes of combustion engines (except gas turbines) situated in an enclosed space containing a flammable gas supply should have an automatic device fitted to prevent overspeeding in the event of accidental ingestion of flammable gas.

The automatic overspeed shutdown device may be omitted from engines installed to drive emergency equipment such as fire pumps, emergency generators and kill pumps, providing it can be demonstrated that combustion air has been ducted from a safe location.

In the case of internal combustion engines driving electrical generating sets, it is suggested that calculations would need to be available to show that the vibration stresses in the shafts resulting from torsional critical speeds are not excessive.

Where engines are fuelled by field gas or oil, the fuel line or lines should be routed so that, if there is a rupture or failure, the danger of extraneous fuel ingress to the engine through the air intake is minimised. Otherwise overspeeding or explosion could result. When designing piping consideration should be given to the welding of joints and the use of heavier than normal gauge, or as an alternative, double-walled piping.

3.2 ENGINES IN HAZARDOUS AREAS

Internal combustion engines should not be located in areas designated as hazardous areas (zone 1). Location in hazardous areas (zone 2) should be avoided where reasonably practicable.

3.2.1 Fixed engines

Where it is necessary to enclose a combustion engine in a hazardous area then pressurisation of this enclosure is likely to be accepted to make it safe. However, consideration should be given to applying the following minimum:

- Pressurisation air should be taken from a safe area.
- Air flow should be sufficient to maintain positive flow from the enclosure into the hazardous area even when one of the access doors between the two spaces is fully open.
- An alarm system should be fitted to indicate pressurised system failure.
- An airlock system should be fitted in a zone 1 area; self-closing doors may be fitted where the hazardous area is zone 2.

3.2.2 Mobile engines

Where it is necessary to locate mobile internal combustion driven units such as wireline workover units in a zone 2 open deck area it is suggested that at least the following should be provided:

- Inlet flame trap.
- Inlet shut-off valve on fuel supply which should be automatically operated on:
 - engine overspeed
 - high exhaust temperature
 - high coolant temperature
 - low tube oil pressure.
- Manual shutdown facilities.
- An inlet air shutdown valve which is capable of stopping the engine (its operation should be independent from the engines).
- An exhaust manifold cooling such that:
 - in the case of forklift trucks, the maximum permissible surface temperature is 350°C
 - in the case of other portable units such as wireline or welding sets, the maximum permissible surface temperature is 250°C.
- Exhaust spark arresters with acceptable characteristics.
- Electrics and instruments approved for service in hazardous areas following the appropriate code.
- Antistatic drive belts and antistatic fans.

Consideration should be given to providing engine starting by compressed air, hydraulic, hand or spring recoil inertia starters. Spring recoil inertia starters would need to be approved for hazardous areas.

Where it is necessary to use a cold-starting aid such as 'start pilot', the associated piping and the fuel reservoir bottles would need to be protected against accidental damage. It is suggested that plastic piping should not be used.

Where plant is likely to be unmanned for long periods during normal operations, a dedicated gas detection system providing gas alarm with automatic engine shutdown should be fitted.

3.3 GAS TURBINES

When designing the layout of gas turbines, consideration should be given to alleviating the effects of the failure of a gas turbine rotor where the fragments cannot be contained. Some of the risks to be considered include:

- Engine acoustic hood penetrations.
- Fuel supply pipe fracture.

- Fire extinguishing bottle explosion.
- Loss of fire protection system.
- Location of the control room in relation to gas turbines.
- Ability of the control room to withstand pressure waves in the event of an explosion in the gas turbine exhaust duct or gas turbine hall.
- Damage to other nearby engines and consequent loss of power.

4. REFERENCES

1. Department of Energy. Offshore Installations: Guidance on Design, Construction and Certification, 4th Edition. HMSO, Consolidated Edition, 1993 (plus Amendment No. 3, 1995). [Withdrawn 1998 by Operations Notice 27].
2. SI 1974 / 289 – The Offshore Installations (Construction and Survey) Regulations 1974, HMSO, 1974. [Revoked and has been replaced by SI 1996 / 913 – The Offshore Installations and Wells (Design and Construction etc.) Regulations, 1996 – ISBN: 0 110 54451 X].
3. Health and Safety Executive. Status of Technical Guidance on Design, Construction and Certification. Operations Notice 27. Revised and Reissued, August 1998.



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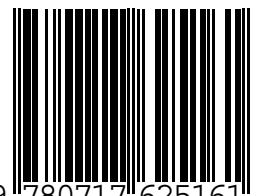
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