

INTERNATIONAL STANDARD

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Reciprocating internal combustion engines — Fire protection

Moteurs alternatifs à combustion interne — Protection contre l'incendie

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Contents

Page

1	Scope	1
2	Normative references	1
3	Definitions	1
4	Other regulations and requirements	2
5	General	2
6	Engine basic class	2
	6.1 Instructions	2
	6.2 Engine fill provisions	3
	6.3 Drain and stop valves	3
7	Engine special requirements	3
	7.1 Fire resistance	3
	7.2 Protection of electrical components	3
	7.3 Piping for flammable liquids	3
	7.4 Protection of high-pressure fuel systems	4
	7.5 Protection of hydraulic systems	4
	7.6 Drain valves	4
	7.7 Filters for flammable liquids	4
	7.8 High-temperature surfaces	4
	7.9 Protection from engine exhaust gas	5
	7.10 Air inlet system flame control	5
	7.11 Crankcase flame control	5
	7.12 Indicator cock flame control	5
	7.13 Flexible connections in engines started by admitting air directly into the cylinders	5
 Annexes		
A	Format for communicating special requirements	6
B	Bibliography	8

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 6826 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*, Subcommittee SC 5, *Special requirements*.

This second edition cancels and replaces the first edition (ISO 6826:1982), which has been technically revised.

Annexes A and B of this International Standard are for information only.

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Reciprocating internal combustion engines — Fire protection

1 Scope

This International Standard establishes requirements for reciprocating internal combustion engines to minimize the risk of fire caused by the engine, its components and the auxiliaries fitted to it. Where necessary, special requirements can be given for particular engine applications.

The requirements of this International Standard are not intended to enable an engine to operate during or after a fire.

This International Standard covers reciprocating internal combustion engines for land, rail-traction and marine use, excluding engines used to propel agricultural tractors, road vehicles, road construction and earth-moving machines and aircraft.

This International Standard may be applied to engines used to propel industrial trucks and small craft and for other applications where no suitable International Standard for fire protection on reciprocating internal combustion engines exist.

For engine applications excluded above, this International Standard may be used as the basis for engine application standards.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7840:1994, *Small Craft — Fire resistant fuel hoses*.

ISO 8846:1990, *Small Craft — Electrical devices — Protection against ignition of surrounding flammable gases*.

ISO 10088:1992, *Small Craft — Permanently installed fuel systems and fixed fuel tanks*.

IEC 79-0:1983, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements*.

3 Definitions

For the purposes of this International Standard the following definition applies.

3.1 fire resistance: Property of a component or an assembly to meet the requirements regarding stability, integrity and/or other expected qualities for fire resistance under the conditions of a standardized fire application test during a defined length of time (see 7.1).

4 Other regulations and requirements

4.1 For engines used on board ships and offshore installations which have to comply with the rules of a classification society, the additional requirements of the classification society shall be observed. The classification society shall be stated by the customer prior to placing the order.

For non-classed engines, additional requirements shall in each case be subject to agreement between the manufacturer and customer.

4.2 If special requirements from regulations of any other authority, e.g. inspecting and/or legislative authorities, have to be met, the authority shall be the customer prior to placing the order.

Any further additional requirements shall be subject to agreement between the manufacturer and customer.

5 General

This International Standard provides one means of conforming with essential safety requirements and helps facilitate communication and understanding between the engine manufacturer and the customer. Application of this International Standard shall be subject to agreement between the engine manufacturer and the customer (AMC).

The measures required for fire protection are very different depending on the type and application of the engine. It is therefore neither necessary nor desirable for all these measures to be applied to every engine.

For this reason an engine delivered according to this International Standard shall comply with at least the basic class (see clause 6) of this standard. The fire protection of the engine in this case shall be designated by

Fire protection ISO 6826

Where additional requirements are applied in order to provide the essential safety requirements for a specific application (i.e. special requirements specified in clause 7), these shall be specified by adding the appropriate feature codes to "ISO 6826". In this case, an engine would have all the basic class measures applied and additionally the protection measures specified in the selected feature codes.

The selection of special requirements according to feature codes A, B, etc. shall be subject to AMC. For this purpose the format given in table A.1 should serve for communicating special requirements. Cross reference of special requirements is given in table A.2.

An example for the designation of fire protection for a specific application of an engine, complying with the basic class and additionally the special requirements (feature codes C, K and P) selected from this International Standard is:

Fire protection ISO 6826-C-K-P

Feature codes, e.g. C-K-P, shall be stated in alphabetic order.

6 Engine basic class

The methods and the design details used to comply with the basic class features are the responsibility of the engine manufacturer.

6.1 Instructions

The manufacturer shall provide instructions for the installation (where applicable), operation and maintenance of the engine. The instructions shall include inspection procedures to maintain the integrity of engine systems containing

flammable liquids, the features of the basic class, and all applicable special requirements. Particular attention shall be given to inspecting hose and pipe connections for thermal or vibration-induced damage.

Gasoline and gas engines shall be operated in well ventilated spaces to avoid explosions in the event of fuel leakage.

6.2 Engine fill provisions

The arrangements for filling engines with flammable liquids shall be such that during filling no flammable liquids are in contact with high-temperature surfaces, electrical components or rotating parts when the procedures stated in the operation manual are followed.

6.3 Drain and stop valves

Drain and stop valve fittings shall be so positioned to enable easy access for operation and service.

7 Engine special requirements

7.1 Fire resistance

7.1.1 30 min fire resistance test (feature code: A)

All components which contain flammable liquids shall withstand exposure to flame without leaking. Flexible pipes and hoses shall be tested when transporting water at $80\text{ °C} \pm 5\text{ °C}$ at the maximum service pressure to check that they can withstand exposure to flame with a temperature of $800\text{ °C} \pm 50\text{ °C}$ for 30 min without leaking.

7.1.2 2,5 min fire resistance test (feature code: B)

All components as installed, which contain flammable liquids, shall withstand exposure to free burning fuel for 2,5 min without leaking. For typical test procedures refer to ISO 7840 and ISO 10088.

7.2 Protection of electrical components (feature code: C)

Electrical components for spark ignition engines shall be designed so that during operation they do not ignite surrounding flammable gases. For test procedures and requirements refer to ISO 8846. For components which shall be operational after exposure to fire and explosion, see IEC 79-0.

7.3 Piping for flammable liquids

7.3.1 Pipe design and installation (feature code: D)

The design or installation of pipes shall prevent flammable liquid dripping or spraying leakage on to high-temperature surfaces, rotating parts and electrical components or into the air inlet system of compression ignition engines.

EXAMPLES

- a) Location of fuel and lubricating oil pipes, particularly pipe joints, away from the vicinity of high-temperature surfaces, electrical components or air inlets.
- b) Local protection, shielding or reinforcement of pipes, especially small pipes such as those for pressure signal transmission.
- c) Suitable locking of drain valves fitted on pipes or components containing flammable liquids to prevent accidental opening.

7.3.2 Pipe fittings (feature code: E)

The number of detachable pipe fittings shall be limited to the necessary minimum.

7.4 Protection of high-pressure fuel systems (feature code: F)

High-pressure fuel injection pipes shall be located and/or protected so that leakage does not contact high-temperature surfaces, rotating parts, electrical components and the air inlet system. Means shall be provided for the detection and drainage of leaks.

7.5 Protection of hydraulic systems (feature code: G)

Hydraulic pipes with a pressure of over 60 bar shall be located and/or protected so that leakage does not contact high temperature surfaces, rotating parts, electrical components and the air inlet system. Means shall be provided for the detection and drainage of leaks.

7.6 Drain valves (feature code: H)

Valves for the draining of systems containing flammable liquids shall open manually and shall be located so that liquids can be drained off so the liquid does not contact high temperature surfaces, rotating parts, electrical components and the air inlet system.

7.7 Filters for flammable liquids

7.7.1 Filter location (feature code: J)

Filters for flammable liquids shall be located and/or protected so that in case of leaks no flammable liquids shall be in contact with high-temperature surfaces, rotating parts, electrical components and the air inlet system.

7.7.2 Filter trays (feature code: K)

Filter locations shall be fitted with trays and/or gutters to conduct flammable liquids spilled during servicing, away from high temperature surfaces, rotating parts, electrical components and the air inlet system.

7.8 High-temperature surfaces (feature code: L)

7.8.1 The exhaust system and all other parts of the engine shall be cooled and/or insulated so that no external surface shall reach a temperature at which leaking flammable liquids will ignite (autoignition temperature).

Examples of autoignition temperatures are

diesel fuel: 220 °C;

lubricating oil: 380 °C;

hydraulic oil: 380 °C;

gasoline: 260 °C (evaporates at 225 °C).

7.8.2 Insulating materials shall be non-flammable and protected against intrusion of flammable liquids by suitable means such as sheet metal, hard sheeting or other impermeable materials.

7.9 Protection from engine exhaust gas (feature code: M)

The engine exhaust system shall be fitted with a spark arrestor or otherwise be suitably designed to act as a spark arrestor.

NOTE — A turbocharger may be considered to be a spark arrestor.

7.10 Air inlet system flame control

7.10.1 Inlet system flame prevention (feature code: N)

The engine induction system shall be designed or equipped with a flame arrestor to ensure that a fire or explosion within it will not propagate into the atmosphere surrounding the engine.

7.10.2 Inlet system fire warning (feature code: P)

For spark ignition and two-stroke trunk piston compression ignition engines the engine air inlet system shall be fitted with a device to give an alarm if there is a fire in the inlet system.

7.10.3 Inlet system drains (feature code: Q)

Two-stroke crosshead engines shall provide the means to drain flammable liquids from the engine air inlet system if a flammable mixture can be formed in this system.

7.11 Crankcase flame control

7.11.1 Crankcase breather flame control (feature code: R)

Crankcase breathers shall be designed or equipped with flame arrestors to ensure that a crankcase fire or explosion will not propagate into the atmosphere surrounding the engine.

7.11.2 Crankcase explosion relief valve flame control (feature code: S)

Crankcase explosion relief valves are fitted to many large engines to restrict the damage that might be caused by crankcase explosions.

Where it is essential to reduce the risk of fire resulting from crankcase explosions, flame arrestors shall be fitted.

NOTE — These valves are frequently specified when staff need to be close to such engines to carry out maintenance work when the engine is running.

7.12 Indicator cock flame control (feature code: T)

Cylinder head indicator cocks shall be designed to avoid flame emission when they open.

7.13 Flexible connections in engines started by admitting air directly into the cylinders (feature code: U)

Flexible connections (bellows, flexible hoses) in pipe lines which are permanently under starting air pressure shall withstand internal explosions.

Table A.2 — Feature codes and cross reference of special requirements

Feature code	Special requirement	Subclause
A	30 min fire resistance test	7.1.1
B	2,5 fire resistance test	7.1.2
C	Protection of electrical components	7.2
—	Piping for flammable liquids	7.3
D	Pipe design and installation	7.3.1
E	Pipe fittings	7.3.2
F	Protection of high-pressure fuel systems	7.4
G	Protection of high-pressure hydraulic systems	7.5
H	Drain valves	7.6
—	Filters for flammable liquids	7.7
J	Filter location	7.7.1
K	Filter trays	7.7.2
L	High-temperature surfaces	7.8
M	Protection from engine exhaust gas	7.9
—	Air inlet system flame control	7.10
N	Inlet system flame prevention	7.10.1
P	Inlet system fire warning	7.10.2
Q	Inlet system drains	7.10.3
—	Crankcase flame control	7.11
R	Crankcase breather flame control	7.11.1
S	Crankcase explosion relief valve flame control	7.11.2
T	Indicator cock flame control	7.12
U	Flexible connections in engines started by admitting air directly into the cylinders	7.13

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Annex B
(informative)

Bibliography

- [1] ISO 3261:1975, *Fire tests — Vocabulary*.

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