
**Reciprocal internal combustion
engines — Recoil starting equipment —
General safety requirements**

*Moteurs alternatifs à combustion interne — Dispositifs de démarrage à
réenrouleur — Exigences générales de sécurité*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14314 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

Introduction

The hierarchy of safety standards in the field of machinery is as follows:

- a) type-A standards (basis safety standards) giving basic concepts, principle for design, and general aspects that can be applied to machinery;
- b) type-B standards (generic safety standards) dealing with one safety aspect or one type of safeguards that can be used across a wide range of machinery;
 - 1) type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);
 - 2) type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards);
- c) type-C standards (machinery safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This document is a type C standard as stated in EN 1070.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards for machines that have been designed and built according to the provisions of this type C standard.

The concept of re-coil starting systems avoids the two main risks inherent in the use of a loose rope to start Reciprocating Internal Combustion (RIC) engines as follows:

- i) by preventing the rope coming loose from the engine starting pulley, in an uncontrolled manner, at the end of the starting operation and injuring the operator;
- ii) by preventing the operator from being in or coming into contact with any rotating parts of the starting system.

Reciprocal internal combustion engines — Recoil starting equipment — General safety requirements

1 Scope

This International Standard specifies the safety requirements for engine re-coil starting equipment intended for use on RIC engines for land, rail and marine use, excluding engines intended for use to propel road vehicles and aircraft. It may be applied to engines intended for use to propel construction and earth-moving machines and for other applications where no other suitable International Standards exist.

In addition to the technical safety requirements, it also contains the method of checking the adherence to these requirements.

This International Standard only addresses the hazards associated with the installation and operation of re-coil starting equipment.

This International Standard is primarily directed at machines which are manufactured after the date of publication of this International Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2710-1, *Reciprocating internal combustion engines — Vocabulary — Part 1: Terms for engine design and operation*

ISO 2710-2, *Reciprocating internal combustion engines — Vocabulary — Part 2: Terms for engine maintenance*

ISO 7967-8, *Reciprocating internal combustion engines — Vocabulary of components and systems — Part 8: Starting systems*

EN 292-1, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

EN 292-2 and EN 292-2/A1, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications*

EN 1070, *Safety of machinery — Terminology*

EN 1679-1, *Reciprocating internal combustion engines — Safety — Part 1: Compression ignition engines*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2710-1, ISO 2710-2, ISO 7967-8, EN 1070, and the following apply.

3.1
re-coil starting systems
 equipment used for starting an RIC engine by the use of a rope, whereby the torque required for starting is transmitted to the crankshaft through a pulley and the pulley is connected to the crankshaft only during the starting action

NOTE 1 After each starting attempt the rope is automatically returned to the park or start position (re-coil).

NOTE 2 The rope used to start the engine is not a separate device.

3.2
rope handle
 handle permanently and securely connected to the rope to offer a safe hold to the operator

3.3
engine assembly
 the combination of the re-coil starting device and the associated RIC engine

4 List of significant hazards

This clause identifies all the hazards, hazardous situations and events, as far as they are dealt with in this International Standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

See Table 1.

Table 1 — Identified significant hazards

Number	Hazard	Hazardous situation	Relevant clause of this International Standard
1	Crushing	Entrapment of the operator's fingers upon reversal of engine rotation during starting	5.2.1
2	Cutting/severing	Cutting from sharp edges if the hand of the operator is pulled against the engine assembly	5.2.2
3	Cutting/severing	Snatching of the starting handle from the operator	5.2.2
4	Drawing-in or trapping	Exposure of rotating parts of the engine assembly	5.2.3
5	Unhealthy posture or excessive effort	Poor operator access to the starting handle	5.2.4
6	Ejected object	Starting rope coming loose from the re-coil starting system and flying in an uncontrolled manner	5.2.5
7	Slip/trip and fall of the operator	Starting rope coming loose from the machine during starting	5.2.6

5 Safety requirements and/or protective measures

5.1 General

Re-coil starting equipment conforming to this International Standard shall comply with the safety requirements and/or protective measures of this clause.

In addition, for hazards which are not dealt with by this International Standard but are relevant but not significant, starting equipment shall be designed in accordance with the principles of EN 292-1 and EN 292-2.

Where the means of reducing the risk is by the physical arrangement or positioning of the re-coil starting device, the manufacturer shall include in the information for use, reference to the reduction means to be provided and, if appropriate, to the means of verification.

5.2 Hazards

5.2.1 Crushing hazard

The rope handle shall be designed such that it can be released by the operator without injury or entrapment.

Clearance distances between the rope handle and the casing or guard of the re-coil starting equipment and the RIC engine shall be in accordance with the requirements of EN 1679-1.

In the event of the engine suddenly reversing its direction of rotation after a failed attempt to start, the rope handle shall be designed such that it can be released without any action on the part of the operator.

5.2.2 Cutting/severing hazard

The rope handle shall be designed with a radius of at least 1,5 mm on all internal and external corners and be free from burrs.

Parts of the re-coil starting equipment within a radius of 100 mm around the rope handle when it is in both its rest position and during operation shall have no sharp corners and shall be free from burrs. The manufacturer shall include this requirement in the installation instructions included in the information for use.

NOTE 0,3 mm chamfers are sufficient.

5.2.3 Drawing-in or trapping hazard

The mechanism used to connect the starting pulley to the engine crankshaft shall automatically disengage after the engine has started. The design shall also be such that engagement of the starting mechanism is prevented while the engine is running.

Access to any rotating parts of the engine assembly shall be prevented by installing a guard or guards in accordance with the requirements of EN 1679-1. Any guards provided by the manufacturer of the re-coil starting system shall be removable only through the use of a tool. Details of the integration of the re-coil starting system guard with that of the RIC engine shall be included in the information for use provided by the re-coil starting system manufacturer.

5.2.4 Unhealthy posture or excessive effort

When installed in accordance with the manufacturer's instructions, the re-coil starting system shall be capable of being operated without the operator having to stretch or adopt an uncomfortable posture.

NOTE The rope may be extended to place the handle on the engine assembly in an easy-to-reach position.

5.2.5 Ejected object

In the event of the rope coming loose from the RIC engine starting pulley, it may fly in an uncontrolled manner and cause injury. For requirements to eliminate this hazard see 5.2.6.

5.2.6 Slip/trip and fall of the operator

The rope itself and its connection(s) to the RIC engine shall be able to withstand the forces that will be met during operation. The manufacturer shall include in the information for use the maximum torque that can be transmitted to the engine by the re-coil starting system and the maximum force that can be exerted on the rope and rope handle.

The rope and its connection(s) to the RIC engine and rope handle shall be able to withstand twice the maximum force that can be exerted on the rope and rope handle.

The rope and rope handle shall be made of materials that will sustain their physical and chemical characteristics when subjected to all the agents likely to be met during the RIC engine operation such as elements of the weather, oil, fuel, vibration and temperature.

6 Verification of safety requirements and/or protective measures

Verification of all the safety requirements shall be by examination of the system/installation drawings and/or measurement during a suitable test.

Additionally, the safety requirements described in 5.2.3 shall be verified as follows:

- a) by performing a functional test of the re-coil starting system;
- b) by performing a test that applies an equivalent static load to the rope.

7 Information for use

7.1 General

Every re-coil starting system shall be supplied with information on the use for which it is designed or for which it has been tested as well as on any condition necessary to ensure that it will be safe to use and without risk to health at all times, but particularly when being adjusted and operated.

The manufacturer shall provide information for use describing the safe installation and operation of the re-coil starting system including its weight, dimensions, fixing requirements and any other information required as described in Clause 5.

7.2 Technical data

The following minimum information shall be provided in the instruction handbook for each model:

- a) mass (kg);
- b) overall dimensions (mm);
- c) maximum torque output (N·m);
- d) installation requirements.

7.3 Marking

The marking shall be located in a readily visible position on the re-coil starting system and shall be resistant to the anticipated in-service conditions, e.g. the effects of temperature, moisture, petrol, oil, diesel, abrasion and weather exposure.

Text may be replaced by pictograms.

When symbols are used, they shall be in stark contrast to their background. Embossed features shall be at least 0,5 mm in height. The information or instructions provided by the symbols shall be clearly legible when viewed by the naked eye from a distance of not less than 500 mm.

The re-coil starting system shall be marked legibly and indelibly with the following minimum information:

- a) name and address of the manufacturer;
- b) year of construction;
- c) any mandatory or statutorily marking;
- d) designation of series or type;
- e) advice to read the instruction handbook and follow all warnings and safety instructions.

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