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Reciprocating internal combustion engines — Handle starting equipment —

Part 1: Safety requirements and tests

Moteurs alternatifs à combustion interne — Dispositifs de démarrage à la manivelle —
Partie 1: Exigences de sécurité et essais

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Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 270, *Internal combustion engines*, in collaboration with ISO Technical Committee ISO/TC 70, *Internal combustion engines*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 11102-1:1997), which has been technically revised.

The main changes compared to the previous edition are as follows:

— test reference to the manufacturer's design data in 6.1 has been deleted;

— automatic disengagement device test has been added in Clause 7.

A list of all parts in ISO 11102 series can be found on ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Reciprocating internal combustion engines — Handle starting equipment —

Part 1: Safety requirements and tests

1 Scope

This document specifies requirements for handle starting equipment used on reciprocating internal combustion engines for land, rail and marine use, excluding engines used to propel road vehicle and aircraft. It can be applied to engines used to propel road construction, earth moving machines and other applications where no suitable International Standards exist.

In addition to the technical safety requirements, this document describes procedures for checking adherence to these requirements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 11102-2, *Reciprocating internal combustion engines — Handle starting equipment — Part 2: Method of testing the angle of disengagement*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
handle starting system
starting system using a crank handle to rotate the engine up to the required firing speed

3.2
automatic disengagement device
device which automatically releases the connection between the engine and the starting handle once the engine is running, thus preventing the handle from being turned by the engine

3.3
guide
part of the *handle starting system* (3.1) which guides the starting handle during starting and prevents its being thrown out after disengagement

3.4
kick back limiter
part of the *handle starting system* (3.1) which, when used in accordance with the instructions and when maintained correctly, prevents or limits the *kick back travel* (3.8) to such an extent as to avoid the risk of injury

3.5
kick back
sudden change of direction of rotation of the starting handle, caused by compression or combustion pressure of the engine during starting procedure

3.6
disengagement travel
circumferential distance which the grip of the starting handle travels from the point of its change of rotational direction to its disengagement from the starting shaft, measured at the centre of the grip

3.7
angle of disengagement
angle through which the shank of the starting handle turns from the point of change of rotational direction to its disengagement from the starting shaft

3.8
kick back travel
distance which the grip of the handle travels from the point of its change of rotational direction until it comes to rest, measured at the centre of the grip

3.9
kick back angle
angle through which the shank of the starting handle turns from the point of its change of rotational direction until it comes to rest

4 Other regulations and requirements

4.1 For engines used on board ships and offshore installations which have to comply with rules of a classification society, it is presupposed that the additional requirements of the classification society are observed. If this applies the name of the classification society shall be stated by the customer prior to placing the order.

For engines which do not require such classification, any additional requirements shall in each case be subject to the agreement between the manufacturer, supplier and customer.

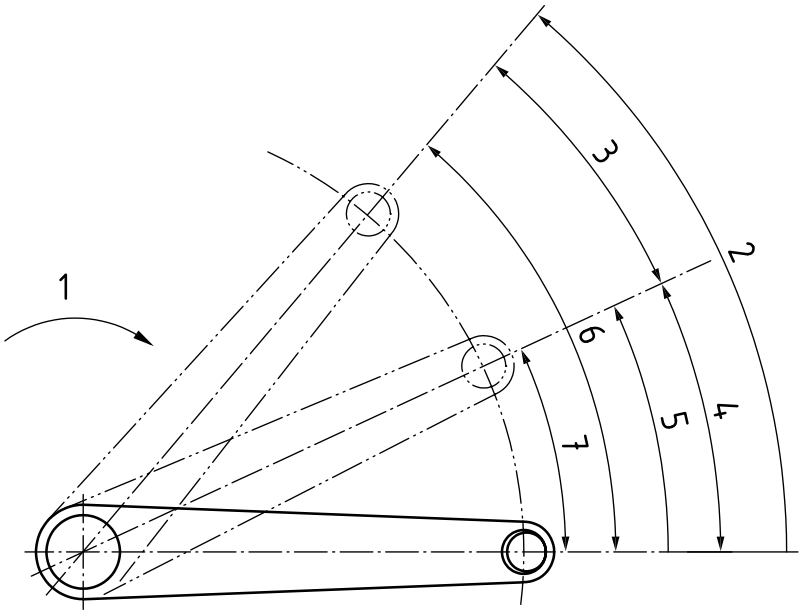
4.2 If special requirements from regulations of any other authority, e.g. inspecting and/or legislative authorities, have to be met, the authority shall be stated by the customer prior to placing the order.

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

5 Technical safety requirements

5.1 General

When a reciprocating internal combustion engine, which is being manually started using a starting handle, suddenly changes its direction of rotation, the handle is subject to an acceleration in the opposite direction to the start of rotation (see Figure 1).



Key

1 direction of handle rotation when starting the engine
2 kick back travel
3 energy absorption
4 energy dissipation
5 travel of disengagement
6 kick back angle
7 angle of disengagement

Figure 1 — Direction of rotation of handle

The resulting angular velocity is at a maximum at the point of disengagement. Due to its inertia, the handle will turn further until all the kinetic energy has been dissipated in overcoming friction and the force exerted by the operator or until it comes up against a stop.

For this reason, the kick back travel and angle are larger, by an undefined amount, than the disengagement travel and angle respectively.

The main factor which leads to injury is not the force itself with which the handle kicks back but the distance during which this force can act upon the operator.

Limitation of the kick back force may therefore not be accepted as a measure to prevent accidents when correctly using a starting handle. Instead, the concern is to limit the kick back travel.

5.2 General requirements

5.2.1 The handle starting system shall be equipped with an automatic disengagement device. The handle shall be prevented from re-engaging when the engine is running.

5.2.2 The handle starting system shall be fitted with a guide which allows the handle to be removed from the engine only when it is disengaged. This can be achieved, for example, when the handle is not being turned, being turned only very slowly, or being turned in the direction opposite to the starting rotation.

5.2.3 The starting handle shall be fitted with a non-removable grip which can freely rotate and shall guarantee safe operation when used properly. These requirements also apply to the use of sleeves.

5.2.4 Starting handles shall be permanently marked with the manufacturers or supplier's identification.

5.3 Requirements in the event of kick back

The angle of disengagement shall not exceed 35 ° and the disengagement travel shall not exceed 100 mm.

6 Tests

6.1 Checking angle of disengagement and travel

Tests in accordance with ISO 11102-2 shall be carried out.

6.2 Checking of other requirements

All other requirements shall be checked by reference to the manufacturer's data and by physical tests.

These shall include a visual check for functional suitability of the starting pin, the starting dog and the starting handle guide.

7 Test report

The manufacturer/importer or their agent shall supply a test report which contains at least the following:

a) starting handle identification:
   - type;
   - manufacturer/supplier;
   - technical specifications of the handle;

b) engine identification:
   - type;
   - manufacturer/supplier;
   - technical specifications of the engine;

c) description of the kick back limiter;

d) angle of disengagement;

e) disengagement travel;

f) results of the tests according to 6.2;

g) date on which tests were carried out;

h) automatic disengagement device test:
   - type;
   - manufacturer/supplier;
   - technical specifications of the automatic disengagement device.