INTERNATIONAL STANDARD

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Agricultural tractors — Test procedures —

Part 12: Low temperature starting

Tracteurs agricoles — Méthodes d'essai —

Partie 12: Démarrage à basse température

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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 3.

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 part of ISO 789 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 789-12 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 2, *Common tests*.

ISO 789 consists of the following parts, under the general title *Agricultural tractors — Test procedures*:

— *Part 1: Power tests for power take-off*

— *Part 2: Rear three-point linkage lifting capacity*

— *Part 3: Turning and clearance diameters*

— *Part 4: Measurement of exhaust smoke*

— *Part 5: Partial power PTO — Non-mechanically transmitted power*

— *Part 6: Centre of gravity*

— *Part 7: Axle power determination*

— *Part 8: Engine air cleaner*

— *Part 9: Power tests for drawbar*

— *Part 10: Hydraulic power at tractor/implement interface*

— *Part 11: Steering capability of wheeled tractors*

— *Part 12: Low temperature starting*

Annex A of this part of ISO 789 is for information only.

Agricultural tractors — Test procedures —

Part 12: Low temperature starting

1 Scope

This part of ISO 789 specifies the test procedure for determining the lowest temperature at which the tractor starter motor is able to start the tractor engine.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 789. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 789 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3016:1994, *Petroleum products — Determination of pour point.*

ISO 3675:1998, *Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method.*

ISO 5163:1990, *Motor and aviation-type fuels — Determination of knock characteristics — Motor method.*

ISO 5164:1990, *Motor fuels — Determination of knock characteristics — Research method.*

ISO 5165:1998, *Petroleum products — Determination of the ignition quality of diesel fuels — Cetane engine method.*

3 Measurement units and tolerances

See Table 1.

Table 1 — Measurement units and tolerances

Quantity	Unit	Tolerance
rotational frequency	revolutions per minute	± 0,5 %
time	seconds	± 1 %
distance	metres or millimetres	± 0,5 %
force	newtons	± 1%
mass	kilograms	± 0,5 %
atmospheric pressure	kilopascals	± 0,2 kPa
task temperatures of fuels, engine oil and transmission	degrees Celsius	± 2 °C
wet and dry bulb thermometer temperatures	degrees Celsius	± 0,5 °C

4 Test conditions

4.1 Fuel

The complete fuel system shall be filled with the appropriate grade of fuel for operation at the test temperature. If prior to the test the engine has been operating on another fuel, new filter elements shall be fitted and care shall be taken to drain the fuel from all components of the fuel system, to flush and fill it with the appropriate test fuel, and finally to run the engine to ensure that the system is free of air and purged of previously used fuel.

The following data of the fuel used shall be recorded (see the specimen test report given in annex A):

— type;

— density at 15 °C (see ISO 3675);

— octane number or cetane number (see ISO 5163, ISO 5164 and ISO 5165);

— pour-point (see ISO 3016).

4.2 Lubrication oil

The engine and transmission lubricating systems shall be filled with the appropriate grade of oil for operation at the test temperature as per the manufacturer's recommendation. If prior to the test the tractor has been operating with oil of a grade appropriate to other temperatures, care shall be taken in draining this oil, and filling with the appropriate oil. The oil level shall be checked after running the engine for a few minutes, and topped up, if necessary, before commencing the test. The grade of oil used shall be recorded.

4.3 Electrical starting systems

The batteries of the tractor are the only energy source allowed for use before and during the start attempts.

The batteries (original batteries and spare batteries of same model and type) shall be fully charged at room temperature and then installed in the tractor prior to the start of the cold soak (cooling down). Battery terminals and leads shall be inspected for good operating condition.

If a battery blanket is deemed to be an acceptable starting aid by the manufacturer, it shall be allowed to operate during the cold-soaking period.

4.4 Cooling system

With water-cooled systems, an antifreeze solution of appropriate strength shall be used.

4.5 Starting aids

All systems to aid starting shall be inspected for correct operation before the start of the test. Starting attempts (tests) should be made with starting aids recommended by the manufacturer, and should be recorded in the test report.

5 Test procedure

5.1 Temperature

The tractor shall be placed and maintained in an environment held at the test temperature until all temperatures are stabilized. Temperatures are considered to be stable when they change less than 2 °C in 1 h.

The process shall be repeated until the lowest temperature at which the engine is able to start is found. If the manufacturer does not request a specific starting temperature, the testing shall begin at −15 °C. If needed, subsequent testing shall be conducted at the initial starting temperature ± 2,5 °C.

The temperature of fuel, engine oil and transmission oil shall be measured in the middle of the tanks with fuel tanks full and engine oil and transmission oil at the recommended levels. The temperature of the coolant shall be measured at the top of the radiator.

The temperatures in the environment shall be measured at four points around the tractor, at approximately 1 m from it; or, if that is impossible, at half the distance between the tractor and chamber wall and at the level of the engine crankshaft centre. The temperature differences between the tractor and the four points shall not be more than 1 °C. No starting attempts are allowed until 24 h after all temperatures are stabilized at the test temperature.

Spare test batteries (to be used during subsequent tests) shall be soaked to test temperature together with the tractor and kept in the environment until the test is completed.

If no spare batteries are available, the test batteries shall be moved to a temperate environment after each test to be fully charged and then allowed to soak with the tractor to the new test temperature.

5.2 Starting

Starting shall be attempted using the normal procedure recommended by the manufacturer. A start shall be deemed successful when the engine runs with the engine speed controlled by the governor within 30 s after the starter begins to crank, without aid from the starter or any manually operated starting aid. In this test, five attempts without charging or changing the battery within a period of 5 min are permissible.

If the five attempts are unsuccessful, the tractor shall be started and run for a period of at least 15 min. The test procedure will then be repeated at a higher test temperature. If on the other hand, the engine starts, the same procedure may be followed at a lower test temperature. The operator shall determine the need for additional tests, and the temperatures at which they are conducted.

5.3 Report of low temperature starting

The following shall be reported:

— starting time;

— ambient temperature.

Annex A presents a specimen test report.

Annex A
(informative)

Specimen test report for low temperature starting

A.1 Locations

Tractor manufacturer's name and address: .....

Place of running-in: .....

Duration of running-in: .....

A.2 Specification of tractor

Tractor

Model: ..... Serial No.: .....

Engine

Make: ..... Model: .....

Type: ..... Serial No.: .....

Displacement: .....

Fuel and injection system

Capacity of fuel tank: .....

Make, type and model of injection pump (or carburettor): .....

Manufacturer's production setting: .....

A.3 Fuel and lubrication specification

Fuel

Trade name: ..... Octane (RON) No.: .....

Octane number or cetane number: ..... Density at 15 °C: .....

Type: .....

Engine oil

Trade name: ..... Type: .....

Viscosity class: .....