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Earth-moving machinery — Performance requirements for non-metallic fuel tanks

Engins de terrassement — Exigences de performance pour les réservoirs de carburant non métalliques

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Foreword

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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 21507 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 1, *Test methods relating to machine performance*.

Earth-moving machinery — Performance requirements for non-metallic fuel tanks

1 Scope

This International Standard describes the performance requirements for non-metallic fuel tanks used in earth-moving machinery as defined in ISO 6165.

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 3411, *Earth-moving machinery — Human physical dimensions of operators and minimum operator space envelope*

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 6165, *Earth-moving machinery — Basic types — Vocabulary*

ISO 11469, *Plastics — Generic identification and marking of plastics products*

ECE R 34:1975, *Uniform provisions concerning the approval of vehicles with regard to the prevention of fire risks,* modified by Amendment 01:1979, Amendment 02: 2003 and Amendment 02/Supplement 01:2004

3 Terms and definitions

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

3.1
non-metallic fuel tank
tank
enclosed compartment on a machine, made of a non-metallic material, that holds fuel

3.2
operator station
space on the machine where the operator is stationed to control the machine functions

3.3
tank installation
system that includes the non-metallic tank, the filler cap and any pipes or tubes that are connected to the tank

3.4
machine ignition temperature area
area on a machine, such as the engine, where components have hot surfaces that can ignite materials in direct contact or close proximity

4 Requirements

4.1 Protection

The tank and pipes or tubing connected to the tank shall be protected by parts of the machine frame or outer structure from contact with obstacles under or around the machine. Alternatively, unprotected tank sections shall pass the impact performance test specified in 5.1.4, and tubing or piping connected to the tank shall be protected by shielding, guarding, or guarding by location.

4.2 Corrosion resistance

The tank installation shall be designed, constructed and installed to resist the internal and external corrosion environment.

4.3 Installation

The tank installation shall accommodate the twisting and bending movements and vibrations of the machine. The connections of flexible pipes to rigid parts of the tank installation shall be so designed and constructed as to maintain a sealed connection under these dynamic conditions.

The tank shall be securely fixed. The installation arrangement or construction shall insure that any fuel leaking from the tank, its filler hole or its connections shall not collect into pools without a passive means for drainage.

If the tank is intended to contain gasoline, the tank installation shall be designed and installed in the machine in such a way that any ignition hazard due to static electricity shall be avoided.

If the filler hole is located on the side of the machine, the filler cap shall not, when closed, project beyond the external envelope of the machine.

The non-metallic fuel tank should be located on a machine so that it is neither in direct contact with, nor within 20 mm of, the surface of a machine ignition temperature area. If the tank is located within 20 mm of the surface of a machine ignition temperature area, then some protection for the tank shall be provided. A non-metallic tank material that has a temperature resistance greater than the maximum surface temperatures of the machine ignition temperature area satisfies this requirement.

4.4 Location restriction

Tanks shall not form a wall of an operator's cab. Tank surfaces or portions of the tank may be adjacent to the operator station, provided that they are located outside the operator enclosure as defined in ISO 3411. The filler hole shall not be located in the operator station.

4.5 Performance

Any fuel that might leak when the tank is being filled shall be directed away or shielded from any machine ignition temperature areas.

5 Test methods

5.1 Pressure and mechanical strength tests of the tank

5.1.1 Strength test

A pressure and mechanical strength test shall be performed on a tank installation, complete with standard tank connections, filler neck and cap. The tank shall be filled to its rated capacity with water. The water temperature during the test shall be 53 °C. All connections to the tank shall be blocked. The tank shall be subjected to a relative internal pressure of 0,03 MPa at a temperature of 53 °C ± 2 °C for a period of 5 h. During the test, the tank shall not leak or crack; however, it may be permanently deformed.

5.1.2 Elevated pressure and temperature

If the tank is intended to be in an application with higher pressure and temperature than those specified in 5.1.1, the test pressure and temperature shall be raised to represent the tank installation pressure and temperature conditions on the machine.

5.1.3 Vacuum performance test

If the tank does not have a valve to avoid under- or over-pressure, a vacuum test shall be performed on a tank installation, complete with standard tank connections, filler neck and cap. The tank shall be empty with all connections to the tank blocked. The vacuum shall be gradually increased to a relative vacuum of 0,02 MPa at a temperature of 53 °C ± 2 °C for a period of 5 h. During the test, the tank shell shall not crack or leak; however, it may be permanently deformed.

5.1.4 Impact performance test

The tank shall be filled to its rated capacity with a water-glycol mixture or with another liquid having a low freezing point which does not change the properties of the tank material, and shall then be subjected to a perforation test. During this test, the tank temperature shall be −40 ± 2 °C.

A pendulum impact testing fixture shall be used for the test. The impact body shall be of steel and have the shape of a pyramid with equilateral-triangle faces and a square base, the summit and the edges being rounded to a radius of 3 mm. The centre of percussion of the pendulum shall coincide with the centre of gravity of the pyramid; its distance from the axis of rotation of the pendulum shall be 1 m.

The total mass of the pendulum referred to its centre of percussion shall be 15 kg. The energy of the pendulum at the moment of impact shall be not less than 30 Nm (3,1 mkg) and as close to that value as possible. The test or tests shall be selected to place the most severe requirements on the vulnerable (i.e. exposed) portions of the fuel tank. The weakest fuel tank sections or points shall be determined on the basis of the shape of the tank and/or according to the way in which the tank is installed on the machine. The test point or points selected shall be indicated in the test report.

During the test, the tank shall be held in position by the fittings on the side or sides opposite to the side of impact. No leaks shall result from the test. At the choice of the manufacturer, all the impact tests may be performed on one tank or each may be performed on a different tank.

5.2 Fuel permeability

5.2.1 Test fuel

The test fuel used for the permeability test shall be the manufacturer's recommended fuel for the tank.

5.2.2 Conditions

Prior to the test, the tank shall be filled to 50 % of its rated capacity with the test fuel and stored, without being sealed, at an ambient temperature of 40 °C ± 2 °C until the weight loss per unit time becomes constant.

5.2.3 Fuel loss

The tank shall then be emptied and be refilled to 50 % of its rated capacity with test fuel, after which the openings in the tank shall be sealed and the tank shall be stored at a temperature of 40 °C ± 2 °C. The pressure shall be adjusted to atmospheric pressure when the contents of the tank have reached the testing temperature. During the ensuing test period, the loss of weight due to diffusion during the test period shall be determined. The maximum permissible average loss of fuel shall be 20 g/m^2 for the area of the inside of the tank that is in contact with the test fuel, per 24 h of testing time. This permeability test can be performed using a test specimen of the fuel tank material and test conditions that represent the test conditions for the complete tank testing.

5.3 Resistance to fuels

After performing the test specified in 5.2, the tank shall still meet the requirements set out in 5.1.

5.4 Fire resistance

The non-metallic fuel tank shall be made of a material that

a) has a burn rate of less than 50 mm/min, as tested according to ISO 3795,

or

b) complies with the fire test requirements of ECE R 34:1975, Annex 5.

5.5 Resistance to high temperatures

5.5.1 Test fixture

The fixture used for the test shall match the manner of installation of the tank on the machine, including the way in which the tank vent works.

5.5.2 Test condition

The tank, filled to 50 % of its rated capacity with water at 20 °C, shall be subjected for 1 h to an ambient temperature of 95 °C ± 2 °C.

5.5.3 Performance criteria

The results of the test shall be considered satisfactory if the tank is not leaking nor seriously deformed, such that connections or mountings are damaged or failed, after completion of the test.

6 Marking

The tank shall be marked using a system based on ISO 11469, as appropriate.