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Safety of toys —

Part 1: Safety aspects related to mechanical and physical properties

AMENDMENT 2: Magnets

Sécurité des jouets —

Partie 1: Aspects de sécurité relatifs aux propriétés mécaniques et physiques

AMENDEMENT 2: Aimants

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Foreword

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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.

Amendment 2 to ISO 8124-1:2009 was prepared by Technical Committee ISO/TC 181, *Safety of toys*.

Safety of toys —

Part 1:
Safety aspects related to mechanical and physical properties

AMENDMENT 2: Magnets

Page 3, Terms and definitions

Add the following definitions:

3.23
functional magnet in electrical or electronic components of toys
any magnet necessary for the function of motors, relays, speakers and other electrical or electronic components in a toy where the magnetic properties are not part of the play pattern of the toy

Renumber subsequent definitions accordingly.

3.38
magnetic component
any part of a toy which contains an attached or fully or partially enclosed magnet

3.39
magnetic/electrical experimental set
toy containing one or more magnets intended for carrying out educational experiments involving both magnetism and electricity

Renumber subsequent definitions accordingly.

Page 36, Clause 4

Add the following requirements:

4.30 Magnets and magnetic components

See Clause E.44.

The requirements in 4.30.1 and 4.30.2 do not apply to functional magnets in electrical or electronic components of toys.

4.30.1 Magnetic/electrical experimental sets intended for children 8 years and over

Magnetic/electrical experimental sets intended for children 8 years and over that contain magnetic components shall carry a warning (see B.2.21 for guidance) if they both:

— have a magnetic flux index greater than 50 kG^2mm^2 (0,5 T^2mm^2) when tested according to 5.32 (magnetic flux index), and

— fit entirely in the cylinder when tested according to 5.2 (small parts test).

NOTE Requirements for magnetic/electrical experimental sets intended for children under 8 years are given in 4.30.2.

4.30.2 All other toys with magnets and magnetic components

a) Any loose-as-received magnet(s) and magnetic component(s) either shall have a magnetic flux index less than 50 kG^2mm^2 (0,5 T^2mm^2) when tested in accordance with 5.32 (magnetic flux index), or shall not fit entirely in the cylinder when tested in accordance with 5.2 (small parts test).

b) Wooden toys, toys intended to be used in water and mouth pieces of mouth-actuated toys with magnets or magnetic components shall be tested in accordance with 5.34 (soaking test for magnets) before being tested in accordance with 4.30.2 c).

c) The following tests shall be carried out in the prescribed order on all unique magnetic component(s). The components used for this testing shall not have been previously subjected to normal use and reasonably foreseeable abuse tests. Any magnet(s) and magnetic component(s) that become liberated from a toy, or from a loose-as-received magnetic component either shall, when tested according to the subclauses listed below, have a magnetic flux index less than 50 kG^2mm^2 (0,5 T^2mm^2) when tested in accordance with 5.32 (magnetic flux index), or shall not fit entirely in the cylinder when tested according to 5.2 (small parts test).

   — 5.31 (tension test for magnets);

   — 5.24.2 (drop test) or, if applicable, 5.24.3 (tip over test for large and bulky toys);

   — 5.24.5 (torque test);

   — 5.24.6.1 (tension test, general procedure);

   — 5.24.6.2 [tension test for seams in soft-filled (stuffed) toys, beanbag-type toys and other similar filled toys], if applicable;

   — 5.33 (impact test for magnets);

   — 5.24.7 (compression test), for magnets that are accessible but cannot be grasped [as specified in 5.24.6.1 (general procedure)];

   — 5.31 (tension test for magnets).

   NOTE 1 Examples of unique magnetic components are rods of different sizes or shapes containing magnets.

   NOTE 2 If the toy contains one magnet, the component holding the magnet is considered to be a unique component.

   NOTE 3 An example of a magnet that is accessible but cannot be grasped is a magnet that is recessed.

Page 49, 5.14

Replace the third paragraph with the following*:*

Drop a steel ball with a diameter of (16 ± 0,15) mm and mass of (16,9 ± 0,7) g from a height of (130 ± 0,5) cm onto the horizontal upper surface of the toy in the area that would cover the eyes in normal use.

Page 54, 5.24.1

Add the following note at the end of the subclause:

NOTE The tests specified in 4.30.2 are carried out in the order specified in 4.30.2 on a toy, or part of a toy, that has not been previously tested according to this subclause (5.24).

Page 71, Clause 5

Add the following test methods:

5.31 Tension test for magnets

See 4.30.2 c).

5.31.1 Principle

These tests simulate the intended or reasonably foreseeable play pattern. It is recognized that toys may contain a single magnet or a combination of magnets, magnetic components and/or metal mating parts; the tests are designed to simulate a reasonably foreseeable play pattern using these components to attach and detach the magnetic parts.

For toys that contain more than one magnet/magnetic component, the test specified in 5.31.2 shall be carried out unless it is not possible to perform the test without damaging the toy. In the latter case, the test shall be carried out using the reference disc, as described in 5.31.4.

NOTE An example of a case where it is not possible to perform the test in 5.31.2 with magnet(s) or magnetic component(s) without damaging the toy, is a toy figurine with one accessible but non-graspable magnet in each foot.

Toys that contain one magnet only and a mating metal component shall be tested according to 5.31.3.

Toys that contain one magnet only and no mating metal component, shall be tested according to 5.31.4, since this simulates a play pattern where the toy is attached and detached to a surface that is not delivered with the toy.

5.31.2 Toys with magnets or magnetic components

Identify the magnet or magnetic component in the toy that is most likely to be able to detach. The identified magnet or magnetic component shall be subjected to the tension test for magnets.

If it is not possible to determine which magnet or magnetic component(s) in the toy is most likely to be able to detach the magnet under test, it is permissible to repeat the test with another magnet or magnetic component from the toy.

Without damaging the toy, place the magnet or magnetic component in the orientation of attraction, as close as possible, making contact if possible, to the magnet to be tested. Gradually apply a pulling force to the magnet/magnetic component until it separates from the magnet under test. Perform the test 10 times or until the magnet under test is detached from the toy, whichever occurs first.

Repeat the procedure for any other magnet that, in accordance with 4.30.2, shall be subjected to the tension test for magnets.

5.31.3 Toys that contain one magnet only and a mating metal component

Without damaging the toy, place the metal components as close as possible, making contact if possible, to the magnet to be tested. Gradually apply a pulling force to the metal component until it separates from the magnet under test. Perform the test 10 times or until the magnet under test is detached from the toy, whichever occurs first.

5.31.4 Toys that contain one magnet only and no mating metal component

5.31.4.1 Apparatus

5.31.4.1.2 Nickel disc with a minimum nickel content of 99 %, a diameter of (30 ± 0,5) mm and thickness of (10 ± 0,5) mm.

5.31.4.2 Procedure

Without damaging the toy, place the flat part of the disc as close as possible to the magnet to be tested, making contact if possible. Gradually apply a pulling force to the disc until it separates from the magnet

under test. Perform the test 10 times or until the magnet under test is detached from the toy, whichever occurs first.

5.32 Magnetic flux index

5.32.1 General

See 4.30.1, 4.30.2 a) and c).

5.32.2 Principle

The magnetic flux index is calculated based on the results from measurements of the flux density and the pole surface area.

5.32.3 Apparatus

5.32.3.1 **Direct current field Gauss meter**, with a resolution of 5 G, capable of determining the field to an accuracy of 1,5 % or better. The meter shall have an axial type probe with an active area diameter of (0,76 ± 0,13) mm and a distance between the active area and probe tip of (0,38 ± 0,13) mm.

5.32.3.2 **Calliper**, or **similar device**, with an accuracy of 0,1 mm.

5.32.4 Procedure

5.32.4.1 Measurement of flux density

Identify the surface of the magnet that is a pole.

Place the tip of the Gauss meter probe in contact with the pole surface of the magnet. For a magnetic component (where the magnet is fully or partially embedded in part of the toy), place the tip of the probe in contact with the surface of the component.

Maintain the probe in a position perpendicular to the surface.

Move the probe across the surface to locate the maximum absolute value of the flux density. Record the maximum absolute value of the flux density.

NOTE Since the meter can read both negative and positive values, the absolute value is used for calculations.

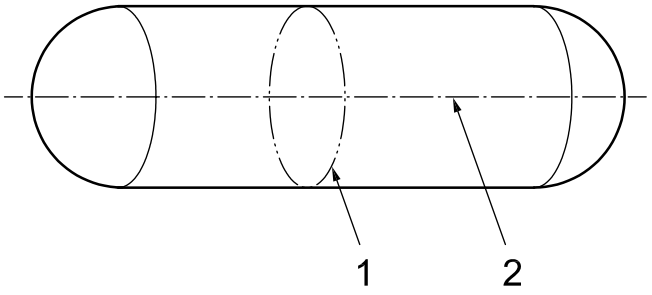
5.32.4.2 Measurement and calculation of the pole surface area

If the magnet is embedded/attached as part of a magnetic component, extract the magnet from the component, even if it is necessary to break the toy.

If the pole surface of the magnet is flat, measure the dimensions with an accuracy of ± 0,1 mm and calculate the area using the appropriate geometric formula.

If the pole is not flat (for example hemispherical), measure the maximum diameter of the magnet perpendicular to an axis through the magnetic poles (see Figure 34), with an accuracy of ± 0,1 mm and calculate the area of the corresponding cross section. For multi-pole magnets, measure and calculate the area of the largest single pole, which can be identified using magnetic field viewing film or equivalent.

NOTE An example of a multi-pole magnet is a rubberized/plastoferrite magnet, consisting of multiple strips or poles.



Key

1 maximum cross-section perpendicular to the axis

2 axis through the magnet poles

Figure 34 — Maximum diameter of magnet with a non-flat pole

5.32.5 Calculation of magnetic flux index

The flux index (kG^2mm^2) is calculated by multiplying the calculated area of the pole surface (mm^2) of the magnet by the square of the maximum flux density (kG^2).

5.33 Impact test for magnets

See 4.30.2 c).

Place the relevant component of the toy in the most onerous position on a plane horizontal steel surface and drop a metallic weight with a mass of (1 ± 0,02) kg, distributed over a diameter of (80 ± 2) mm, through a distance of (100 ± 2) mm onto the toy.

Determine whether any liberated magnets or magnetic components fit entirely in the cylinder when tested in accordance with 5.2 (small parts test).

5.34 Soaking test for magnets

See 4.30.2 b).

Submerge the toy or toy component completely in a container of demineralized water at a temperature of (21 ± 5) °C for 4 min. Remove the toy, shake off the excess water and keep the toy at room temperature for 10 min.

Perform the soaking test for a total of four cycles.

Immediately after the last cycle, determine whether any liberated magnets or magnetic components fit entirely in the cylinder when tested in accordance with 5.2 (small parts test).

Page 80, Annex B

Add the following subclause:

B.2.21 Magnetic/electrical experimental sets for children 8 years and over

See 4.30.1 and Clause E.44.

The packaging and the instructions for use of magnetic/electrical experimental sets intended for children 8 years and over shall carry a statement comparable or similar to the following.

“Warning. Not suitable for children under 8 years. This product contains (a) small magnet(s).

Swallowed magnets can stick together across intestines causing serious injuries. Seek immediate medical attention if magnet(s) are swallowed.”

Page 97, Clause E

Add the following clause:

E.44 Magnets

See 4.30.

These requirements are intended to address the hazards associated with ingestion of strong magnets [e.g. neodymium iron boron type magnets (NIB)], that are capable of causing intestinal perforation or blockage. These hazards are additional to those associated with small parts, such as suffocation or asphyxiation (see E.6). These requirements apply regardless of the age of the intended user.

Magnets found by children can be ingested. If more than one magnet, or one magnet and a ferromagnetic object (for example an iron or nickel object) is ingested, the objects can attract each other across intestinal walls and cause perforation or blockage, which can cause severe injuries that can be fatal.

Multiple incidents, including at least one fatality, have been reported involving ingestion of magnets resulting in perforation or blockage of the intestines. These incidents have involved children younger and older than 3 years of age. Medical signs associated with intestinal perforation or blockage can easily be misinterpreted since many children exhibit only flu-like symptoms. Such misinterpretations have caused delays in the medical treatment and led to serious consequences for children.

For the purpose of this International Standard, magnets or magnetic components that can be ingested are identified using the small parts cylinder. The small parts cylinder was originally designed to identify small parts in toys intended for children under 3 years of age, which are capable of causing suffocation or asphyxiation. It was not designed for identifying objects that can be ingested by older children. The decision to use the small parts cylinder also for assessment of magnets or magnetic components that can be ingested was made for practical reasons: The cylinder is a well known test template and it provides a safety margin since the magnets and magnetic components that have been involved in incidents all fit into the cylinder with a large margin. This same principle has been applied in the requirements for expanding materials.

The risk of magnets attracting each other across intestinal walls is a function of magnet strength. A limit value in the form of a magnetic flux index has been introduced to define what a sufficiently weak magnet is. Analysis of the data indicates that only the small, powerful NIB type magnets have been involved in the known incidents. Further analysis has determined that magnets with a magnetic flux index less than 50 kG^2mm^2 (0,5 T^2mm^2) are considered appropriate to ensure, with a safety margin, that powerful magnets of this type will not be permitted for use in toys if they fit entirely within the small parts cylinder. By introducing the flux index limit, the risk of injuries with magnets will be minimized. As additional data becomes available in the future, this limit will be assessed to determine whether it is still appropriate.

Two or more magnets can attract each other and form a compound magnet with a higher flux index than each single magnet. The flux index will not double if two equally strong magnets are attracted to each other, and the increase in flux index will be relatively smaller for every new magnet that is added and will depend on magnetic material, shape, cross-section, etc. Ingestion of multiple magnets has only been observed

with stronger magnets and there is no incident data regarding weak magnets close to the flux index limit forming a (stronger) compound magnet. Therefore, no additional test for compound magnets is introduced.

Toys that contain magnets and which can be expected to become wet during normal and foreseeable use are subjected to a soaking test to ensure that glued magnets do not detach when the toy is wet. Also, wooden toys are subjected to the test since the properties of wood (such as size of holes) can change even with changes in air humidity.

In some cases, magnets are recessed and therefore cannot be subjected to the normal torque and tension tests. Examples of toys have been found where a magnet has become detached by another magnet. A tension test for magnets has been introduced to minimize the risk that such magnets become detached during normal and foreseeable play.

For toys that comprise only one magnetic component, that toy is considered to meet the definition of a magnetic component (see 3.38).

Functional magnets in toys are not considered to present the same risk as magnets that form part of the play pattern. The use of magnets in these components may not be recognized, as they will be present inside electrical motors or in relays in electronic circuit boards. None of the reported incidents has been linked to magnets released from electrical or electronic components.

Magnetic/electrical experimental sets that are intended for children 8 years and over are excluded from the requirements in 4.30.2 and instead they are required to carry the prescribed warning. The exception applies to only the more advanced experimental sets that include building of electrical motors, loudspeakers, doorbells, etc., i.e. products that require both magnetism and electricity for their function. It should be noted that the warning aligns with the requirements of EN 71-1 but not ASTM F963. However, magnetic/electrical experimental sets that carry the ASTM F963 warning will be in compliance with the ISO warning since the ASTM F963 text is considered to be “comparable”. Magnetic/electrical experimental sets that are intended for children under 8 years are, therefore, required to comply with the requirements in 4.30.2.

Page 98, Bibliography

Replace Reference [4] with the following:

[4] EN 71-1:2011, *Safety of toys — Part 1: Mechanical and physical properties*

ICS 97.200.50

Price based on 7 pages