TECHNICAL SPECIFICATION

ISO/TS 29584

First edition
2012-10-15

Glass in building — Pendulum impact testing and classification of safety glass for use in buildings

Verre dans la construction — Essai d'impact au pendule et classification du verre de sécurité utilisé dans les bâtiments

Reference number
ISO/TS 29584:2012(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/TS 29584 was prepared by Technical Committee ISO/TC 160, *Glass in building*, Subcommittee SC 2, *Use considerations*.

Introduction

This Technical Specification has been prepared as a means of detailing the differences and similarities in pendulum impact tests for the classification of safety glass.

The traditional impactor has been a lead shot-filled leather bag. This has been found to suffer from ageing or shape change and variability in the energy transfer into the test piece if not properly maintained. It has been found that there can be wide variation in the supporting frame or sub-frame.

During their work, CEN/TC 129, *Glass in building*; WG 13, *Safety test methods*; examined some of the problems associated with the lead shot-filled leather bag impactor and the supporting frame. CEN/TC 129/WG 13 prepared EN 12600[5], that uses an impactor consisting of steel masses and two tyres.

The primary objectives in developing the new impactor for the evaluation of safety glass can be summarized as follows:

a) elimination of the differences between:

   1) taped and untaped lead shot bags,

   2) lead shot bags and bags filled with sand or glass beads;

b) ageing of lead shot bag;

c) elimination of the use of lead shot;

d) harmonization of national impact test methods.

Glass in building — Pendulum impact testing and classification of safety glass for use in buildings

1 Scope

This Technical Specification examines test methods currently employed to determine the pendulum impact performance of safety glass. Use of the methodologies in this Technical Specification improves the reproducibility of test results and gives a common basis of classification. The aim is for the performance of glass products manufactured and tested in various countries to be better understood and accepted.

This Technical Specification evaluates, by means of soft body impactors, safe breakage characteristics of glazing products intended to reduce cutting and piercing injuries to persons through accidental impact.

This Technical Specification defines two types of soft body impactor. The traditional shot bag impactor is detailed both in terms of manufacture and maintenance in an attempt to overcome problems associated with such impactors becoming misshapen. The twin tyre impactor is also detailed.

This Technical Specification also describes the test equipment, excluding the impactor. A method of calibrating the test frame is given. The benefit of calibrating the test equipment is the increased reproducibility of the test results.

This Technical Specification also details the classification of glass products. The classification system allows information on the following to be given:

a) the maximum drop height at which the glass either did not break or broke safely, i.e. in a manner similar to laminated glass or toughened glass;

b) the manner in which the glass would break, i.e. as toughened glass, laminated glass, annealed glass, irrespective of whether or not the glass was broken during the test;

c) the maximum drop height at which the glass either did not break or broke safely, i.e. in a manner similar to laminated glass.

This Technical Specification does not specify the intended use of the products, but provides a method of classification in terms of the performance of the materials being tested. The impact energy used for the various levels of classification are designed to provide the intended user or the legislator with the information to assist in defining the level of safety and protection required relative to the intended location at which the selected safety glass is to be used.

NOTE The eventual aim is to develop an International Standard covering the pendulum impact testing of safety glass for use in building. Such a standard could be cited as a normative reference, e.g. in ISO 12543-2[3].

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 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 2408, *Steel wire ropes for general purposes — Minimum requirements*

ISO 4251-1, *Tyres (ply rating marked series) and rims for agricultural tractors and machines — Part 1: Tyre designation and dimensions, and approved rim contours*

3 Terms and definitions

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

3.1
safety glass
glass, which if fractured, gives fragments which are less likely to pierce or to cause severe cuts than fragments of ordinary annealed glass

NOTE Adapted from ISO 6345:1990[1], 6.4.

EXAMPLE Laminated glass and wired glass.

3.2
safety glazing material
glazing material so constructed, treated or combined with other materials that, if broken by accidental human contact, the likelihood of cutting and piercing injuries that might result from such contact is minimized

3.3
soft body impactor
impactor that is representative of a human body

EXAMPLE A soft body impactor can be either a shot bag (see 6.1.3.1) or a twin tyre (see 6.1.3.2) type.

3.4
asymmetric material (1)
glass that has different surface characteristics on opposite faces, e.g. patterning, coating

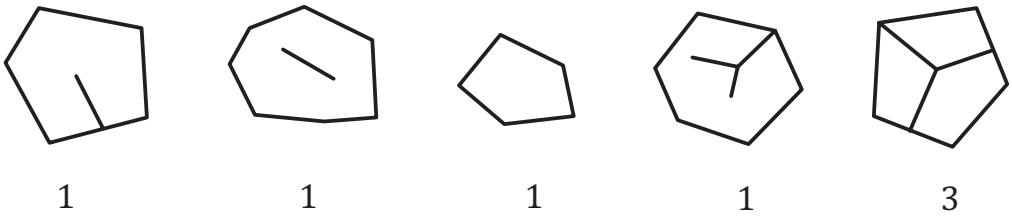
3.5
asymmetric material (2)
glass manufactured from laminations of glass or plastics glazing sheet material together with interlayer materials that are arranged in different sequential order and of varying thicknesses

3.6
drop height
vertical height from the horizontal centre line of the impactor at the point of release to the horizontal centre line of the impactor when at rest vertically

3.7
crack-free particle
piece of glass that does not contain any cracks that run from one edge to another

NOTE See Figure 1.

3.8
masking
temporary protective covering applied to the test piece for ease of transportation



Key

1, 3 numbers of crack free particles in each piece of glass

Figure 1 — Example of crack free particles

4 Principle

Accidental human impact with glass panes can be a source of injury. The classification of glass in terms of its ability to withstand impact and the consequences of the glass breaking under such impact has been considered in many countries. The use of a soft body impactor to represent a human body has enabled regulators, code officials, and other control organizations to specify glazing that reduces the risk of cutting and piercing injuries. The test method defines the safe breakage characteristics for different types of glass (see Clause 5).

It is the intent of this Technical Specification to bring together the latest technology and understanding of how safety glass is to be tested and to evaluate and classify the result. The test provides a means of determining the retention characteristics and performances of various types of safety glazing materials.

5 Test requirements

5.1 When tested by the method given in Clause 6, each test piece shall either not break or shall break as defined in either 5.2 or 5.3.

5.2 Numerous cracks appear, but no shear or opening is allowed within the test piece through which a (76 ± 1) mm diameter sphere can pass when a maximum force of 25 N is applied (in accordance with Annex C).

Additionally, if particles are detached from the test piece up to 3 min after impact, they shall, in total, weigh no more than the mass equivalent to 10 000 mm^2 of the original test piece. The largest single particle shall weigh no more than the mass equivalent of 4 400 mm^2 of the original test piece.

5.3 The ten largest crack-free particles collected within 3 min after impact shall weigh no more than the mass equivalent of 6 500 mm^2 of the original test piece.

6 Test method

6.1 Test apparatus

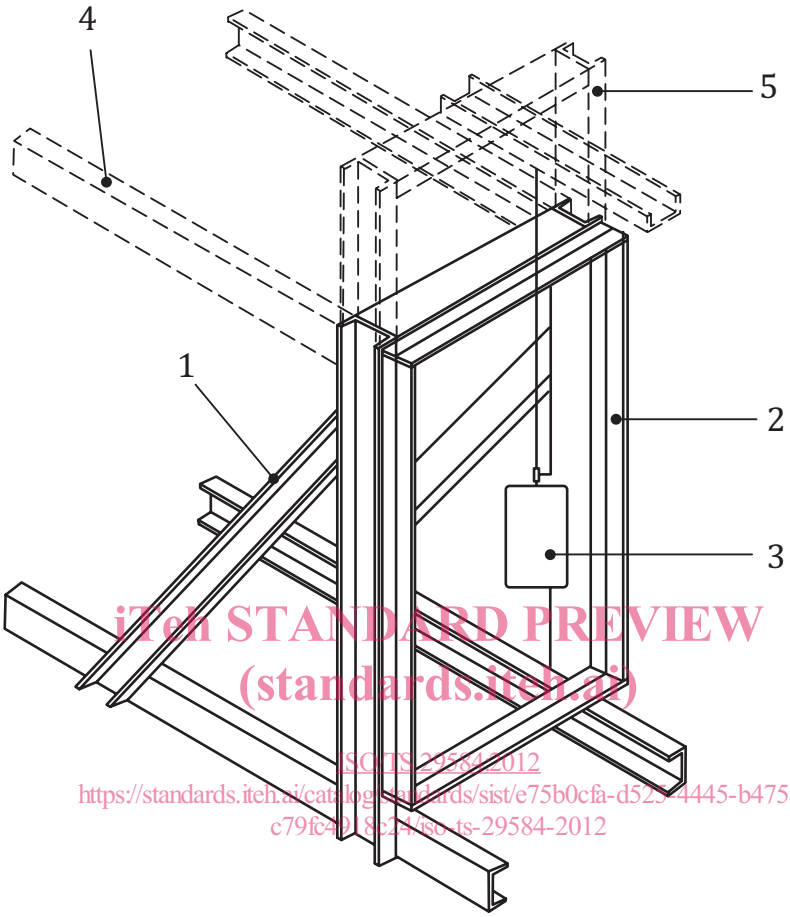
6.1.1 **Main frame**, constructed from welded or bolted, hot-rolled steel channel sections with rounded edges, designed to present a rigid and flat surface to the sub-frame. See Figures 2 and 3. The lower cross members shall be securely fixed to a concrete floor.

NOTE Additional support to the frame can be provided, if required, by means of horizontal steel sections fixed to an adjacent rigid wall (see Figure 2, key item 4).

The dimensions of the main frame (see Figure 4) shall be:

— internal width: (847 ± 5) mm;

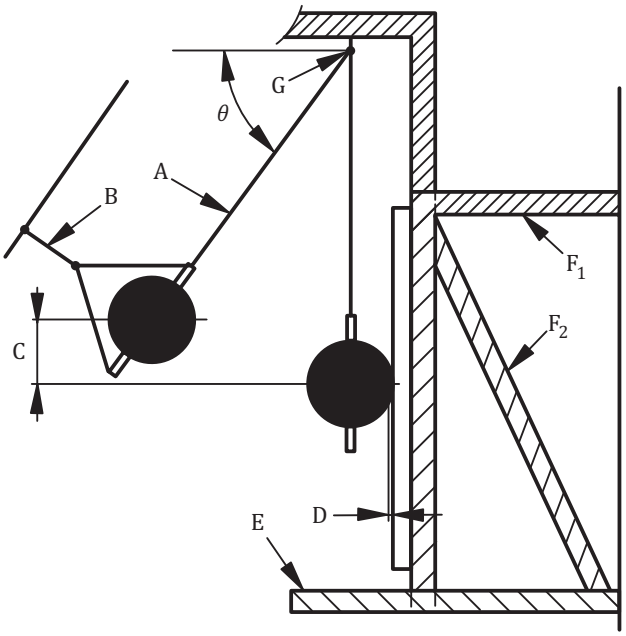
— internal height: (1 910 ± 5) mm.



Key

1 main frame
2 clamping frame
3 impactor
4 optional support member
5 optional suspension device

Figure 2 — Test frame



Key

A suspension cable
B traction cable
C drop height
D impactor distance from sample
E support member
F_1 optional support member
F_2 cross members
G bracket (5 mm ≤ d ≤ 15 mm)
θ impactor angle from horizontal

Figure 3 — Side elevation of the main frame with the impactor

Dimensions and tolerances in millimetres

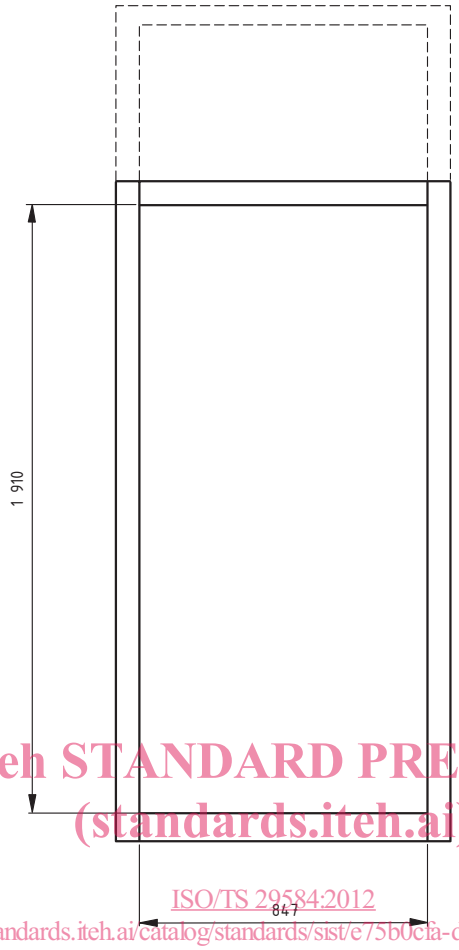


Figure 4 — Dimensions of the front elevation of the frame

6.1.2 Clamping frame, fitted on to the main frame and used to hold the test piece in position for the duration of the test, consisting of two rectangular parts which clamp the test piece along its perimeter. See Figure 5. The inner part of the clamping frame is attached to the main frame.

The assembly is held together by a clamping device. The clamping frame shall be suitably rigid to withstand the pressure exerted by the clamping device.

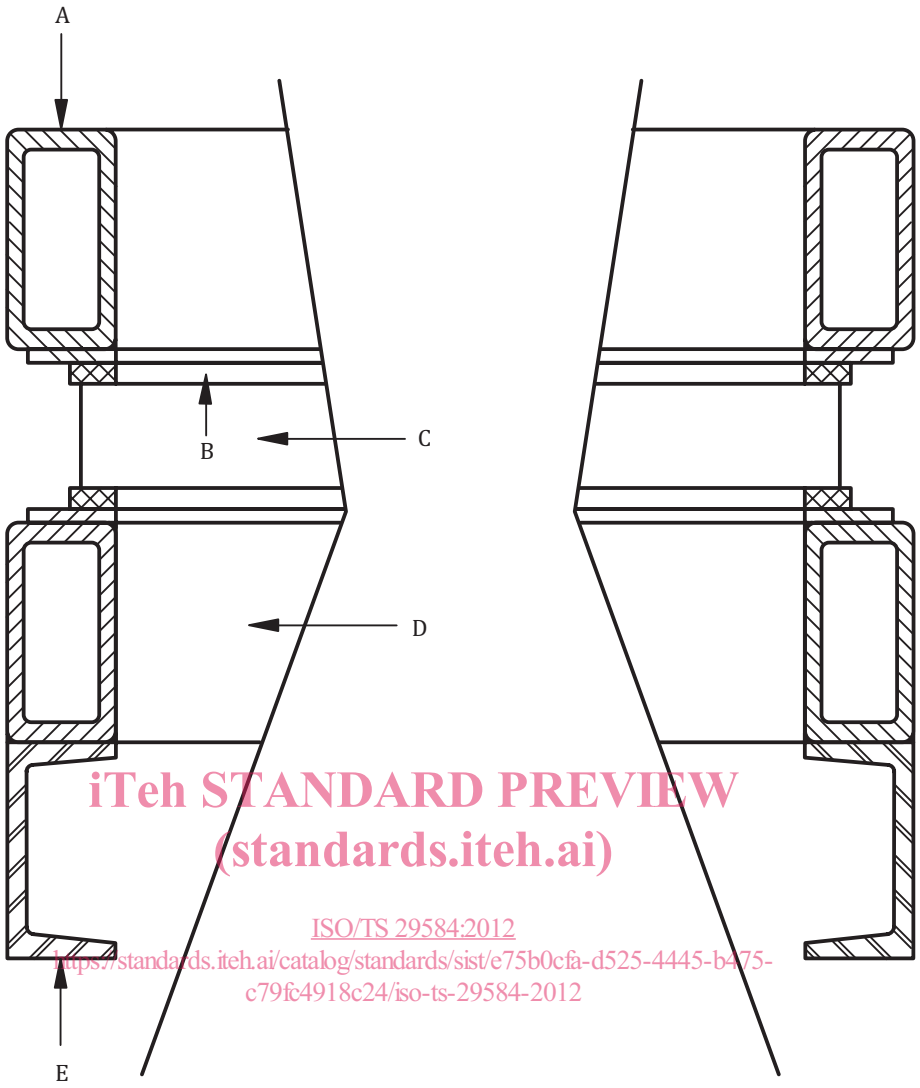
The dimensions of the clamping frame shall be:

— internal width: (847 ± 5) mm;

— internal height: (1 910 ± 5) mm.

Each part of the clamping frame shall be fitted with a strip of rubber. The rubber strips shall be the only element in contact with the test piece and shall be (20 ± 2) mm wide and (10 ± 1) mm thick and have a hardness of (60 ± 5) IRHD in accordance with ISO 48.

NOTE Polychloroprene (neoprene) or a similar material is suitable.



Key

A clamping frame e.g. ~100 mm × 50 mm × 8 mm
B rubber strips (20 ± 2) mm × (10 ± 1) mm
C test piece
D outer part of the main frame e.g. ~100 mm × 50 mm × 8 mm
E inner part of the main frame e.g. ≤100 mm × 50 mm

Figure 5 — Example of clamping of the test piece

6.1.3 Impactor, of type 6.1.3.1 or 6.1.3.2, suitable for use with the suspension device (6.1.4) and release mechanism (6.1.5).

6.1.3.1 Lead shot bag.

6.1.3.1.1 General description. The bag (see Figure 6a) is a reinforced leather bag filled with chilled lead shot of diameter (2,5 ± 0,1) mm providing a total mass of (45 ± 0,1) kg. See Figure 6a. The bag is constructed of 1,5 mm thick pliable leather.

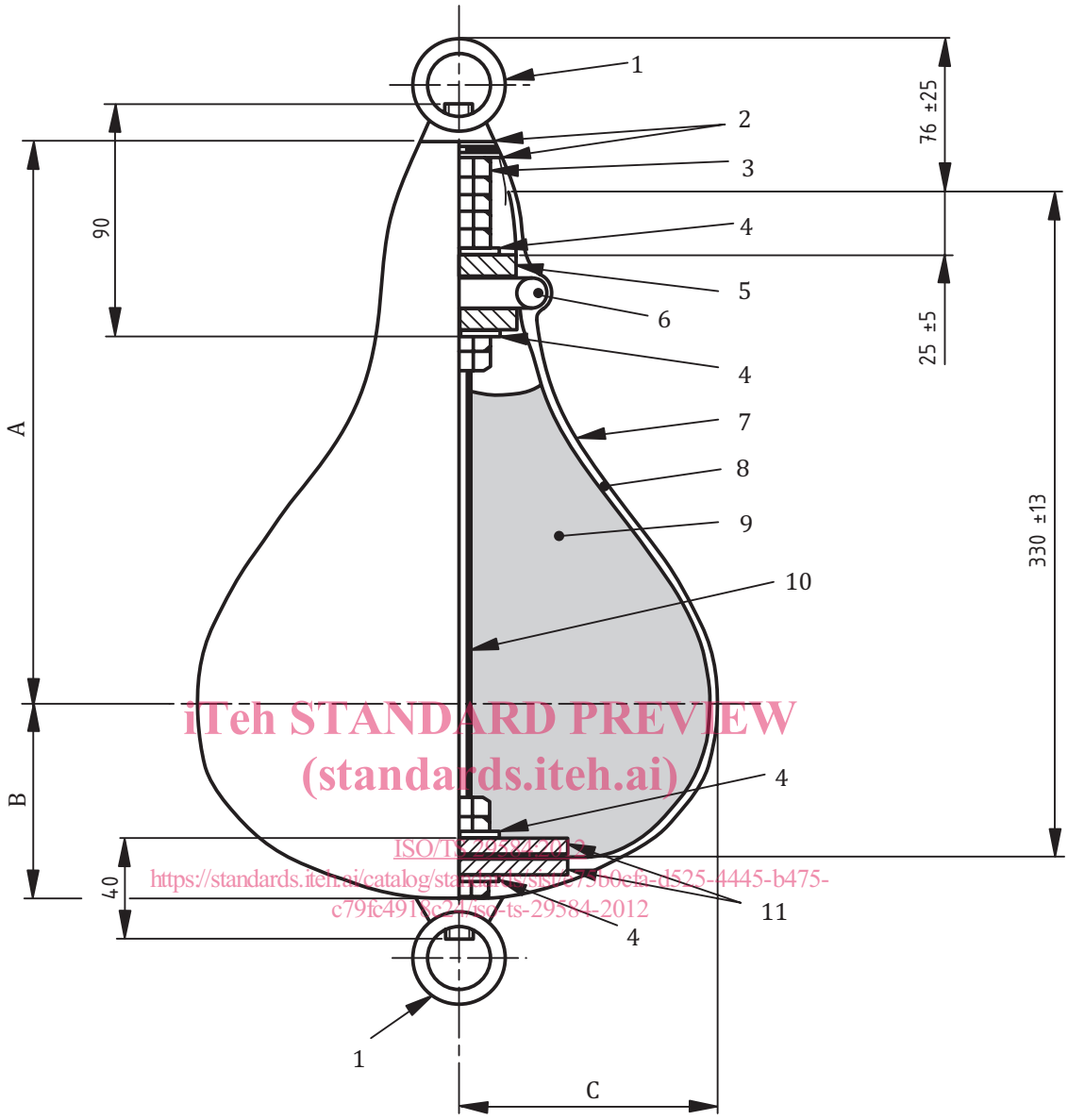
6.1.3.1.2 Method of manufacture. See Annex A.

6.1.3.1.3 Maintenance. Inspect the shot bag impactor at intervals of 1 000 impacts and calibrate as required. If the tape of the impactor is damaged (e.g. when glass fibres are apparent, or the leather bag is visible), it shall be removed and replaced according to Annex A. When the deformation of the impactor is beyond the tolerances, the impactor shall be reshaped manually. If the impactor cannot be restored to within the tolerances, it shall be replaced.

Remove all glass particles embedded in the surface of the impactor.

The tolerances of dimensions for the impactor are shown in Figure 6a.

Dimensions and tolerances in millimetres



Key

		No. required	Remarks
1	eye nut	2	M10
2	plane washer	2	M10
3	hexagonal nut	10	M10
4	spring washer	4	M10
5	sleeve nut	1	length: 25 mm; diameter: 32 mm
6	hose clamp	1	
7	glass fibre-reinforced adhesive polyester tape (see Note 2)	3 rolls	width: 12 mm; thickness: 0,15 mm
8	leather bag	1	synthetic leather (see Note 1)
9	lead shot	~45 kg	chilled shot, diameter: (2,5 ± 0,1) mm
10	threaded metal rod	1	M10 Length : 400mm
11	metal washer	2	Thickness: 4.8 ± 1.6mm Diameter: 76 ± 3mm