
International Standard



5395/3

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

**Power lawn mowers, lawn tractors, and lawn and garden tractors with mowing attachments — Safety requirements and test procedures —
Part 3: Requirements for rotary mowers**

Tondeuses à gazon à moteur, tracteurs de pelouse, tracteurs de jardin et de pelouse avec équipements de tonte adaptables — Règles de sécurité et méthodes d'essai — Partie 3: Spécifications des tondeuses à axe vertical

Second edition — 1985-03-15

UDC 631.352

Ref. No. ISO 5395/3-1985 (E)

Descriptors: agricultural machinery, horticultural machinery, lawn mowers, power horticultural machinery, safety requirements, specifications, tests, test equipment.

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5395/3 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

ISO 5395/3 was first published in 1981. This second edition cancels and replaces the first edition, to which the following items have been added:

- clauses 12, 15 and 21 to 23 (draft Addendum 2);
- clauses 16 to 20 (Addendum 1);
- annexes A, B and C (draft Addendum 2).

Contents

	Page
0 Introduction	1
1 Scope and field of application	1
2 References	1
Section one: Rotary mowers — General construction	
3 Blade enclosure	2
4 Discharge openings	2
5 Guards and grass catchers	2
6 Blades	2
Section two: Rotary mowers — Test procedures	
7 General test conditions	3
8 Impact test	3
9 Imbalance test	3
10 Foot probe test	3
11 Blade security test	4
12 Thrown object and structural integrity tests	4
Section three: Rotary mowers — Pedestrian-controlled machines — Requirements	
13 Controls	16
14 Handle construction	16
15 Blade enclosure — Front and rear	16
16 Safety instructions	17
Section four: Rotary mowers — Ride-on (riding) machines — Requirements	
17 Controls	19
18 Brake requirements and test method	19
19 Stability requirements and test method	19
20 Safety instructions	21

Section five: Towed units – Requirements

21	Hitches	23
22	PTO drive-shafts to power source	23
23	Controls	23

Annexes

A	Thrown object test fixture	24
B	Corrugated fibreboard penetration tests on rotary mowers	26
C	Specimen test report of thrown object test	28
D	Handle construction requirements for mowers weighing less than 10 kg	30

Power lawn mowers, lawn tractors, and lawn and garden tractors with mowing attachments — Safety requirements and test procedures —

Part 3: Requirements for rotary mowers

0 Introduction

This part of ISO 5395 forms part of a series covering safety requirements and test procedures for power lawn mowers, lawn tractors, and lawn and garden tractors with mowing attachments. The complete list of parts will be as follows:

Part 1: Definitions.

Part 2: Basic requirements.

Part 3: Requirements for rotary mowers.

Section one: General construction.

Section two: Test procedures.¹⁾

Section three: Pedestrian-controlled machines — Requirements.

Section four: Ride-on (riding) machines — Requirements.

Section five: Towed units — Requirements.

Part 4: Requirements for cylinder (reel) mowers.

Section one: General construction.

Section two: Test procedures.

Section three: Pedestrian-controlled machines — Requirements.

Section four: Ride-on (riding) machines — Requirements.

Section five: Towed units — Requirements.

Part 5: Test code for the measurement of airborne noise with a view to determining compliance with noise limits.²⁾

1 Scope and field of application

This part of ISO 5395 specifies safety requirements and test procedures applicable to powered rotary mowers, including pedestrian-controlled and ride-on (riding) types, ride-on (riding) lawn tractors, and lawn and garden tractors with mower attachments, designed primarily for use around the home, and having a width of cut greater than 300 mm.

NOTES

1 This part of ISO 5395 does not apply to Sulky-type attachments, flail mowers, or sickle bar mowers; the electrical aspects of electrically driven machines with voltages above 42 V are not covered.

2 Additional requirements for ride-on (riding) lawn tractors and lawn and garden tractors, having a drawbar pull up to 6 600 N, are specified in ISO 500.

3 Where applicable, the requirements of this part of ISO 5395 can be applied to professional (commercial) power lawn mowers, lawn and garden tractors and lawn tractors.

2 References

ISO/R 58, *Substances of paper*.

ISO 2758, *Paper — Determination of bursting strength*.

ISO 2759, *Board — Determination of bursting strength*.

ISO 3304, *Plain end seamless precision steel tubes — Technical conditions for delivery*.

ISO 3305, *Plain end welded precision steel tubes — Technical conditions for delivery*.

ISO 3306, *Plain end as-welded and sized precision steel tubes — Technical conditions for delivery*.

1) The structural integrity test is still under study and will form the subject of a future addendum.

2) At present at the stage of draft.

ISO 3600, *Tractors and machinery for agriculture and forestry — Operator manuals and technical publications — Presentation.*

ISO 3767, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays —*

Part 1: Common symbols.

Part 3: Symbols for powered lawn and garden equipment.¹⁾

ISO 3789/3, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Location and method of operation of operator controls — Part 3: Controls for powered lawn and garden equipment.*

ISO 4200, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length.²⁾*

ISO 4254/1, *Tractors and machinery for agriculture and forestry — Technical means for providing safety — Part 1: General.¹⁾*

ISO 5395/2, *Power lawn mowers, lawn tractors, and lawn and garden tractors with mowing attachments — Safety requirements and test procedures — Part 2: Basic requirements.*

IEC Publication 335-1, *Safety of household and similar electrical appliances — Part 1: General requirements.*

IEC Publication 335-18, *Safety of household and similar electrical appliances — Part 2: Guidelines for the safety of battery-powered, motor-driven and magnetically driven appliances for household and similar appliances and their charging and battery assemblies.*

Section one : Rotary mowers — General construction

3 Blade enclosure³⁾

The blade enclosure shall extend beyond the plane of the blade tip circle, except at the grass discharge opening. The blade enclosure shall be subjected to the foot probe test (see section two, clause 10) and the thrown object test (see section two, clause 12).

4 Discharge openings³⁾

When discharge openings are provided, the tangential extension of the discharge chute perimeters shall not intersect the operator zone when the mower is set at any height of cut; also no tangential line from the blade tip circle shall intersect the operator zone without first contacting the blade enclosure or guard.

5 Guards and grass catchers³⁾

The grass catcher and/or guards, when properly and completely installed, shall effectively prevent objects from being thrown out in a manner dangerous to the operator or bystander.⁴⁾ Swinging guards or guards which have to be

displaced in order to fit the grass catcher shall automatically return to the full guard position, or the mower shall become inoperable. Guards shall not be removable without the use of tools. The guards shall be considered as forming part of the blade enclosure for the purposes of clauses 3 and 4.

6 Blades

6.1 Stopping devices — Pedestrian-controlled or ride-on machines

(See ISO 5395/2.)

6.2 Blade stopping time

The blade(s) shall stop rotating from the manufacturer's specified maximum speed within 7 s after shutting off the power or declutching.

For mowers not stopping within this time, visual indication of blade rotation and a warning label shall be provided, with the label reading: "Blades continue to rotate after the machine is switched off or declutched".

1) At present at the stage of draft.

2) At present at the stage of draft. (Revision of ISO 4200-1981.)

3) Under study.

4) A structural integrity test is under study.

Section two: Rotary mowers — Test procedures

Section two specifies the tests for pedestrian-controlled and ride-on mowers, and has the following clauses:

- 7 — General test conditions
- 8 — Impact test
- 9 — Imbalance test
- 10 — Foot probe test
- 11 — Blade security test
- 12 — Thrown object and structural integrity test

7 General test conditions

Where it is specified that the mower blade shall run during the tests in section two, it shall be operated at the maximum speed specified by the mower manufacturer.

8 Impact test

8.1 Test equipment

The test equipment shall be as illustrated in figure 1. The mower shall be completely encircled by a wall of 1 800 g/m² (350 lb/1 000 ft²) double-wall fibreboard resting on the floor. The wall of fibreboard shall be 600 mm from the blade tip circle with a minimum height 600 mm above the floor or supporting surface. (For board strength determination, see ISO 2759.)

NOTE — 500 mm × 200 mm boards or similar protection should be placed on the outside face of the wall of fibreboard to protect personnel.

8.2 Test method

The mower shall be positioned over a 30 mm × 3 mm (nominal) welded or seamless steel tube that has been placed in the test fixture (see figure 1). The blade of the test mower shall be adjusted to the cutting height closest to 50 mm and shall be so positioned that when the tube is inserted into the path of the rotating blade, the blade will strike the exposed portion of the tube within 10 to 15 mm of the blade tip (see figure 1). The tube shall be inserted once into the path of each blade assembly.

The mower shall be run for 15 s, or until the mower motor stops or the tube is severed.

Where it is not possible to insert the tube due to mower design, the mower shall be moved the minimum distance necessary to permit the tube to be inserted.

8.3 Test acceptance

No complete blade, arm or disc to which it is mounted shall become detached. Also, any breakage of the blade or blade

retaining device shall be considered failure of the test. Breakage of the shearing pin is not considered failure.

In addition, no part of the mower shall penetrate all layers of the wall of fibreboard as specified in 8.1.

9 Imbalance test

9.1 Test equipment

The mower shall be completely encircled by a wall of 1 800 g/m² (350 lb/1 000 ft²) double-wall fibreboard resting on the floor. The wall of fibreboard shall be 600 mm from the blade tip circle with a minimum height of 600 mm above the horizontal plane of the blade tip circle.

NOTE — 500 mm × 200 mm boards or similar protection should be placed on the outside face of the wall of fibreboard to protect personnel.

9.2 Test method

The blade imbalance, in kilogram metres, should first be determined by the formula

$$2,369 (10^{-2}) L^3$$

where L is the diameter of the blade tip circle, in metres.

The calculated imbalance shall be created by removing material from, or adding it to, the blade until the desired imbalance is obtained.

The test shall be run at the maximum speed specified by the mower manufacturer, for 1 h in the fibreboard enclosure for each blade assembly.

9.3 Test acceptance

The mower under test shall not lose any component necessary for compliance with the requirements of this part of ISO 5395, and no component or part shall penetrate the fibreboard enclosure.

10 Foot probe test

10.1 Test equipment

The test fixture shall be as illustrated in figure 2, with a foot probe in accordance with figure 2.

10.2 Test method

The mower shall be placed on a hard flat surface. The guards or deflectors, or both, shall be secured in the normal operating position on the blade enclosure and the mower support members shall be in contact with the supporting surface.

Components of mowers or machines, or both, such as wheels and frames, may be considered as part of the blade enclosure for the purpose of this test. The test shall be conducted under static conditions.

The probe shall be held vertical and rotated in the vertical plane a maximum of 15° above and below the horizontal (see figure 2) and tested in all positions within these rotation limits. The probe shall be applied at any point of the discharge chute and at the periphery of the blade enclosure, with a force of 20 N or until the blade enclosure lifts from the original position.

The tests shall be made with the blades in the highest and lowest cutting positions. If the blade path height is different at different blade speeds, the test shall be conducted so as to include the two extremes of blade height.

10.3 Test acceptance

The test probe shall not enter the path of the blade(s) assembly.

11 Blade security test

11.1 Test method

The blade, or blade drive retaining device, shall be tightened to the torque value specified by the manufacturer; if no torque value is specified, the test shall be conducted as-received. The blade shaft shall be blocked against rotation during the test. The test shall be performed successively on any blade or blade support that can be made to rotate relative to the shaft. The torque shall be applied to the blade in the direction of normal rotation, until the component under test turns relative to the shaft or until a torque limit of 65 N·m is reached. If the blade or blade support turns relative to the shaft, it shall be turned in the same direction for 15 revolutions, or until the torque applied reaches the 65 N·m limit. The blade shall also be turned in the opposite direction for 15 revolutions or until the torque applied reaches the 65 N·m limit.

11.2 Test acceptance

There shall be no evidence of failure of any blade-securing fixture, and the initial fastening torque shall not have changed by more than $\pm 10\%$ at the end of the test.

12 Thrown object and structural integrity tests

12.1 Thrown object test

The thrown object test fixture shall be in accordance with figure 3.

12.1.1 Test equipment

12.1.1.1 Test fixture base.

See figure 4 and annex A.

12.1.1.2 Injection points shall be provided at the 12 o'clock position located 25 ± 5 mm inside the blade tip circle for injection of projectiles. An injection point shall be provided for each blade of a multispindle mower. (See figure 5 for injection point locations.)

The injection point(s) shall be flush with the upper surface of the plywood base (see figure 4) and the system shall be so arranged that the ball may be ejected with variable velocity.

Adjust the velocity with which the ball is ejected so that the ball rises about 20 mm above the surface of the coconut matting. Then with the mower in place and operating at rated blade speed, allow balls one at a time into the mower. Increase the velocity of the balls in small increments until each ball is hit by the mower blade. Start the test when this minimum velocity is established.

12.1.1.3 Projectiles.

Balls of hardened steel (45 HRC) of diameter 6,35 mm.

12.1.1.4 Target (see figures 3 and 6 to 10, and annexes A and B).

A target is provided to register the hits of any projectiles that are ejected from the mower housing during the test. The target consists of eight panel areas, each 900 mm high, arranged perpendicular to the base of the test fixture so as to form an octagon. The target panels shall meet the material specification of annex A. If Kraft paper is part of the target, it shall be placed at the front of each target wall. The target in the operator area of a pedestrian-controlled mower above 900 mm shall consist of a single sheet of Kraft paper rising to a height of 2 000 mm. (It is suggested that the panel supports be designed to allow sliding in and out of at least one target panel, in order to facilitate the counting of hits.) Target material shall be preconditioned and stored under controlled relative humidity conditions that do not exceed 80 % for a minimum of 24 h prior to testing. Replace the targets if hits from previous tests leave holes that cannot be covered by a 40 mm square gummed label.

The targets shall also be generally located perpendicular to a radial line extending 750 ± 50 mm from the blade tip circle of single spindle mowers, or to the nearest blade tip circle of multispindled mowers (figures 6 to 9). If a target interferes with a part of the mower such as grass box, handle, or wheel, the target shall be moved back to avoid such interference.

The target shall be divided into four quadrants located at the front, rear, and both sides of the mower as shown in figure 3. The target shall be further divided into elevation zones by horizontal lines as indicated in annex C.

The *front quadrant* is defined by the area included by the intersection of the radial lines used to locate target panels ② and ⑧ of figure 3.

The *rear or operator quadrant* (pedestrian-controlled mowers) is determined by the intersection of lines extending from centre (A) of the blade tip circle for single blade mowers or from the centre (B) of a line through the centres of the outer blade tip circles for multibladed mowers and tangent to the 1 000 mm

diameter operator zone. The centre of the operator zone is located 330 mm to the rear of the handles on a line passing from centres (A) or (B) — thus, the centre of the handgrip part of the handle (see figures 6 and 7). The target surface between the intersection of the two tangents and the target is the rear of the operator quadrant.

For mowers with swing-over handles, the mower shall be tested in each direction of travel.

For mowers with movable offset handles, the handle shall be positioned to the left to locate the left limit of the operator zone and then to the right to locate the corresponding right limit.

The *rear quadrant* (ride-on mowers) is defined by the intersection of the radial lines used to locate target panels (4) and (6) of figure 3.

The *side quadrants*, right and left, include the areas not defined for quadrants front and rear (operator).

12.1.2 Test method

The mower shall be adjusted to a 30 mm cut height or the next highest cutting position when set on the test surface. Measurement shall be from the top of the coconut matting to the lowest point on the blade cutting edge, within 6 mm. The mower shall be operated at the mower manufacturer's maximum recommended speed.

Inject 500 projectiles for each test. On multispindle mowers, alternate the ball injections from one blade to the next (to obtain random distribution of balls entering the mower). In the event of excessive hits in a localized area, it may be necessary to repair or replace the target before continuing with the tests. Balls remaining within the test fixture (on test surface) may be removed at the option of the tester to minimize ricochet hits.

A new blade shall be used for each test (500 projectiles) unless the blade is not damaged by impact with projectiles.

12.1.3 Test results

Count and record hits on the data sheet provided (see annex C). Hits are defined as projectiles passing through the Kraft paper, if used, and through the corrugated fibreboard. Projectiles passing through the Kraft paper in the operator zone above the 900 mm line are also hits. Projectiles that hit and damage the centreline of the zone height line shall be scored with the zone below that line.

12.2 Structural integrity test

Under study.

Dimensions in millimetres

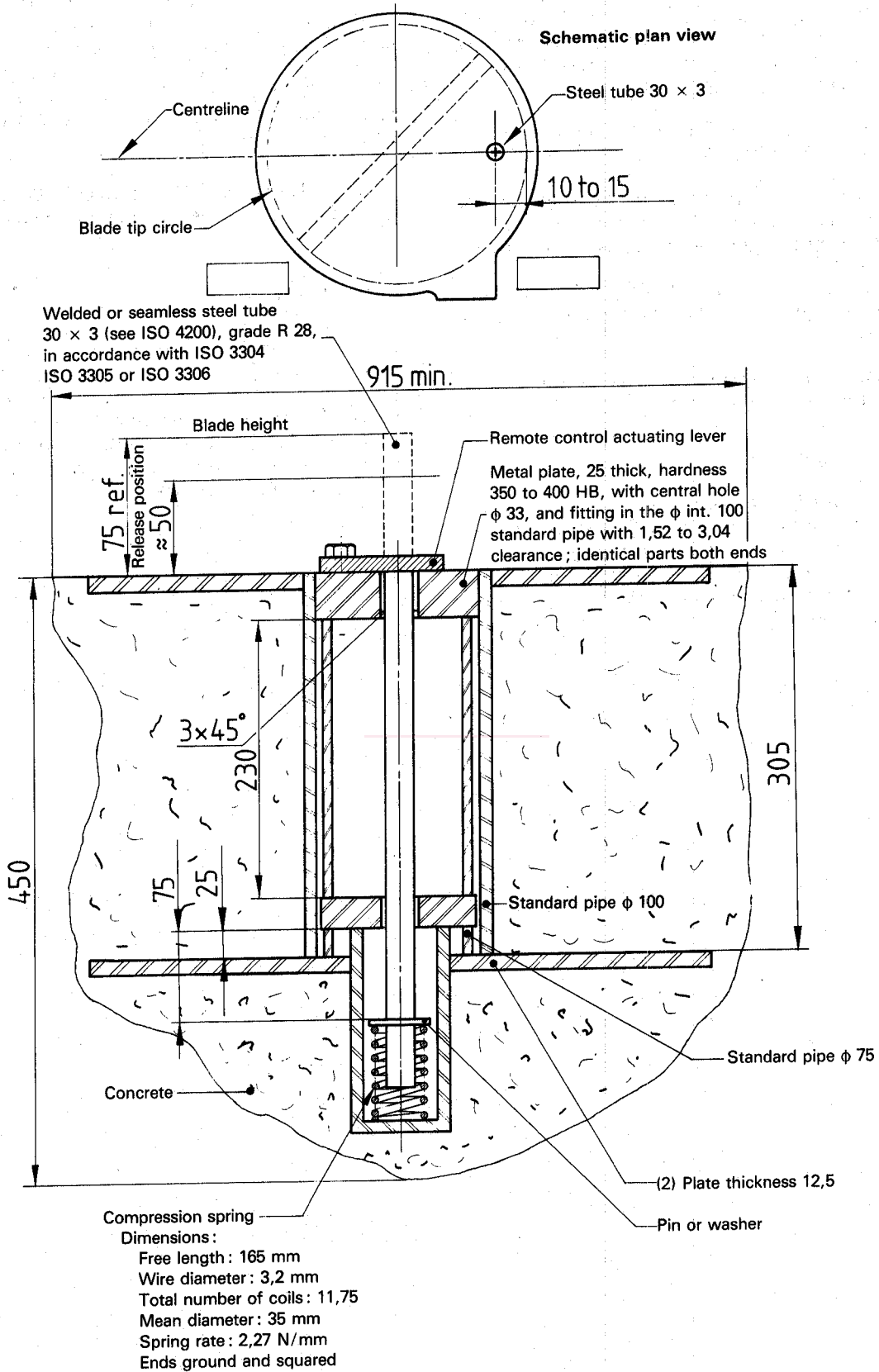


Figure 1 – Impact test fixture

Dimensions in millimetres

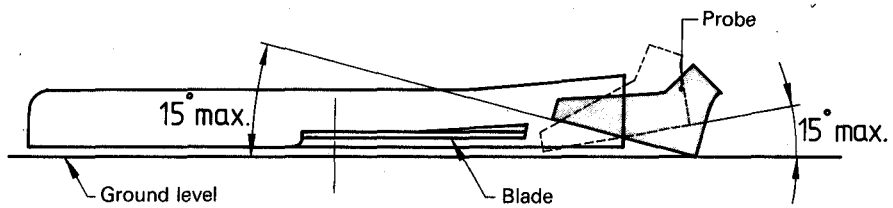
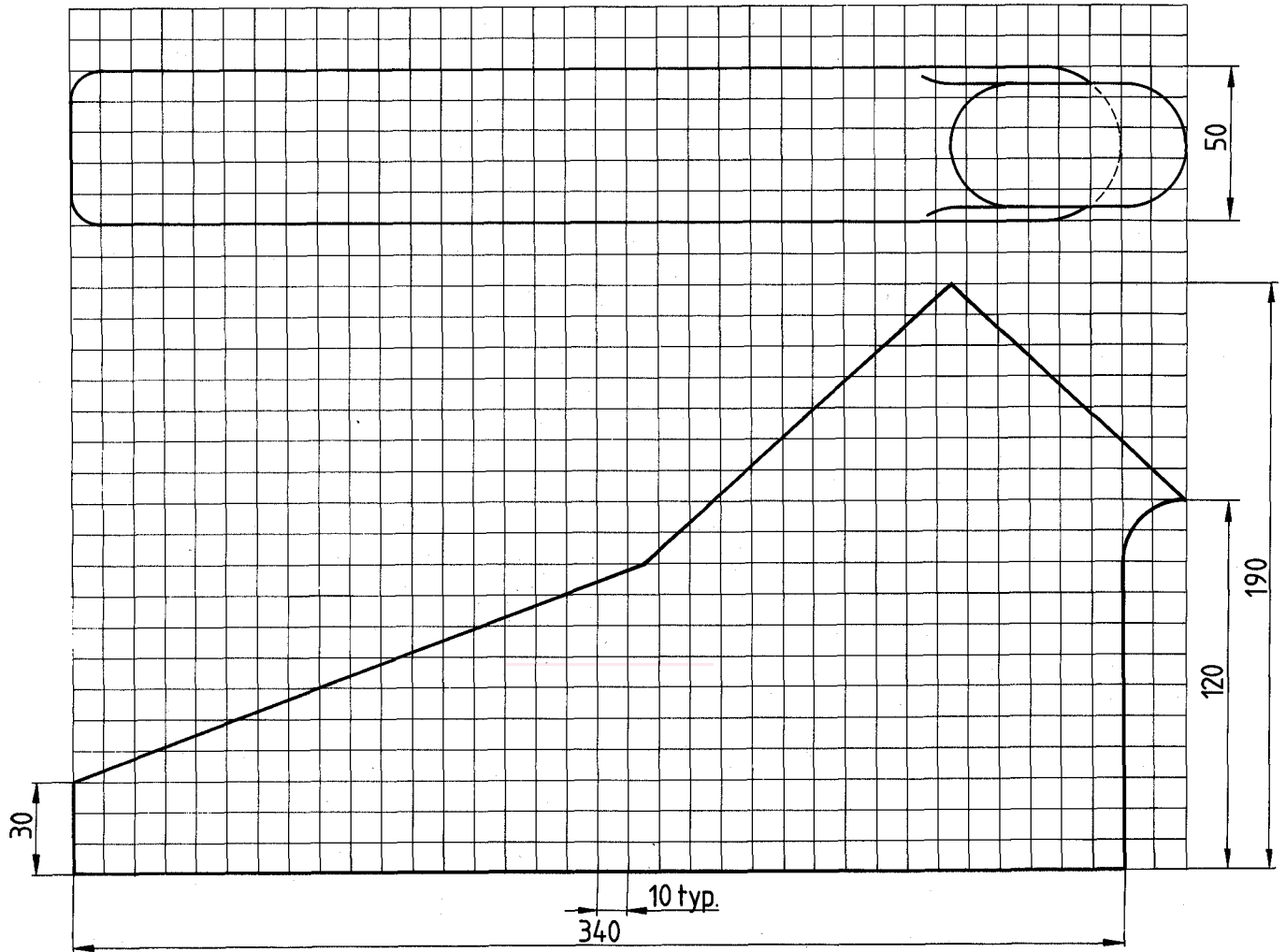


Figure 2 — Foot probe test

Dimensions in millimetres

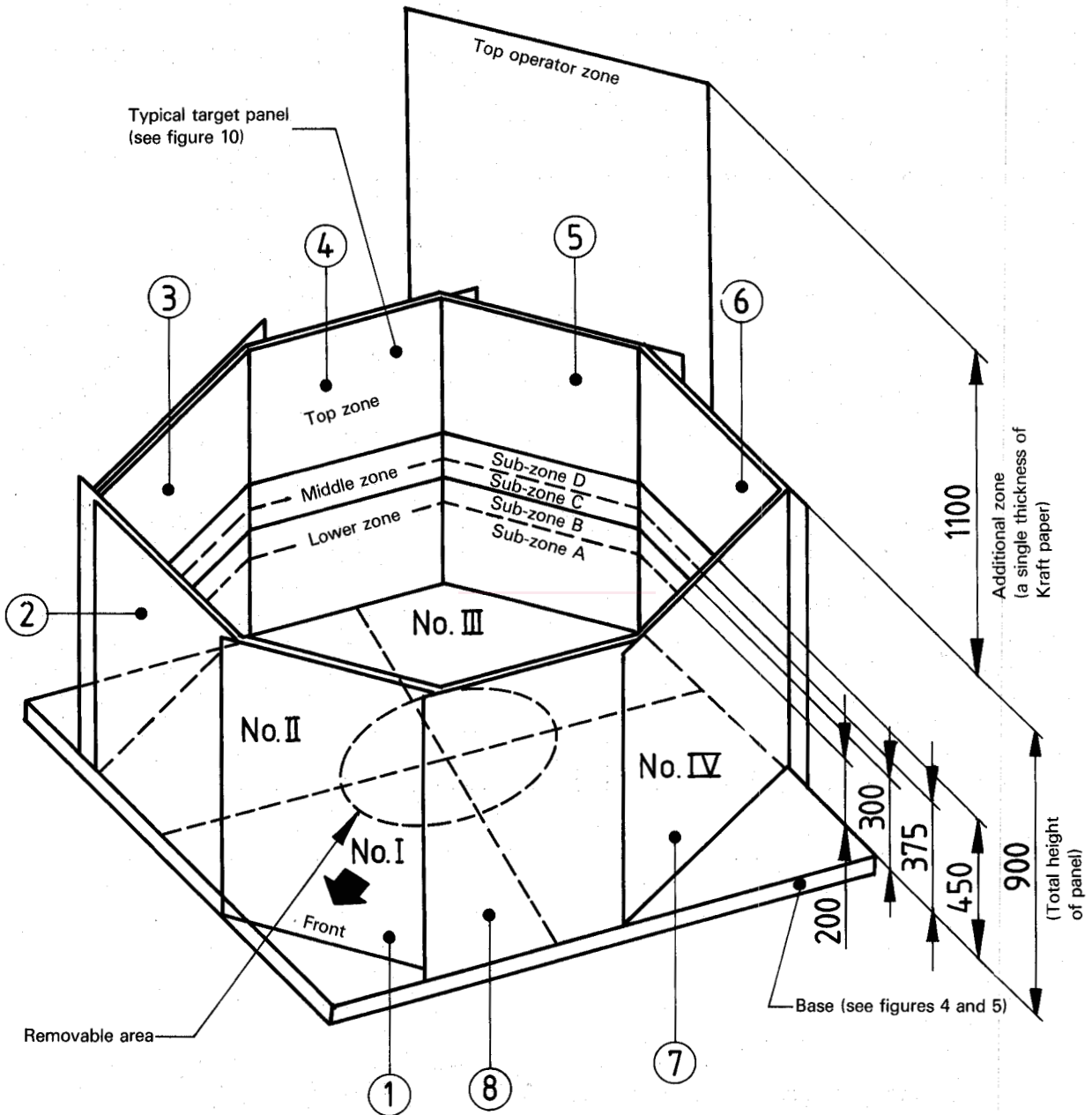


Figure 3 — Thrown object test fixture — General layout