
Garden equipment — Integrally powered shredders/chippers — Safety

The European Standard EN 13683:2003 has the status of a
British Standard

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British Standards

National foreword

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The UK participation in its preparation was entrusted to Technical Committee AGE/20, Powered lawn and garden equipment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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incorporé - Sécurité

Gartengeräte - Motorgetriebene Schredder/Zerkleinerer -
Sicherheit

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Contents

Page

Foreword	4
0 Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	7
4 List of significant hazards	11
5 Safety requirements and/or measures.....	13
5.1 General	13
5.2 Access to power driven components	13
5.2.1 Feed safety openings.....	13
5.2.2 Discharge chutes	22
5.2.3 Guards.....	25
5.2.4 Power driven components except cutting means	25
5.3 Hot exhaust surfaces	25
5.3.1 General	25
5.3.2 Test equipment and method of test	26
5.3.3 Test acceptance	26
5.4 Controls.....	28
5.4.1 Location	28
5.4.2 Stopping and starting the power source	28
5.4.3 Identification of controls	28
5.5 Protection from exhaust fumes	28
5.6 Electrical requirements	28
5.6.1 General	28
5.6.2 Low voltage battery circuits (not including magneto grounding circuits).....	28
5.6.3 Overload protection	29
5.6.4 Terminals and uninsulated electrical parts	29
5.7 Liquid spillage	29
5.8 Transport.....	29
5.9 Verification of safety requirements	29
5.9.1 Test conditions.....	29
5.9.2 Thrown object test (see 5.2.3.1).....	30
5.9.3 Stability	33
5.9.4 Dynamic stability test	33
5.10 Noise.....	34
5.10.1 Noise reduction as a safety requirement.....	34
5.10.2 Verification of requirements on noise – Noise measurement	34
6 Information for use.....	35
6.1 Instruction for use.....	35
6.2 Marking.....	36
6.2.1 Minimum marking.....	36
6.2.2 Warning marking.....	36
6.2.3 Marking durability	37
6.2.4 Test37	
Annex A (informative) Examples of inlet openings where the safety distance is ≥ 200 mm (see 5.2.1.2)	38
Annex B (normative) Test enclosure	39
Annex C (normative) Target panels - Specification for corrugated fibreboard (see 5.9.2)	41

C.1	Corrugated fibreboard target panel composition	41
C.2	Corrugated fibreboard penetration test	41
C.2.1	General	41
C.2.2	Test fixture	41
C.2.3	Corrugated fibreboard samples	41
C.2.4	Procedure	41
C.2.5	Acceptance criteria	42
Annex D	(informative) Safety instructions	44
D.1	General	44
D.2	Safe operating practices	44
D.2.1	Training	44
D.2.2	Preparation	44
D.2.3	Operation	45
D.2.4	Maintenance and storage	46
D.2.5	Additional safety instructions for units with bagging attachments	46
Annex E	(normative) Symbols and/or pictograms	47
E.1	General	47
E.2	Pictograms	47
Annex F	(normative) Noise test code – Engineering method (grade 2)	49
F.1	Scope	49
F.2	A-weighted sound power level determination	49
F.3	A-weighted emission sound pressure level measurement	50
F.4	Requirements for test floor	53
F.4.1	Artificial surface	53
F.4.2	Natural grass	53
F.5	Installation, mounting and operating conditions	53
F.6	Measurement uncertainties and declaration of noise emission values	54
F.7	Information to be recorded and reported	54
Annex G	(informative) Example of a material and construction fulfilling the requirements for an artificial surface	55
G.1	Material	55
G.2	Construction	55
Annex ZA	(informative) Relationship of this document with EC Directives	57
Bibliography	58

Foreword

This document (EN 13683:2003) has been prepared by Technical Committee CEN/TC 144 "Tractors and machinery for agriculture and forestry", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2004, and conflicting national standards shall be withdrawn at the latest by May 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

Annexes A, D and G are informative. Annexes B, C, E and F are normative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies safety requirements and their verification for the design and construction of hand fed, shredders/chippers with integral power source and with or without vacuum assisted collection which are designed primarily to reduce organic material to smaller pieces. It is only applicable to shredders/chippers that are designed for use outdoors in a stationary position by an operator standing on the ground. It applies to shredders/chippers with feed intake openings in the form of a single opening or an opening divided into a number of segments. The feed intake openings or segments each being of any shape that will fit into a square of 250 mm × 250 mm measured at the relevant safety distance to the cutting means.

NOTE Feed safety openings are limited to 250 mm × 250 mm but the total feed intake opening can be any size.

This standard describes methods of elimination or reduction of hazards arising from the use of shredders/chippers. In addition it specifies the type of information to be provided by the manufacturer on safe working practices.

This standard does not cover requirements for:

- units driven by an external power source;
- mobile use of units which can be used in both stationary and mobile modes;
- units with powered discharge intended to broadcast material or load vehicles;
- units with mechanically powered feed intake or attachments;
- units with cutting means of either one or more non-metallic filaments, or one or more non-metallic cutting elements pivotally mounted on a generally circular central drive unit, where these cutting elements rely on centrifugal force to achieve cutting, and have a kinetic energy for each single cutting means of less than 10 J;
- electrical aspects of electrically driven shredders.

Environmental hazards and EMC have not been considered in this standard.

This standard deals with all significant hazards, hazardous situations and events relevant to shredders/chippers, when they are used as intended (see clause 4).

This document is not applicable to shredders/chippers which are manufactured before the date of publication of this document by CEN.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 294: 1992, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*.

EN 954-1:1996, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design*.

EN 1070:1998, *Safety of machinery — Terminology.*

EN ISO 354:2003, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003).*

EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994).*

EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995).*

EN ISO 11688-1:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1 : Planning (ISO/TR 11688-1:1995).*

EN ISO 12100-1:2003, *Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles (ISO 12100-2:2003)*

ISO 3767-1:1998, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 1: Common symbols.*

ISO 3767-3:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 3: Symbols for powered lawn and garden equipment.*

ISO 3767-4:1993, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 4: Symbols for forestry machinery.*

ISO 3864-1:2002, *Graphical symbols - Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas.*

ISO 11684:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1070:1998 and the following apply.

3.1

discharge chute

extension of the opening through which the shredded or chipped material is discharged

3.2

discharge zone

any space wherein material is intended to be ejected from the machine

3.3

exhaust system

means of conveying exhaust gases from the power source to the atmosphere

3.4

feed safety opening

opening through which material is passed located at the relevant safety distance from the cutting means. This may be the same as the feed intake opening (3.5) or at some point between the feed intake opening and the cutting means. It is *W* in Table 1

3.5

feed intake opening

opening through which material is inserted to be fed to the cutting mechanism. A feed intake opening can become feed safety opening(s) if the relevant safety distance from the cutting means is met

3.6

normal operation

any use of the machine which is specified by the manufacturer, and which is consistent with such activities as reducing organic material, starting, stopping, and fuelling

3.7

normal use

normal operation, plus routine maintenance, servicing, cleaning, transporting, attaching or removing accessories, and making adjustments as determined by the manufacturer's instructions

3.8

material discharge deflector

fixed or movable component used to direct the flow of processed material discharging from the machine

3.9

maximum operating speed

highest power source speed obtainable when adjusted in accordance with manufacturer's specifications and/or instructions with the cutting means engaged

3.10

power source

engine or motor which provides energy for linear or rotational movement

3.11

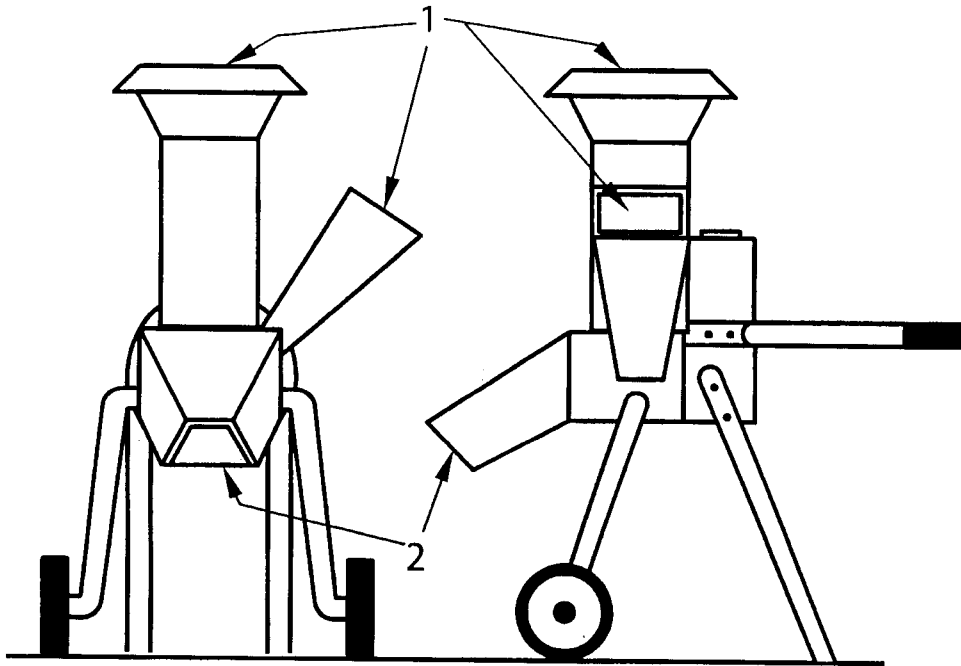
screen (grid)

perforated metal piece or bar(s) located between the cutting means and discharge chute or opening of the machine to assist in reducing bulk organic materials to smaller pieces

3.12

shredder/chipper

machine designed for use in a stationary position having one or more cutting means for the purpose of reducing organic materials to smaller pieces. See Figures 1, 2 and 3

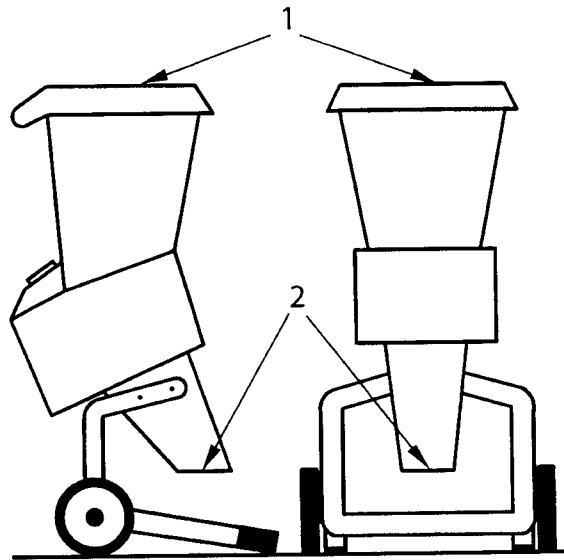


Key

- 1 Feed intake opening
- 2 Discharge chute

Figure 1

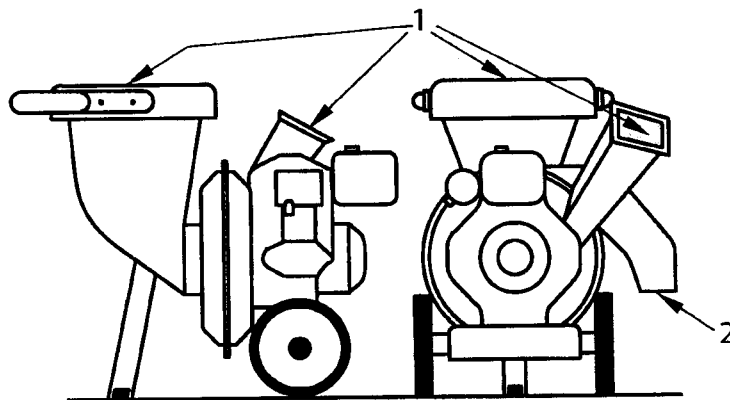
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Key

- 1 Feed intake opening
- 2 Discharge chute

Figure 2



Key

- 1 Feed intake opening
- 2 Discharge chute

Figure 3

Figures 1, 2 and 3 — Examples of typical shredders/chippers

4 List of significant hazards

This clause contains for defined danger zones all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for these types of machines and which require specific action by the designer or manufacturer to eliminate or to reduce the risk (see Table 1). It is the responsibility of the manufacturer to check whether or not the safety requirements recommended by the standard apply to each significant hazard presented by its specific machine and to validate that the risk assessment is complete with particular attention to:

- intended use of the machine including maintenance, setting and cleaning and its reasonably foreseeable misuse;
- identification of all significant hazards associated with the machine.

Table 1 — List of significant hazards associated with shredders/chippers

Ref. No.	Hazard	Location or event	Reference of this standard
Hazards, hazardous situations and hazardous events			
	Mechanical hazards due to:		
	- machine parts or workpieces, e.g.:		
	a) relative location;	Safe positioning of the machine	6.1; annex D
	b) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion);	Dynamic stability of machine	5.9.4
	c) inadequacy of mechanical strength;	Guard failure/strength	5.2.3.2
1.3	Cutting or severing hazard	Feeding material into the machine.	5.2.1; 6.1; annex D
		Clearing processed material from discharge chute	5.2.2; 6.1; annex D
1.4	Entanglement hazard	Feeding material into the cutting means	6.1; 6.2; annex D
1.5	Drawing-in or trapping hazard	Feeding material into the cutting means	5.2.1; 6.1; annex D
1.6	Impact hazard	Thrown objects	5.2.3.1; 5.9.2; 6.1; annex D
2	Electrical hazards due to:		
2.1	Contact of persons with live parts (direct contact)	High voltage and ignition parts	5.6.4
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	Damage caused by oil, fuel, abrasion etc	5.6.2.1
3	Thermal hazards, resulting in:		
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	Contact with hot parts	5.3
4	Hazards generated by noise, resulting in:		
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	Hearing damage due to machine and/or processing of material	5.10; 6.1; 6.2; annexes D, F and G

Table 1 (continued) — List of significant hazards associated with shredders/chippers

7	Hazards generated by materials and substances (and their constituent elements) processed or used by the machinery		
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts	Breathing of engine exhaust fumes	5.5; 6.1 and annex D
7.2	Fire or explosion hazard	Refuelling	6.1 and annex D
8	Hazards generated by neglecting ergonomic principles in machinery design as, e.g. hazards from:		
8.1	Unhealthy postures or excessive effort	Handling during moving machine	5.8; 6.1; annex D
8.3	Neglected use of personal protection equipment	Protect against noise and thrown objects,	5.10; 6.1; annex D
8.6	Human error, human behaviour	Incorrect use etc. Keep bystanders away	6.1; annex D 6.2
8.7	Inadequate design, location or identification of manual controls	Location of stop/start control(s)	5.4.1
		Identification of control(s)	5.4.3
10	Unexpected start-up, unexpected over-run/over-speed (or any similar malfunction) from:		
10.2	Restoration of energy supply after an interruption	Unexpected starting of cutting means after power failure	5.4.2
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	Feeding non-vegetable material	6.1; 6.2; annex D
		Removing guards before stopping the cutting means	5.2.4; 6.1; 6.2; annex D
13	Failure of the power supply	Unexpected start up of cutting means after power failure	5.4.2
14	Failure of the control circuit	Durability of interlock devices	5.2.3.1
15	Errors of fitting	Using the machine without guards or with guards fitted incorrectly	5.2.3.1; 6.1; annex D
16	Break-up during operation	Cutters breaking in use	5.9.4.2
17	Falling or ejected objects or fluids	Thrown objects from feed intake	5.9.2; 6.1; annex D
18	Loss of stability / overturning of machinery	Static stability	5.9.3
19	Slip, trip and fall of persons (related to machinery)	Operating position	6.1; annex D
Additional hazards, hazardous situations and hazardous events due to mobility			
24	Due to the power source and to the transmission of power		
24.1	Hazards from the engine and the batteries	Harm from battery vapours Spillage of battery and fluid containers	5.6.2.2; 5.7
		Battery overload	5.6.3
25	From/to third persons		
25.1	Unauthorised start-up/use	Unauthorised start up of battery start machines	5.4.2; 6.1; annex D
26	Insufficient instructions for the driver/operator	Unfamiliar or dangerous usage	6.1; annex D

5 Safety requirements and/or measures

5.1 General

The machine shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100 for hazards relevant but not significant, which are not dealt with by this document (e.g. sharp edges on the outside of the machine).

5.2 Access to power driven components

5.2.1 Feed safety openings

5.2.1.1 General

To safeguard against contact with the cutting means through the feed safety opening(s) the machine shall:

- either be constructed to meet the dimensional requirements given in 5.2.1.2 and Table 2, or
- if a straight rod of 1 m length and 12 mm diameter will not pass through the opening to contact the cutting means then the tortuous path test of 5.2.1.3 shall apply.

5.2.1.2 Dimensional requirements

Where a feed intake opening is divided into two or more feed safety openings the device that creates the divisions shall be rigidly and permanently attached to the feed intake opening.

Where a feed safety opening is not a slot, square or round, the overall size of opening is considered to be a slot, square, or round envelope that contains the opening. The shortest safety distance of the respective envelope shall be used. Where a combination of slots, squares, and/or rounds are used and they create a pinch point of less than or equal to 30 mm, each shape shall be considered separately for opening size and safety distance (see Table 2). Annex A gives some examples of such combinations.

Table 2 — Safety distances of cutting means from feed safety openings

Feed safety opening (<i>W</i> mm)	Distance - Feed safety opening to cutting means (<i>D</i> mm)		
	Slot	Square	Round
$W \leq 30$	$D \geq 200$	$D \geq 200$	$D \geq 200^d$
$30 < W \leq 50$	$D \geq 850^{a \text{ or } b}$	$D \geq 200$	$D \geq 200^d$
$50 < W \leq 250$	$D \geq 850^{b \text{ or } c}$	$D \geq 850^{b \text{ or } c}$	$D \geq 850^{b \text{ or } c}$

^a *D* is reduced to ≥ 200 mm if the longest side of the slot is ≤ 65 mm. However where the shortest side of the slot is in combination with another aperture and if it is considered separately (see 5.2.1) the longest side shall be ≤ 50 mm.

^b (i) Where the height (*h*) is < 1200 mm and $(\alpha) \leq 40^\circ$, *D* shall be 850 mm measured as the shortest distance to the cutting means. (See Figures 4a and 4b).

(ii) Where the height (*h*) is < 1200 mm and $90^\circ \geq (\alpha) > 40^\circ$, *D* shall be measured as the shortest distance from the outer edge of the feed opening to the cutting means subject to the following conditions (see Figure 4c):

- $L + 150 (2 + \sin \alpha) \geq 850$ mm; and
- $L \geq 550$ mm.

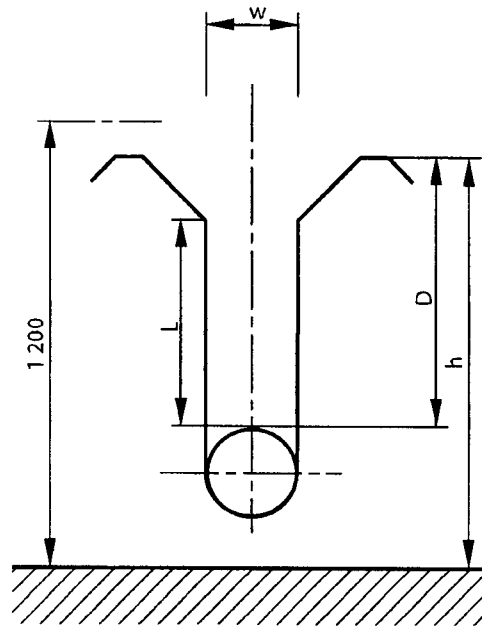
^c (i) Where the height (*h*) is ≥ 1200 mm, and $(\alpha) \leq 40^\circ$, *D* shall be measured as a chain measurement, subject to the following two conditions (see Figures 4d, 4e and 4f):

- $d_1 + d_2 \dots + d_n \geq [850 - \frac{1}{2} (h - 1200)]$ mm; and
- $L \geq 550$ mm.

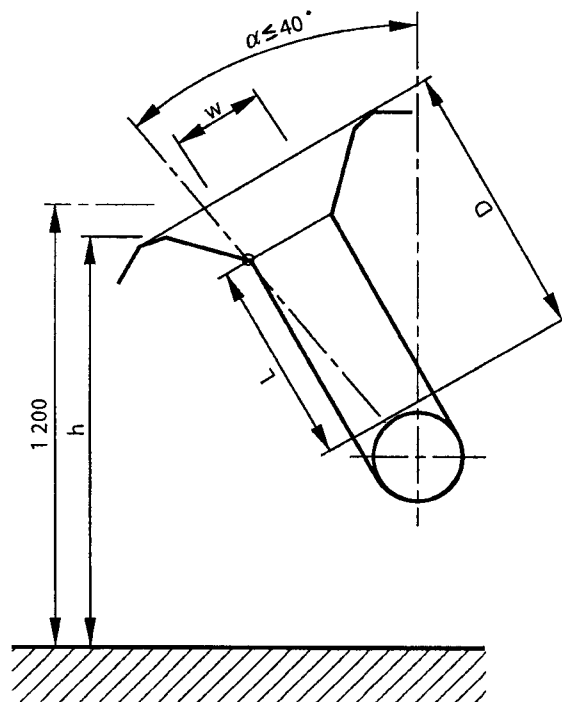
(ii) Where the height (*h*) is ≥ 1200 mm and $90^\circ \geq (\alpha) > 40^\circ$, *D* shall be measured as a chain measurement, subject to the following two conditions (see Figures 4g and 4h):

- $d_1 + d_2 \dots + d_n \geq [L + 150 (2 + \sin \alpha)] - \frac{1}{2} (h - 1200)$ mm; and
- $L \geq 550$ mm.

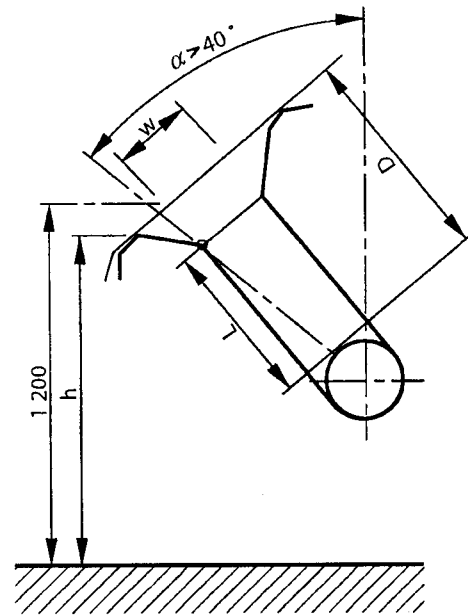
^d Where a round opening of ≤ 40 mm is used without combination or overlap with any other shape, *D* shall be ≥ 120 mm.



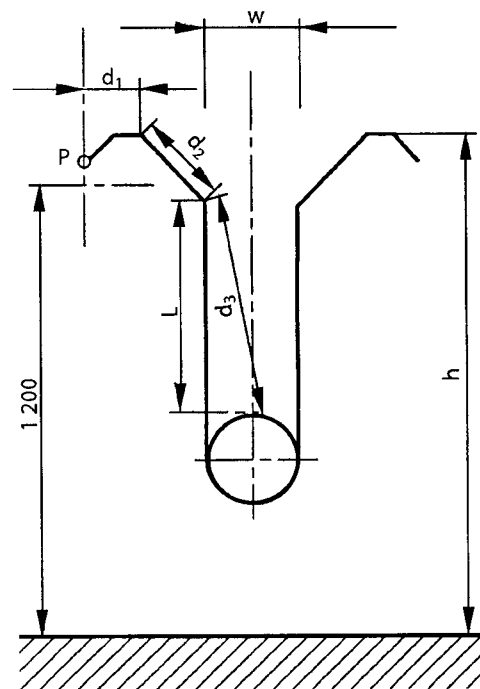
a)



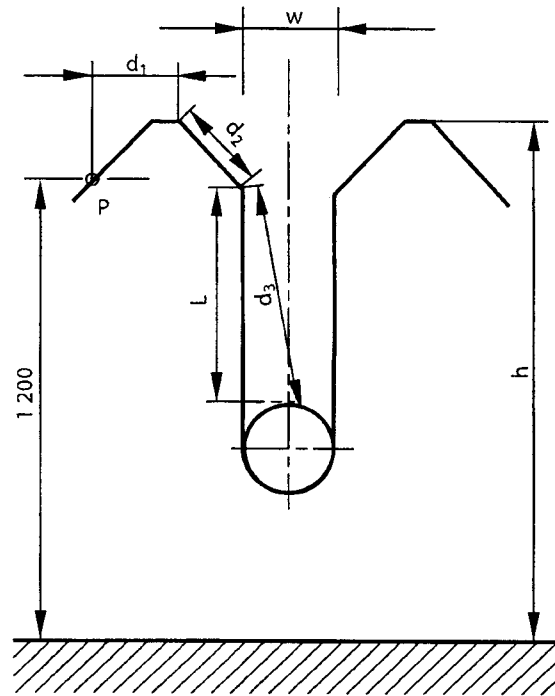
b)



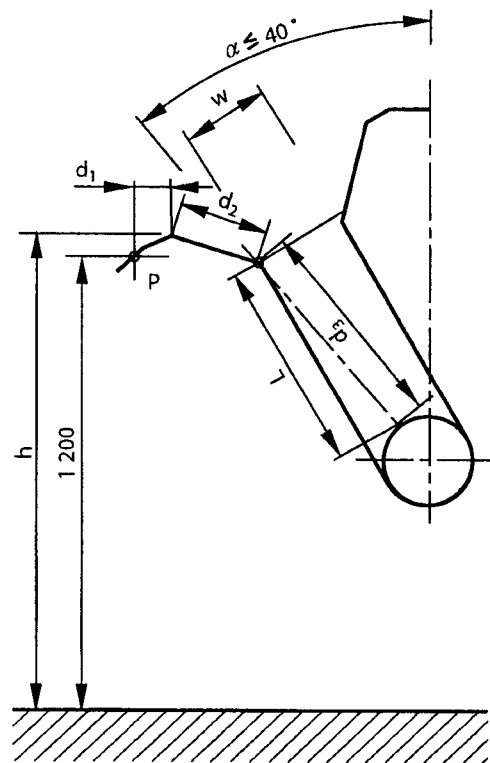
c)



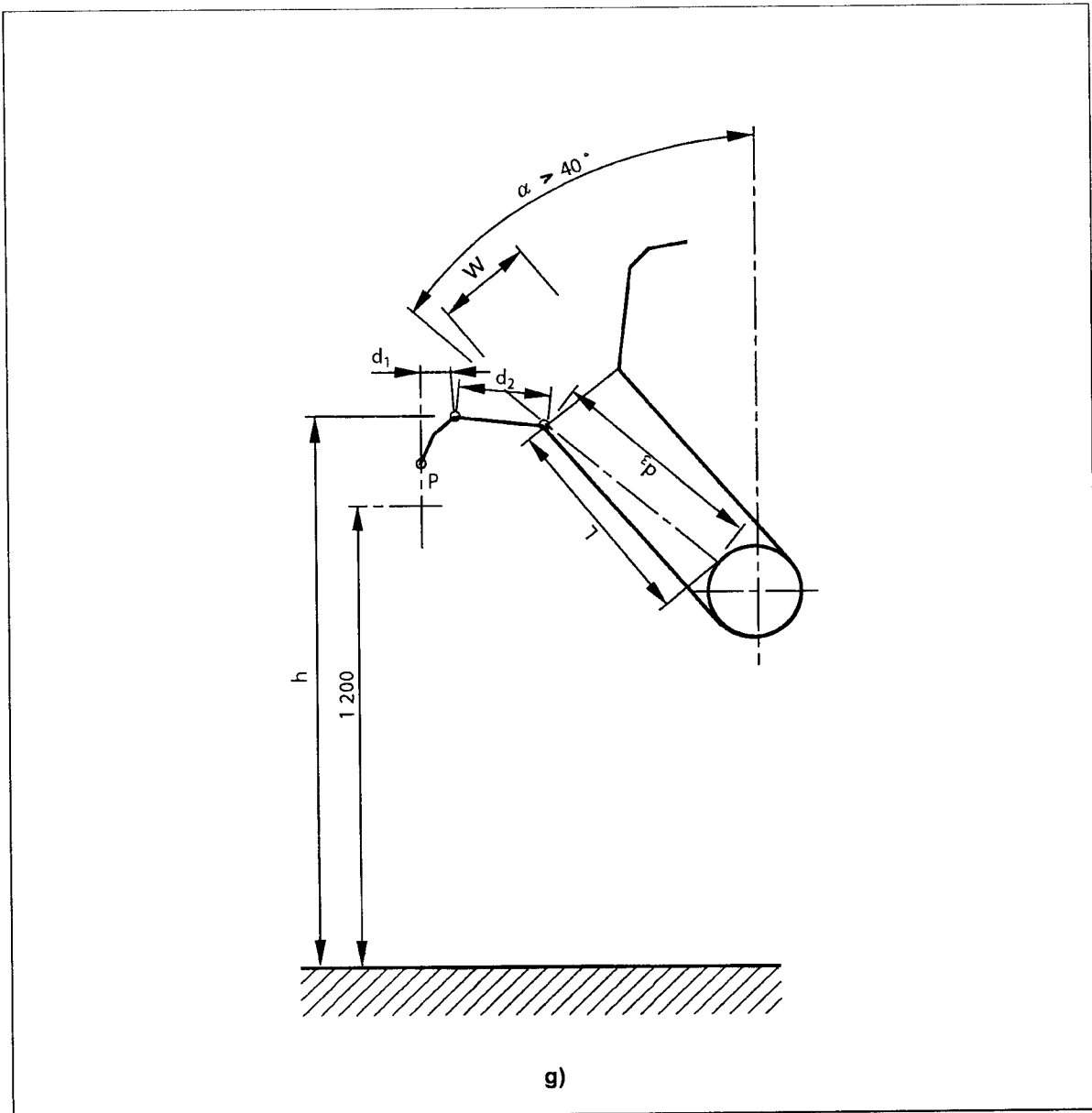
d)

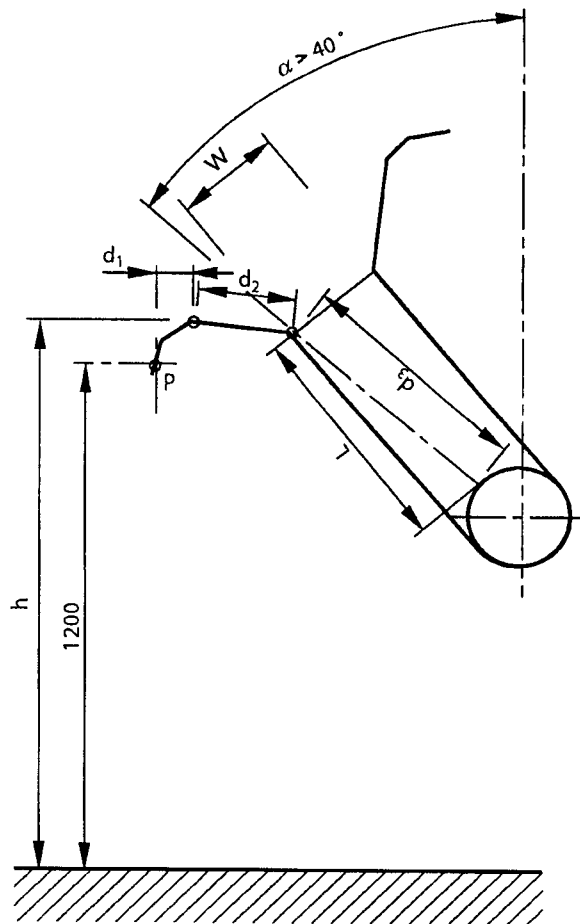


e)



f)





h)

Key

- h height of lowest point of feed intake opening from ground
 L minimum distance from the highest point of the cutting means to (W)
 P point on the feed intake with distance ≥ 1200 mm from the ground. P is starting point for the chain
 Measurement from the feed intake opening to the highest point of the cutting means
 W feed safety opening
 α angle between a vertical line through the centre of the cutting means and a straight line from the
 point of the cutting means nearest to the opening to the highest point on the lower side of the inside of
 the feed inlet

Figure 4— Distance from feed safety opening to cutting means (D mm)

5.2.1.3 Tortuous path test

The arm probe (see Figure 5) shall not be able to make contact with the cutting means when it is inserted into the feed intake opening up to a maximum distance of 850 mm measured from the point of the upper edge of the feed intake opening nearest to the cutting means. The articulations of the probe shall be manufactured to enable a rotation of $\pm 90^\circ$ about the articulation axis. The movements of the joints of the probe shall be free enough to allow easy articulation as the probe is inserted into the opening. The probe shall be applied with a force not exceeding 20 N.

The arm probe shall be twisted and moved in any direction allowed by the joints when approaching the cutting means. If necessary, one or more sections of the machine may be cut away to allow the probe to be configured such that it penetrates as far as possible towards the cutting means. If a section is removed this shall not allow the probe to penetrate further than it would have done before the removal of the section(s).

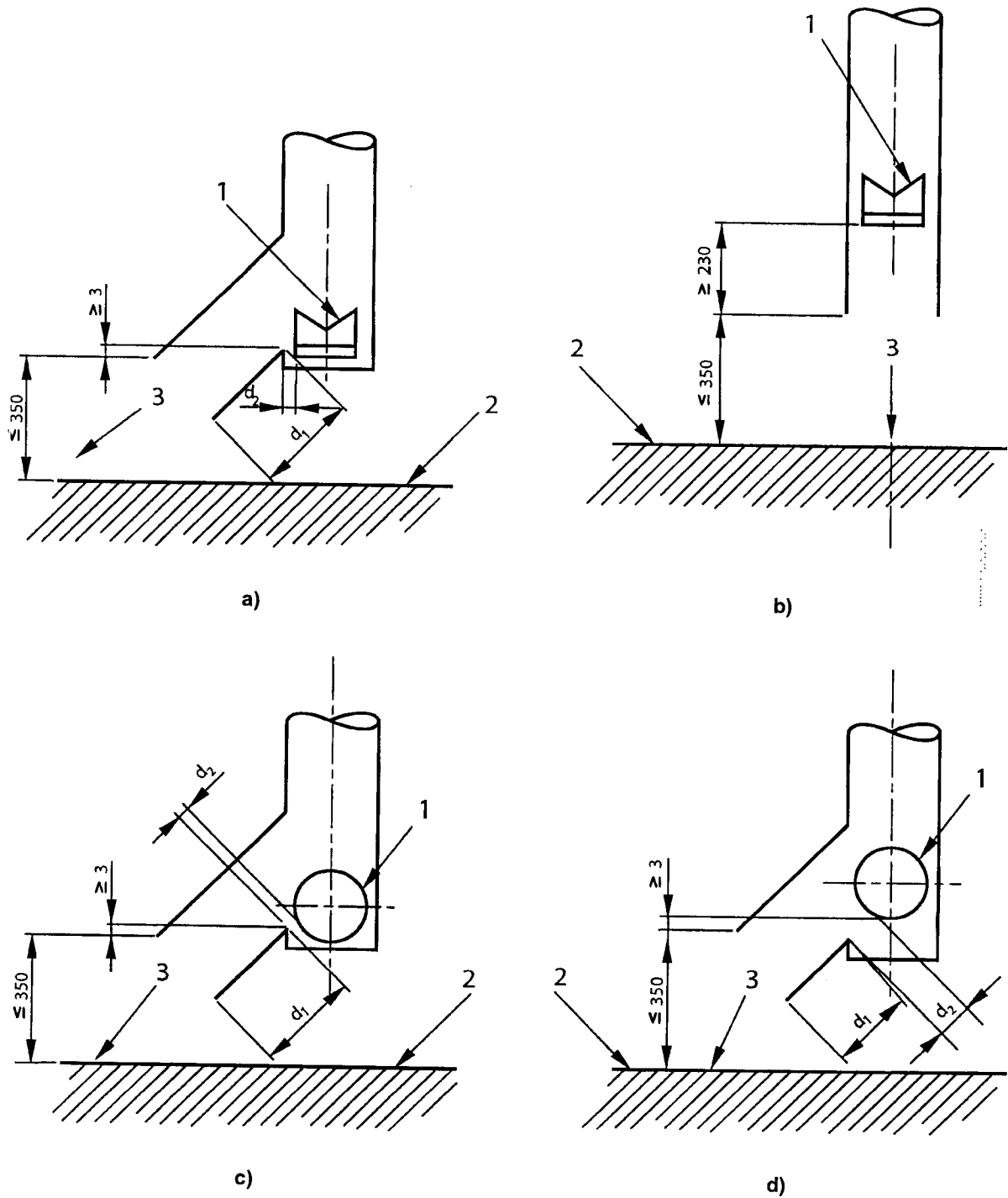
5.2.2 Discharge chutes

Except as stated in 5.2.3, the discharge chute shall be designed so as to prevent direct access to and accidental contact with the cutting means. Compliance shall be achieved according to one of the following:

- 1) if no part of the outer edge of the discharge chute is more than 350 mm from the ground, the lowest point of the end of the discharge chute nearest the cutting means shall be at least 3 mm above the highest part of the outer edge of the discharge chute. In addition the minimum distance from any point of the outer edge of the discharge chute to the cutting means shall be 230 mm (see Figures 6a, 6b and 6c). If the lowest part of the cutting means is above the lowest point of the end of the discharge chute nearest the cutting means then the 3 mm dimension shall apply to the vertical distance between the highest part of the outer edge of the discharge chute and the lowest point of the cutting means (see Figure 6d); or
- 2) if the highest edge of the discharge opening is greater than 350 mm from the ground and the opening size is not more than 120 mm × 120 mm, the safety distance shall conform to the principles set out in 4.5.1 or 4.5.3 of EN 294:1992 as appropriate; or
- 3) if the highest edge of the discharge opening is greater than 350 mm from the ground and the opening size is larger than 120 mm × 120 mm, the safety distance shall be ≥ 850 mm. The maximum discharge opening size shall be 250 mm × 250 mm; or
- 4) it shall not be possible to come into contact with the cutting means by using the probe shown in Figure 7. The probe shall be inserted a maximum of 850 mm inside the discharge opening towards the cutting means, measured from the most unfavourable point on the discharge opening, with a force of not more than 20N.

NOTE The safety distances of 5.2.1 and 5.2.2 have been developed on the basis of EN 294:1992 and amended as necessary according to established current practice.

Dimensions in millimetres



Key

- 1 Cutting means
- 2 Ground surface
- 3 Discharge direction $d_1 + d_2 = 230 \text{ min.}$

Figure 6 — Examples of discharge chute distance requirements

5.2.3 Guards

5.2.3.1 Attachment

Guards allowing access to the cutting means shall be interlocked at least according to category 1 of EN 954-1:1996, to cause the moving parts to come to rest before access can be gained. While the cutting means is exposed it shall not be possible to drive the cutting means. Other guards shall be fixed guards and shall not be detachable without the use of tools, or the construction of the machine shall be such that it can not be used without the guard in its guarding position. Guarding shall be designed to prevent hazardous thrown objects. This shall be tested according to 5.9.2.

For battery start machines the following additional requirement shall apply 2 years after publication of this standard. Guards allowing access to the cutting means shall be interlocked at least according to category 1 of EN 954-1:1996, to disable the battery starter.

Discharge openings enclosed with a collecting bag or container which when removed do not meet the requirements of 5.2.2 shall be fitted with an interlock which causes the moving parts to come to rest. While the cutting means is exposed it shall not be possible to start the power source.

Unless otherwise stated all guards shall conform to the relevant parts of 3.22 and 3.23 of EN ISO 12100-1:2003.

5.2.3.2 Strength

Guards shall have adequate strength and be constructed to withstand such rough handling that may be expected in normal use. Guards shall be checked by the following test.

Each of three samples of the complete machine shall be subjected to an impact of $(6,5 \pm 0,2)$ J on a part of the relevant guard likely to be the weakest, with the machine standing on a level surface.

The tests shall be so conducted that in each test the sample receives an impact in a location different from the other two tests.

The impact shall be produced with a smooth solid steel sphere (as used for ball bearings) having a diameter of 50 mm. If the part being tested is at an angle of up to 45° to the horizontal, the sphere shall be allowed to fall vertically from rest to strike the part. Otherwise, the sphere shall be suspended by a cord and shall be allowed to fall from rest as a pendulum to strike the part. In either case, the vertical travel of the sphere shall be 1,3 m.

After the test there shall be no visible signs of cracking and the requirements of 5.2.1 and 5.2.2 shall be maintained.

5.2.4 Power driven components except cutting means

All power driven components except the cutting means (see 5.2.1, 5.2.2 and 5.2.3) shall be guarded to prevent contact with these parts during normal operation. Guards designed to be opened or removed shall have a sign warning of the relevant hazard visible on the machine both when the guard is closed and when it is opened or removed.

Unless otherwise stated in this standard all openings and safety distances shall conform to 4.5.1 or 4.5.3 of EN 294:1992 as applicable

5.3 Hot exhaust surfaces

5.3.1 General

Exposed components of the power source exhaust system having a surface temperature greater than 80°C at $(20 \pm 3)^\circ\text{C}$ ambient temperature shall be considered hot and shall be guarded so that they are not accessible to unintentional contact during normal use. These parts, which shall also include

EN 13683:2003 (E)

the power source exhaust guard, are considered accessible if the area contactable by the appropriate test cone is larger than 10 cm² (see 5.3.3).

5.3.2 Test equipment and method of test

5.3.2.1 Temperature measuring equipment

The temperature measuring equipment for hot surfaces shall have an accuracy of ± 4 °C.

5.3.2.2 Method of test

The test shall be conducted in the shade. The power source shall be operated at its maximum operating speed until the surface temperatures stabilise. Identify the hot surface area(s) on the power source exhaust system and guard. Temperatures shall be determined by correcting the observed temperature by the difference between the specified ambient and test ambient temperature.

Allow the hot parts to cool. It is not necessary to test the accessibility of hot parts while they are hot.

When the distance between the identified hot area and the nearest control is > 100 mm, Cone A in Figure 8 shall be used. For a distance \leq 100 mm between the identified hot area and the nearest control, Cone B in Figure 8 shall be used.

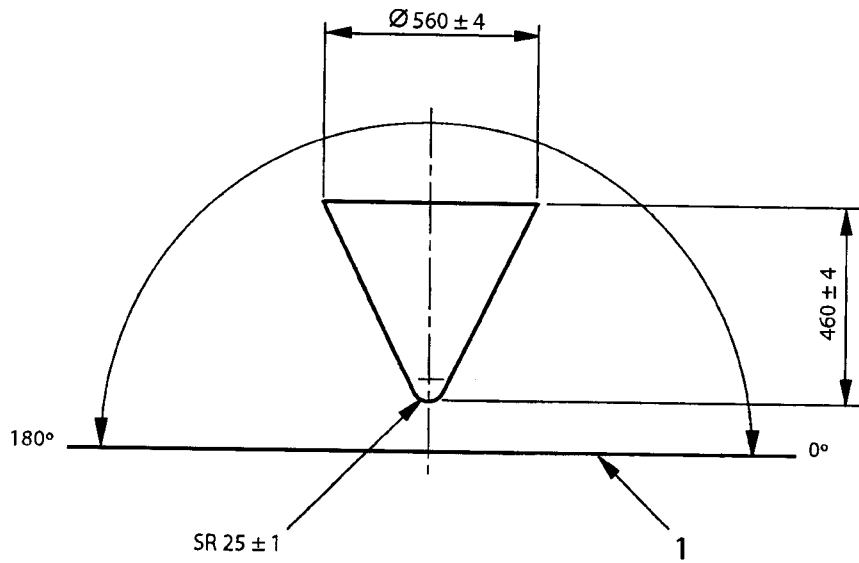
For Cone A, with the axis of the cone anywhere between 0° and 180° to the horizontal and with the nose or point of the cone in a downward to horizontal direction, move the cone towards the hot surface. Cone A shall not be moved in an upward direction. Cone B shall be moved in any direction.

When moving the cone(s), determine if contact is made with the hot surface area(s) by the cone tip or conical surface of the cone.

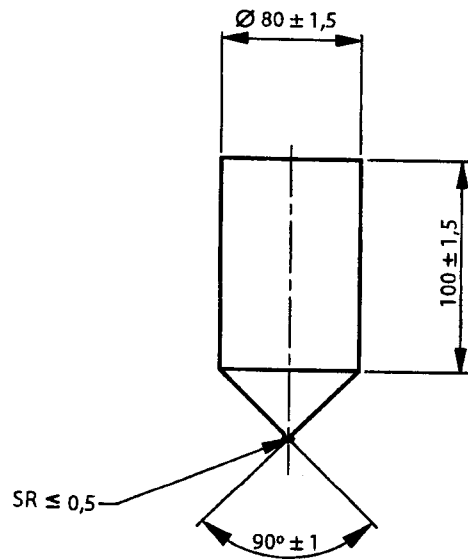
5.3.3 Test acceptance

The tip or conical surface of Cones A or B shall not be able to make contact with a hot surface area greater than 10 cm².

Dimensions in millimetres



Cone A



Cone B

Key

- 1 Horizontal plane
- SR Spherical radius

Figure 8 — Test cones (see 5.3.2.2)

5.4 Controls

5.4.1 Location

Designated operating position(s) shall be specified by the manufacturer in such a manner that the operator is not required to be in an unsafe position (such as near the discharge zone or in front of the power source exhaust outlet). All controls shall be located in an easily accessible position for each designated operating position.

5.4.2 Stopping and starting the power source

A power source stopping device shall be provided. The device shall not depend on sustained manual pressure for its continued operation. This device shall require manual and intentional activation in order to restart the power source, and shall be accessible from designated starting positions. Reactivation of the power supply following a failure or disconnection shall not result in the cutting means moving or starting automatically. When a cutting means is stopped, for whatever reason, it shall not be possible for it to restart without manual and intentional operation of a control.

It shall not be possible to sustain a power source speed greater than the maximum operating speed (see 3.9) by the use of any control or by simple adjustments using standard tools. Sealed adjustments shall not be moved when checking the maximum operating speed.

For battery start machines a switch operated by a removable key, or a similar device shall be provided. The key or similar device shall only be removable when the switch is in the off position.

Machines shall not be equipped with a starter operated by means of a loose rope.

5.4.3 Identification of controls

Controls, whose purpose is not obvious, shall have the function, direction and/or method of operation clearly identified by a durable label or mark (see 6.2.3). Where symbols are used they shall be in accordance with ISO 3767-1:1998, ISO 3767-3:1995 and ISO 3767-4:1993.

Detailed instructions on the operation of all controls shall be provided in an instruction handbook.

5.5 Protection from exhaust fumes

The exhaust shall be directed downwards or away from the operator.

5.6 Electrical requirements

5.6.1 General

These electrical requirements apply only to battery circuits of less than 42 V and high-tension ignition circuits.

5.6.2 Low voltage battery circuits (not including magneto grounding circuits)

5.6.2.1 Electrical cables

Electrical cables shall be protected if located in potentially abrasive contact with metal surfaces and shall be resistant to, or protected against, contact with lubricant and fuel.

The wiring assembly shall, where possible, be grouped together, be supported and be located so that no portion is in contact with the carburettor, metallic fuel lines, the exhaust system, moving parts or sharp edges. Any edges of metal members likely to be in contact with the cables shall be rounded or protected to prevent possible damage to the cables by cutting or abrasion.

Compliance shall be checked by inspection.

5.6.2.2 Battery installation

The compartment for a vented storage battery shall have openings to provide ventilation.

Compliance shall be checked by inspection.

5.6.3 Overload protection

All circuits, except starter motor and high tension ignition circuits, shall be provided with overload protection devices in the underground line near the battery terminal. For a grounded system the overload protection shall be in the ungrounded line. For a two-wire system it may be located in either wire.

Compliance shall be checked by inspection.

5.6.4 Terminals and uninsulated electrical parts

Terminals and uninsulated electrical parts, and two-wire non-grounded systems shall be protected against short-circuiting by the fuel can or tools, during normal re-fuelling and lubrication servicing.

All high-voltage parts of the circuit including spark plug terminals shall be electrically protected in such a manner that the operator cannot make accidental contact with them.

Ignition interruption or short-circuiting shall be provided and shall be fitted on the low-voltage side.

Compliance shall be checked by inspection.

5.7 Liquid spillage

When filled to the maximum, according to the manufacturer's instructions, liquid containers, batteries, fuel systems, oil reservoirs, and coolant systems shall be constructed to prevent spillage for 1 min whilst the machine is tilted at 30° from the vertical. Weeping at vent systems shall not be considered spillage

Compliance shall be checked by practical test and inspection.

5.8 Transport

For machines of mass greater than 25 kg two ground contacting wheels and a holding means shall be provided to facilitate movement of the machine. Compliance shall be checked by inspection.

5.9 Verification of safety requirements

5.9.1 Test conditions

Test personnel shall either be kept out of the test area or otherwise protected from the hazards resulting from the following tests.

The tests shall be carried out in the order presented in this standard. A new machine may be used for each test if necessary.

The machine shall be completely assembled and shall rest on a horizontal surface and shall be operated at the maximum operating speed. Any component that can be removed without the use of tools shall be removed when conducting these tests. Machines shall be tested in the most unfavourable condition allowed by the user instructions.

EN 13683:2003 (E)

Where it is specified that the cutting means shall run during the tests, the power source shall be operated at the maximum operating speed.

5.9.2 Thrown object test (see 5.2.3.1)

5.9.2.1 General

This test shall not be applied to machines where the cutting means rotates at speeds $\leq 300 \text{ min}^{-1}$ when measured with the power source rotating at maximum operating speed.

5.9.2.2 Test enclosure

The thrown object test enclosure shall be constructed generally as shown in Figures 9 and 10. If, during testing the results show that there are test pieces or bits of test pieces ricocheting over the 2000 mm high panels then the top of the enclosure shall be covered with an additional horizontal layer of Kraft paper over the whole assembly to provide a fully enclosed test environment and the testing restarted.

The base of the test enclosure shall be horizontal and the walls shall consist of eight target panels mounted perpendicular to the base so as to form an octagon as in Figure 9. Each target panel shall consist of a lower section of corrugated fibreboard and an upper section of Kraft paper. The lower sections of corrugated fibreboard shall extend from the base up to a height of and 900 mm and the Kraft paper shall extend from these lower sections up to a total height of 2000 mm.

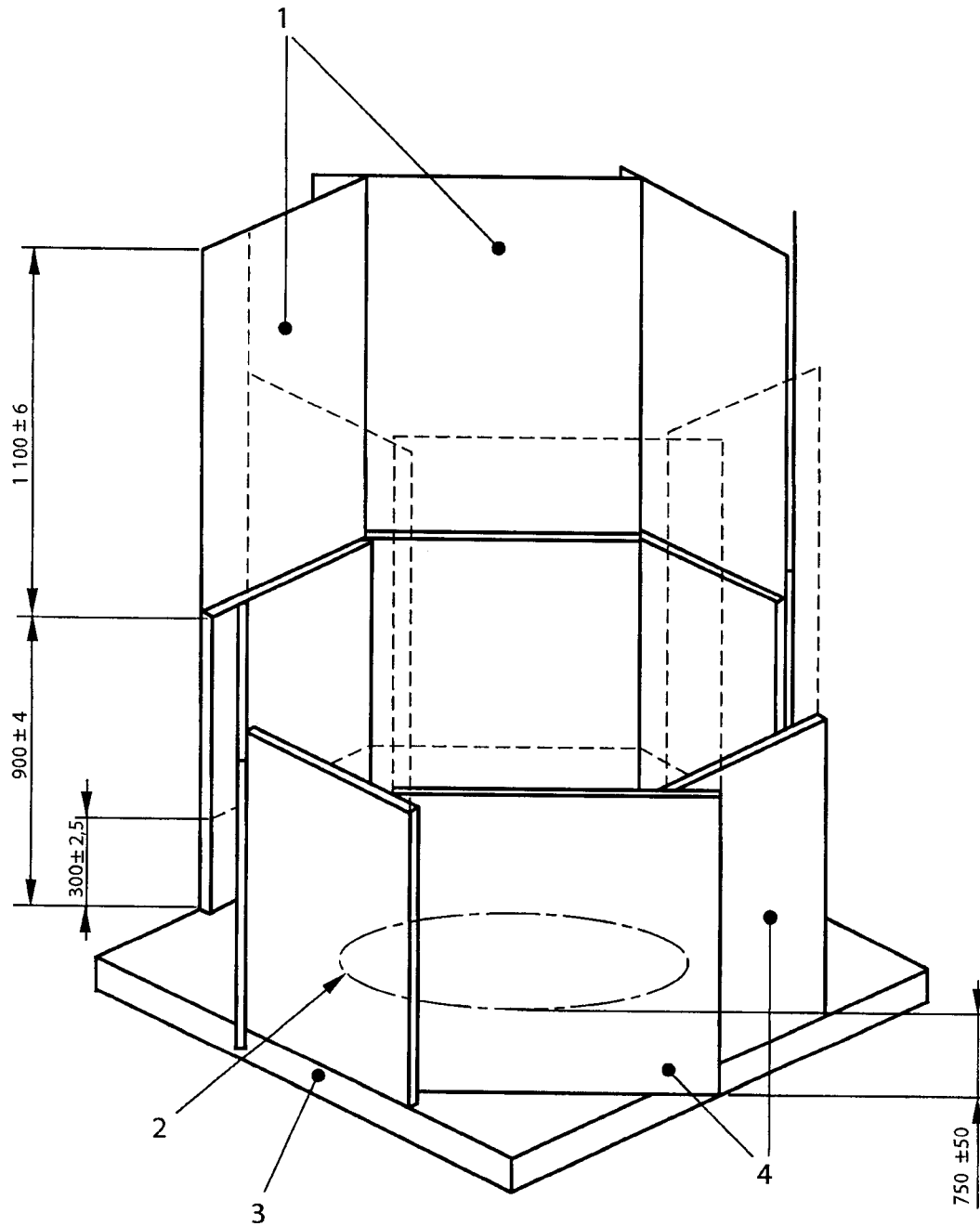
The composition of the base and the lower sections of the target panels shall meet the specifications given in annex B and annex C. The upper sections of the target panels and the top horizontal layer shall be of 80 g/m^2 Kraft paper stretched lightly over appropriately sized frames made of narrow section rigid material. The vertical target panels shall generally be located at right-angles to a radial line extending (750 ± 50) mm from the discharge opening(s) of the machine (see Figure 9). If any other part of the machine interferes with any part a target panel, the target panel shall be moved outwards just sufficiently to avoid the interference.

Inside the total enclosure additional target panels of 80 g/m^2 Kraft paper, fitted to a frame, shall be mounted (200 ± 10) mm above, and project at least 200 mm beyond, all sides of the feed intake opening(s). If the design of the machine and/or the enclosure prevents these distances from being maintained, these panels shall be arranged so as to achieve the closest possible dimensional compliance (see Figure 10).

NOTE In order to facilitate the counting of hits, the target panel supports should be designed to allow sliding in and out of at least one of the vertical target panels.

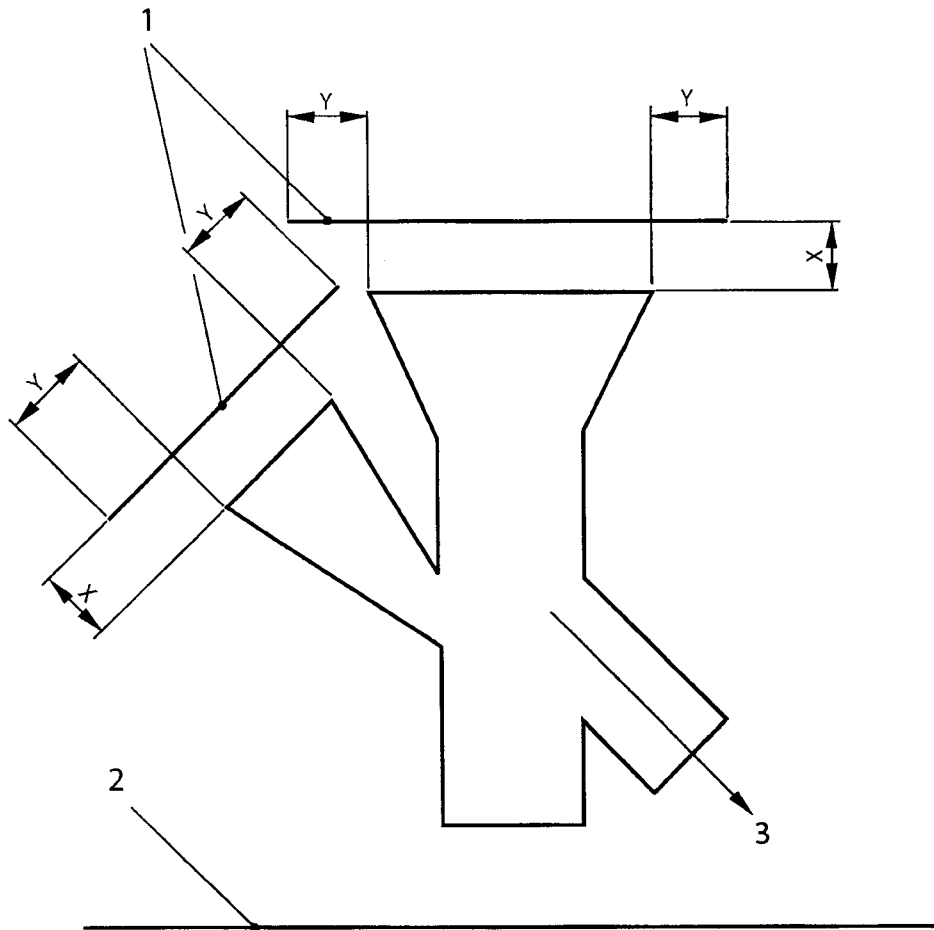
A line parallel to the base and 450 mm high shall be marked on each target panel.

Dimensions in millimetres

**Key**

- 1 Kraft paper (80 g/m^2) target panels extending full 360°
- 2 Circle of radius = distance of discharge opening from the vertical centre-line of the machine.
- 3 Base (see annex B and Figures B.1 and B.2)
- 4 Corrugated fibreboard target panels (see Figure B.1 and annex B)

Figure 9 — Thrown object test fixture - General layout



Key

- 1 Kraft paper (80 g/m²) target panels
- 2 Base (see annex B)
- 3 Discharge direction
- X = (200 ± 10) mm
- Y ≥ 200 mm

Figure 10 — Kraft paper target panel placement

5.9.2.3 Test method

All moveable guards shall be adjusted to the position of greatest opening or discharge (worst condition). The machine shall be placed centrally on the test enclosure base.

For each feed intake opening 50 test pieces (beech wood dowels (or equivalent) (20 ± 0,5) mm diameter and 50 mm long) shall be fed in, one at a time, at a rate which is slow enough to ensure that the machine does not jam.

The machine shall be stopped 10 minutes after all test pieces have been fed into the feed intake opening(s) or when all projectiles have been fully processed and discharged by the machine.

5.9.2.4 Test results

Determine if any hits occurred on the Kraft paper target panel above the feed intake opening(s) or on the vertical target panels. A hit shall be recorded if the test piece or any part of it has passed completely through a target panel. In cases of doubt the penetrator that is used to evaluate the corrugated fibreboard panels in annex C (see Figure C.1) shall be used to determine if a hit has been made. Any test pieces or bits of test pieces shall be removed from the machine side of the panel and then, with the panel held horizontally, the ball end of the penetrator shall be applied vertically to each impact area under its own weight. A hit shall be counted if the whole of the ball end of the penetrator passes through the panel.

Replace the target panels if hits from previous tests leave holes that cannot be covered by a 40 mm square gummed label. Not more than one thickness of gummed labels, used as patches, shall be placed over any one area.

5.9.2.5 Test acceptance

A machine shall have passed the test if all of the following criteria are satisfied:

- there are no hits for the Kraft paper target panels above the feed intake openings;
- there are no hits for the horizontal Kraft paper target panel covering the whole test enclosure;
- there are not more than five (5) hits between the base and the 450 mm line for the vertical target panels;
- there are no hits above the 450 mm line for the vertical target panels.

In the event of a test failure, two additional identical machines shall be tested. If either of the additional machines fails a test, the model shall have failed the test.

5.9.3 Stability

5.9.3.1 General

Shredders/chippers shall be stable for all use conditions

5.9.3.2 Test method

The machine shall be placed, free standing, on a tilt table. Attachments, adjustable features, debris collectors, fuel tanks etc. shall be set/filled to their most unfavourable conditions. Wheels shall be set in their most unfavourable position and chocked as necessary. The tilt table axis shall be set to 10° to the vertical and rotated slowly through 360°.

5.9.3.3 Test acceptance

The machine shall not tip over.

5.9.4 Dynamic stability test

5.9.4.1 Test method

A welded or seamless mild steel tube nominally 30 mm in diameter and 400 mm long with a nominal wall thickness of 3 mm shall be inserted quickly into the feed intake opening of the machine in an unsupported manner. Machines having more than one feed intake opening shall have the test conducted with a new tube at each opening. The tube shall be bent as required to engage with the cutting means.

EN 13683:2003 (E)

If a feed intake opening of less than 30 mm exists a tube of adequate diameter and length shall be used.

If the machine does not stop in 15 seconds, the test shall be concluded. A new machine shall be tested for each feed intake opening.

5.9.4.2 Test acceptance

The machine shall remain standing in its operating position and shall not tip over in any direction.

Additionally no parts of the machine shall be ejected except through the discharge chute and no part of the machine necessary for compliance with this standard shall become detached or deformed so that it no longer complies with the standard. It is not required that the machine be suitable for use after the test. Ejection of small chips of machine parts not exceeding 2 g shall be ignored.

5.10 Noise

5.10.1 Noise reduction as a safety requirement

5.10.1.1 Noise reduction at source by design and by protective measures

The machine shall be designed to generate a noise level as low as practicable. The main sources causing noise, are:

- air intake system;
- engine cooling system (applicable only for combustion engine);
- engine exhaust system (applicable only for combustion engine);
- cutting system;
- vibrating surfaces.

EN ISO 11688-1 gives general technical information on widely recognised technical rules and means to be followed in the design of machines with low-noise emission. For combustion engine driven machines special care shall be taken in the design of exhaust system and the selection of the silencer.

NOTE EN ISO 11691:1995 and EN ISO 11820:1996 can be used for the testing of the silencer.

5.10.1.2 Noise reduction by information

If, after taking all possible technical measures for reducing noise at the design stage, a manufacturer considers that further protection of the operator is necessary then the instruction handbook shall:

- recommend the use of low-noise operating modes, and/or limited time of operation;
- give a warning of the noise level and recommend the use of ear protection.

5.10.2 Verification of requirements on noise – Noise measurement

For the determination of the sound power level and of the emission sound pressure level at the operator's position the measurement methods given in annex F shall be used.

6 Information for use

6.1 Instruction for use

Each machine shall be provided with instructions for use giving operating, servicing, maintenance and safety instructions that comply as appropriate with clause 5.5 of EN ISO 12100-2:2003. The instructions shall include those operations that are meant to be performed by the user. The instructions shall be simple and clear such that they are suitable for unskilled users. They shall include:

- instructions and where appropriate, drawings, for the proper assembly and disassembly of the machine for use, if the machine is not supplied in a completely assembled form;
- instructions and where appropriate, drawings, for the proper use of the machine including advice on what the machine should be used for and how to use it for the intended purpose(s);
- instructions and where appropriate, drawings, for proper adjustment and any necessary user maintenance of the machine, including time scales and a warning of the danger of rotating cutting means;
- instructions and where appropriate, drawings, for one or more designated operating positions and the correct and safe operation of the machine such as moving, safe positioning, handling, clearing blockages and keeping the discharge chute clear of processed material;
- instructions that the machine is not suitable for use by children;
- instructions and where appropriate, drawings, giving detailed instructions on the operation of all controls;
- for machines powered by an internal combustion engine, instructions to position the machine such that it is not necessary to work downwind of the exhaust, and instructions for safe handling of fuel;
- instructions and where appropriate, drawings, for the recommended replacement or repair of, or service attention to, critical components;
- explanations of any pictograms that are used on the machine and a repeat of all other information except the serial number;
- for machines with bagging facility provide instructions for when and how to attach and detach the bag from the unit;
- for machines powered by an internal combustion engine: instructions such as those given as an example in annex D;
- for mains-connected electrically driven machines; instructions such as those given as an example in annex D, or other relevant CENELEC Publications (when published).

The instruction handbook and the technical documentation describing the machine shall:

- give the declared noise emission values of the machinery in accordance with 1.7.4 (f) of annex A of EN ISO 12100-2:2003;
- give reference to the noise test code specified in annex F.

Compliance shall be checked by inspection.

6.2 Marking

6.2.1 Minimum marking

All machines shall be marked legibly and indelibly with the following minimum information:

- name and address of the manufacturer;
- year of construction;
- designation of series or type;
- serial number, if any;
- nominal power in kilowatts (if over 20 kW);
- mass in kilograms (if over 25 kg);
- guards designed to be opened or removed shall have a sign warning of the relevant hazard visible on the machine both when the guard is closed and when it is opened or removed;
- controls, whose purpose is not obvious, shall have the function, direction and/or method of operation clearly identified.

In order to ensure that the cutting means is satisfactorily identified to ensure safe replacement parts the cutting means shall be marked to identify the part number(s) and the manufacturer, importer or supplier.

The substance of the following warnings shall be marked on the machine, indicating (in words or pictograms). If pictograms are used they shall be those given in annex E.

- DANGER - Rotating blades. Keep hands and feet out of openings while machine is running;
- Read the user instructions;
- Keep bystanders away.

And as appropriate to the machine design:

- Wear eye and/or ear protection.

Compliance shall be checked by inspection.

6.2.2 Warning marking

Marking giving warning information shall be easily legible and located as close as practicable to the relevant hazard. Such marking shall be in one of the official languages of the country in which the machine is to be sold. Alternatively appropriate pictograms/symbols in contrasting colours shall be used (i.e. black on yellow, (red or orange if general background is yellow) but not green or blue). If the marking is cast, embossed or stamped, colours are not required.

6.2.3 Marking durability

Marking provided for identification and directional or warning information shall satisfy the following requirements:

- have a durable bond with the base material surface;
- be water resistant and designed to be permanently legible;
- not curl at the edges;
- legibility shall not be affected by fuel or lubricant.

Compliance shall be checked by inspection and by the following test.

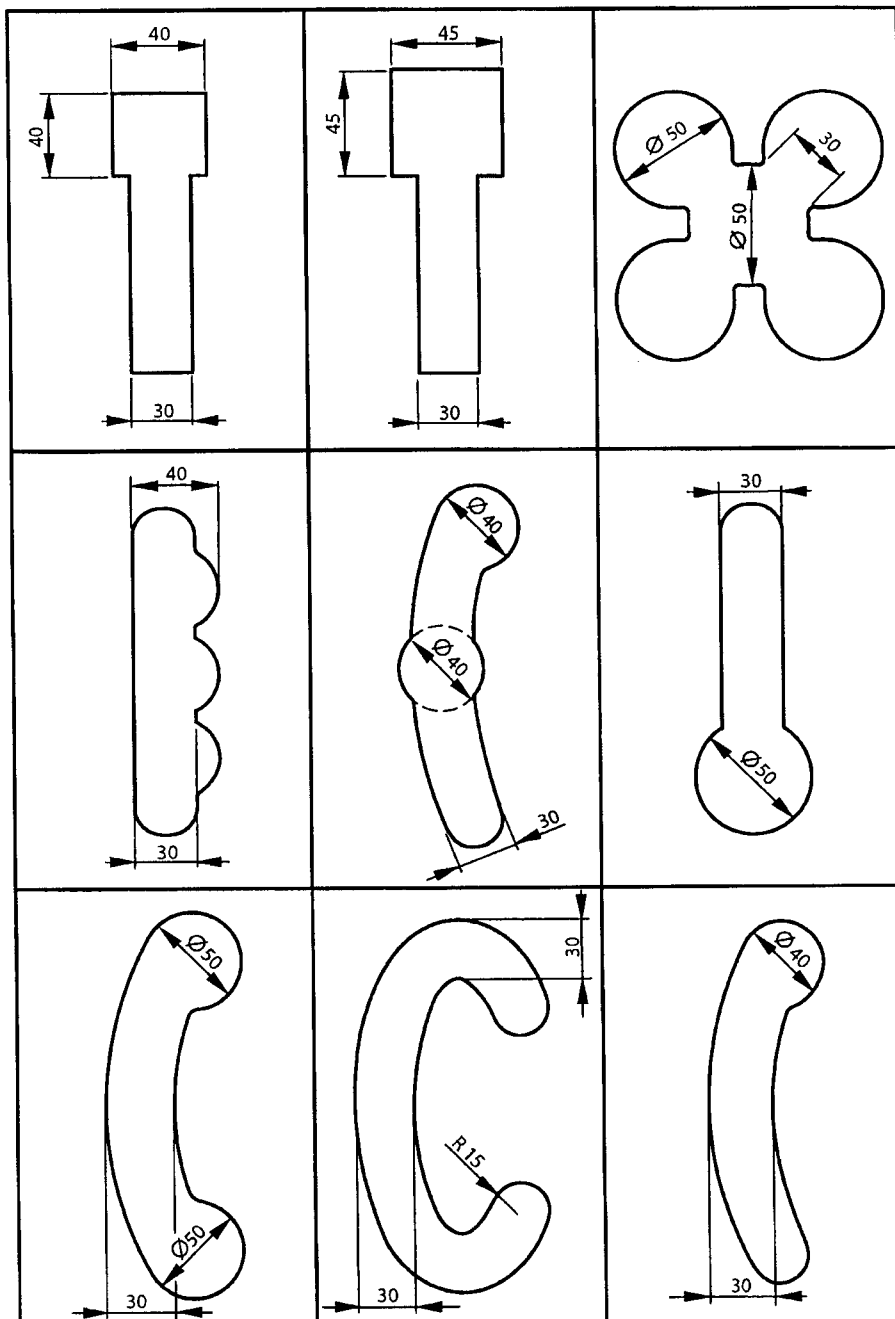
6.2.4 Test

Unless cast, embossed or stamped, all marking required by 6.2.1 shall be rubbed by hand for 15 s with a piece of cloth soaked in water and again for 15 s with a piece of cloth soaked in hexane. The marking shall remain easily legible. It shall not be easily possible to remove any label nor shall any label show any sign of curling.

Annex A
(informative)

**Examples of inlet openings where the safety distance is ≥ 200 mm
(see 5.2.1.2)**

Dimensions in millimetres

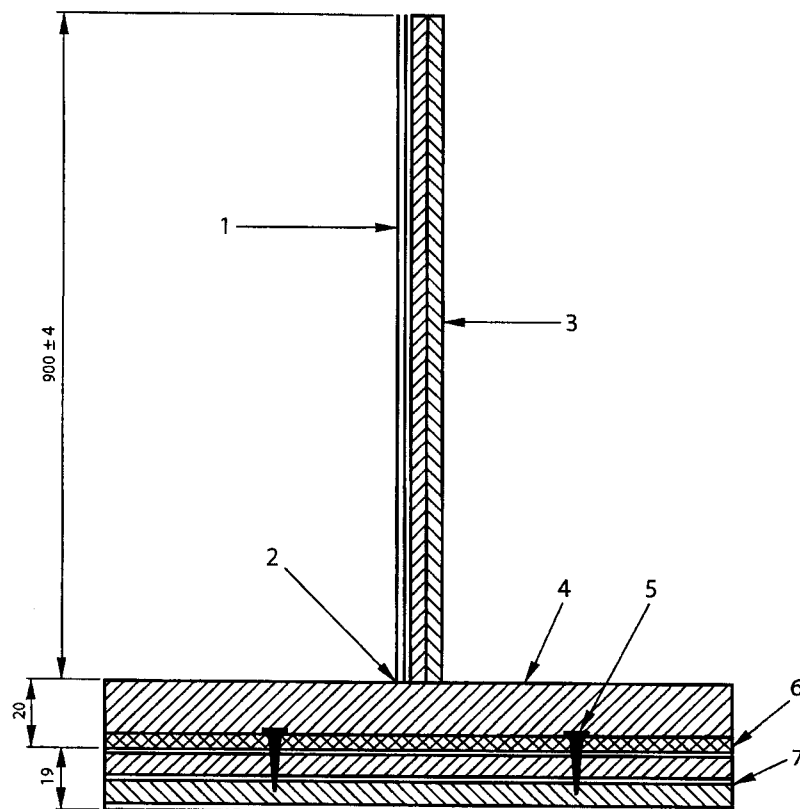


Annex B (normative)

Test enclosure

The test enclosure base specified in 5.9.2.2 shall consist of 19 mm plywood covered with coconut matting. The minimum base size shall be sufficient to support the whole of the enclosure area as shown in Figure 9. The coconut matting shall have approximately 20 mm high fibres embedded in a PVC base weighing approximately 7000 g/m². The general construction of the test enclosure shall be as shown in Figure B.1

Dimensions in millimetres



A - Inside of test enclosure

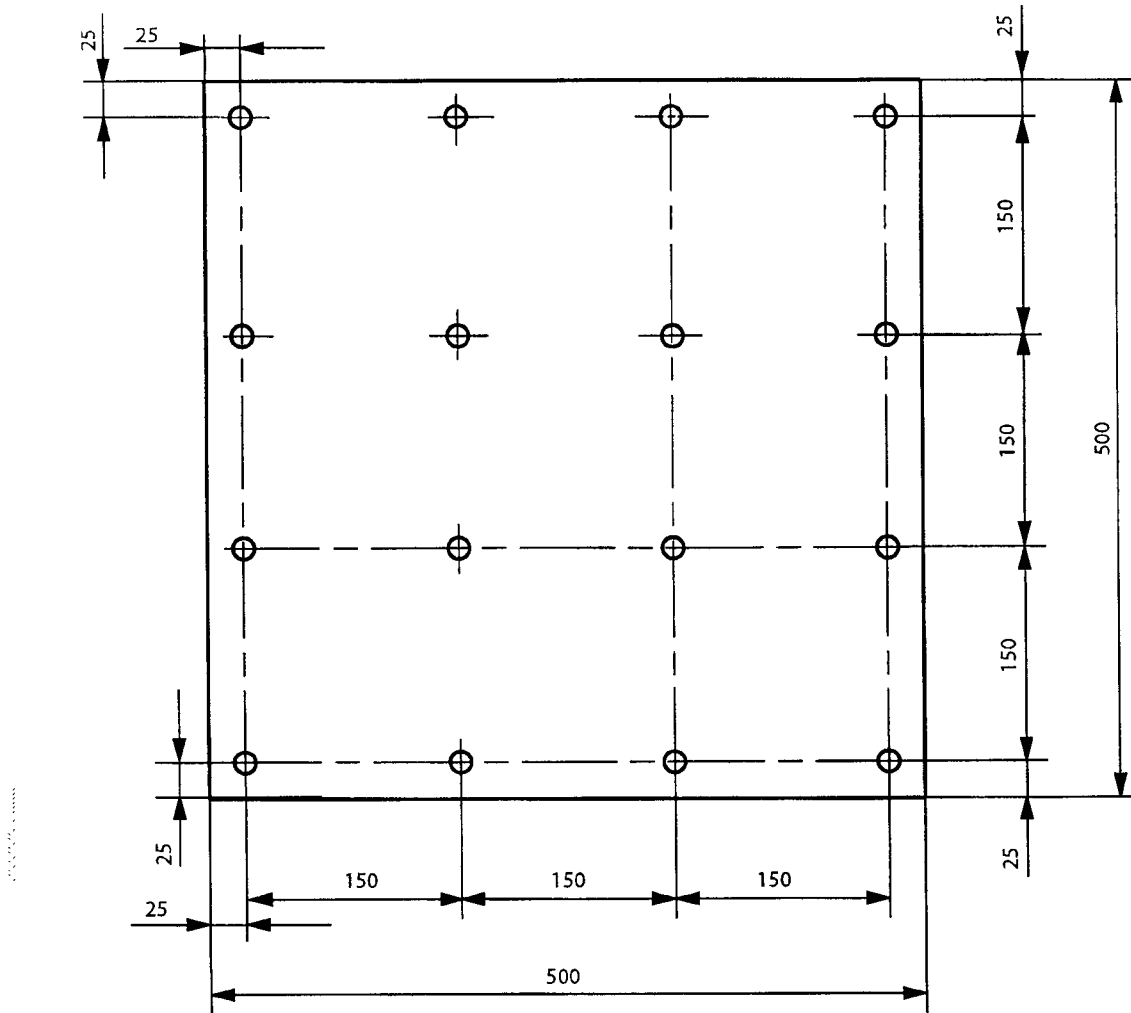
B - Outside of test enclosure

Key

- | | |
|---|-------------------|
| 1 Kraft paper used as necessary | 4 Coconut matting |
| 2 Target panel edges fit snugly to coconut matting surface to prevent chips from escaping from test enclosure | 5 Nail |
| 3 Corrugated fibreboard, one or two layers as necessary | 6 PVC |
| | 7 Plywood base |

Figure B.1 — Test enclosure walls and base (not to scale)

Dimensions in millimetres



NOTE 1 All dimensions shown are approximate.

NOTE 2 500 mm squares of coconut matting may be used so that, should wear develop the worn area can be replaced without replacing the entire test surface. In that case the squares should be nailed to the plywood with nails spaced as shown in Figure B.2.

NOTE 3 The coconut matting surface may be covered with a light flexible plastic sheet to assist in clean up of discharged wood chips on the condition that it does not affect the test results.

Figure B.2 — Nail plan of test fixture base if 500 mm squares are used

Annex C (normative)

Target panels - Specification for corrugated fibreboard (see 5.9.2)

C.1 Corrugated fibreboard target panel composition

Each corrugated fibreboard target panel shall consist of one of the following:

- a single sheet of corrugated fibreboard;
- a single sheet of corrugated fibreboard with extra sheets of Kraft paper added in front of the target face;
- two sheets of corrugated fibreboard stacked together. The corrugated fibreboard construction may have two or three liners and have one or two flutes.

C.2 Corrugated fibreboard penetration test

C.2.1 General

The purpose of the penetration test is to provide a means of selecting a uniform target material for thrown object tests.

C.2.2 Test fixture

The penetration test fixture shall be in accordance with Figure C.1.

C.2.3 Corrugated fibreboard samples

The corrugated fibreboard shall be cut into squares of 150 mm per side.

C.2.4 Procedure

Immediately before and after the thrown object test is carried out, ten samples of the corrugated fibreboard shall be tested and the requirements of C.2.5 shall be met.

Place a corrugated fibreboard square centrally on the bottom plate of the test fixture. The square may be secured at the edges by tape or adhesive. Cover with the top plate and make sure that the centre holes of the top and bottom plates are aligned and that the corrugated fibreboard is flattened by the steel top plate.

Raise the penetrator and allow it to fall onto the corrugated fibreboard samples.

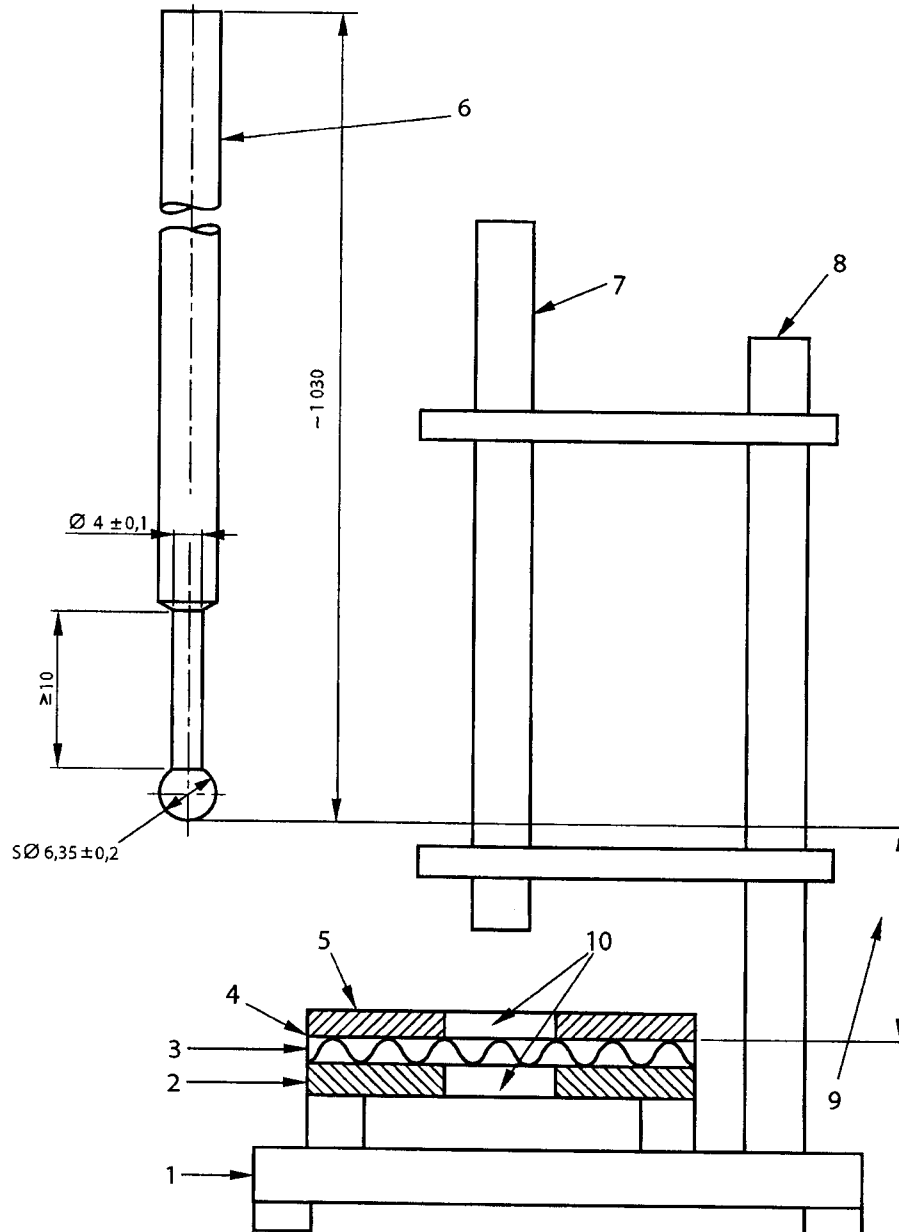
C.2.5 Acceptance criteria

The corrugated fibreboard shall be considered suitable for use as target panel material in the thrown object test of 5.9.2 if:

- when dropped 300 mm, the spherical end of the penetrator does not penetrate completely through the test sample on more than 2 out of 5 drops; and
- when dropped 400 mm, the spherical end of the penetrator does penetrate completely through the test sample in at least 4 out of 5 drops.

If the penetrator penetrates the corrugated fibreboard more than the permitted number of times when dropped 300 mm, sufficient sheets of Kraft paper shall be added to the target face of the corrugated fibreboard in order to meet penetration requirements.

Dimensions in millimetres

**Key**

- | | | | |
|---|--|----|--|
| 1 | Base | 6 | Penetrator made from $(6,35 \pm 0,2)$ mm diameter steel rod and of mass $(0,25 \text{ kg} \pm 0,005) \text{ kg}$ |
| 2 | Steel bottom plate $(6,35 \times 150 \times 150) \text{ mm}$ | 7 | Guide tube – vertical $\pm 2^\circ$ |
| 3 | Fibreboard sample | 8 | Support tube |
| 4 | Add extra Kraft paper here | 9 | Drop height |
| 5 | Steel top plate $(20 \times 150 \times 150) \text{ mm}$ | 10 | Two holes $(50 \pm 0,3)$ mm diameter |

Figure C.1 — Test fixture for corrugated fibreboard penetration test

Annex D (informative)

Safety instructions

D.1 General

This annex presents an example of safe operating practices for all machines covered by this standard. The instruction handbook should include, where appropriate, the substance of the following clauses of this annex.

It should also include information concerning noise levels and any necessary warnings, together with the following:

IMPORTANT

READ CAREFULLY BEFORE USE

KEEP FOR FUTURE REFERENCE

D.2 Safe operating practices

D.2.1 Training

Become familiar with the owner's manual before attempting to operate this equipment.

D.2.2 Preparation

- 1) do not allow children to operate this equipment;
- 2) do not operate this equipment in the vicinity of bystanders;
- 3) do not run engine powered machines in an enclosed area since the exhaust from an engine contains carbon monoxide, which is colourless, odourless, and tasteless; carbon monoxide can be extremely dangerous in enclosed areas;
- 4) wear ear protection and safety glasses at all times while operating the machine;
- 5) avoid wearing clothing that is loose fitting or that has hanging cords or ties;
- 6) only operate the machine in open space (e.g. not close to a wall or other fixed object) and on a firm, level surface;
- 7) do not operate the machine on a paved or gravel surface where ejected material could cause injury;
- 8) before starting the machine, check that all screws, nuts, bolts, and other fasteners are properly secured and that guards and screens are in place. Replace damaged or unreadable labels;
- 9) use extra care in handling fuels. They are flammable and the vapours are explosive. The following points should be observed:
 - use only an approved container;

- never remove the fuel cap or add fuel with the power source running. Allow engine and exhaust components to cool before refuelling;
- do not smoke;
- never refuel the machine indoors;
- never store the machine or fuel container inside where there is an open flame, such as a water heater;
- if fuel is spilled, do not attempt to start the power source, but move the machine away from the area of spillage before starting;
- always replace and securely tighten the fuel cap after refuelling;
- if the fuel tank is drained, this should be done outdoors.

D.2.3 Operation

- 1) before starting the machine, look into the feeding chamber to make certain that it is empty;
- 2) keep your face and body away from the feed intake opening;
- 3) do not allow hands or any other part of the body or clothing inside the feeding chamber, discharge chute, or near any moving part;
- 4) keep proper balance and footing at all times. Do not overreach. Never stand at a higher level than the base of the machine when feeding material into it;
- 5) always stand clear of the discharge zone when operating this machine;
- 6) when feeding material into the machine be extremely careful that pieces of metal, rocks, bottles, cans or other foreign objects are not included;
- 7) if the cutting mechanism strikes any foreign objects or if the machine should start making any unusual noise or vibration, shut off the power source and allow the machine to stop. Disconnect the spark plug wire from the spark plug (electric unit disconnect from supply) and take the following steps:
 - inspect for damage;
 - check for and tighten any loose parts ;
 - have any damaged parts replaced or repaired with parts having equivalent specifications.
- 8) do not allow processed material to build up in the discharge zone; this may prevent proper discharge and can result in kickback of material through the feed intake opening;
- 9) if the machine becomes clogged, shut-off the power source and disconnect the spark plug wire (electric unit disconnect from supply) before clearing debris. Keep the power source clear of debris and other accumulations to prevent damage to the power source or possible fire. Remember that operating the starting mechanism on engine powered machines will still cause the cutting means to move;
- 10) keep all guards and deflectors in place and in good working condition;
- 11) do not tamper with the power source governor settings; the governor controls the safe maximum operating speed and protects the power source and all moving parts from damage caused by over-speed. Seek authorised service if a problem exists;

- 12) do not transport this machine while the power source is running;
- 13) shut off the power source and disconnect the spark plug lead (electric unit disconnect from supply) whenever you leave the work area;
- 14) do not tilt the machine while the power source is running.

D.2.4 Maintenance and storage

- 1) when the machine is stopped for servicing, inspection, or storage, or to change an accessory, shut off the power source, disconnect the spark plug wire from the spark plug (electric unit disconnect from supply), make sure that all moving parts have come to a complete stop and, where a key is fitted remove the key. Allow the machine to cool before making any inspections, adjustments, etc.
- 2) store the machine where fuel vapour will not reach an open flame or spark. For extended storage periods, run the unit dry of fuel. Always allow the machine to cool before storing;
- 3) when servicing the cutting means be aware that, even though the power source will not start due to the interlock feature of the guard, the cutting means can still be moved by a manual starting mechanism.

D.2.5 Additional safety instructions for units with bagging attachments

- 1) shut-off the power unit before attaching or removing the bag.

Annex E (normative)

Symbols and/or pictograms

E.1 General

The safety symbols and pictograms which may be used on hand fed powered shredder/chippers as defined in this European Standard are presented in this annex.

Symbols shall follow the conventions laid down in ISO 3767-1:1998, ISO 3767-3:1995, ISO 3767-4:1993 and ISO 3864-1:2002 while the pictograms shall follow the conventions presented in ISO 11684:1995.

The symbol or pictogram size may be modified to fit a specific machine design. The pictograms or symbols presented are not all-inclusive.

E.2 Pictograms

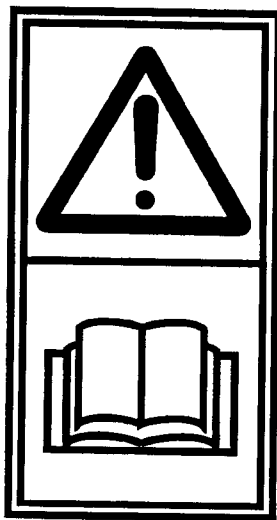


Figure E.1 — "Read operator's manual"

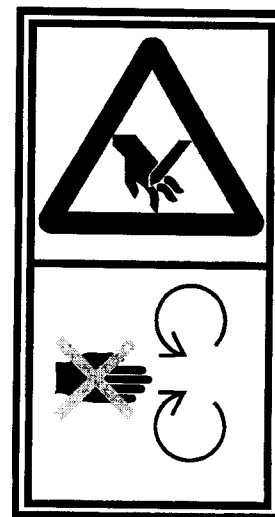


Figure E.2 — "Danger - Rotating blades. Keep hands and feet out of openings while machine is running."



Figure E.3 — "Keep bystanders away"



Figure E.4 — "Wear ear protection"



Figure E.5 — "Wear eye protection"



Figure E.6 — "Wear eye and ear protection"

Annex F (normative)

Noise test code – Engineering method (grade 2)

F.1 Scope

This noise test code specifies the information necessary to carry out efficiently and under standardised conditions the determination of the noise emission characteristics of integrally powered shredders/chippers.

Noise emission characteristics include the emission sound pressure level at the operator position and the sound power level. The determination of these quantities is necessary for:

- manufacturers to declare the noise emitted;
- comparing the noise emitted by machines in the family concerned;
- purposes of noise control at the source at the design stage.

The use of this noise test code ensures reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise measurement method used. Noise measurement methods allowed by this standard give results with Grade 2 of accuracy.

F.2 A-weighted sound power level determination

For the determination of A-weighted sound power level, EN ISO 3744:1995 shall be used subject to the following modifications or additional requirements:

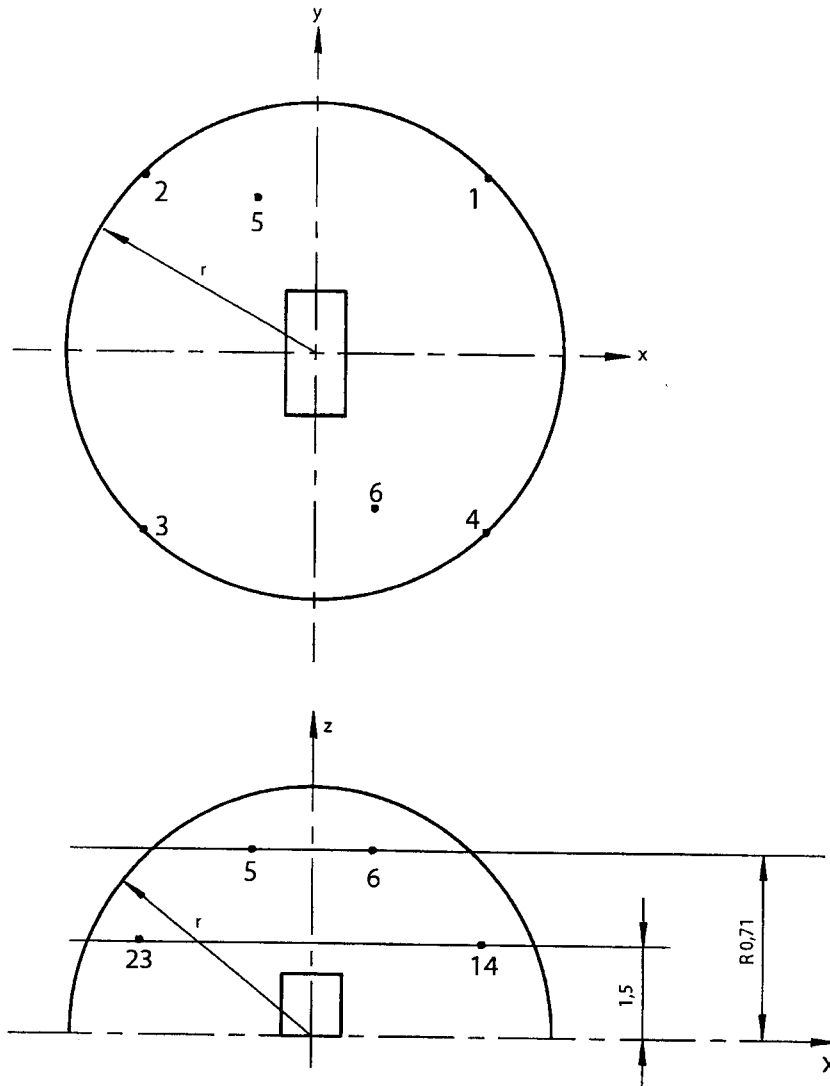
- reflecting surface shall be replaced by an artificial surface which complies with F.4.1 or by natural grass which complies with F.4.2. Reproducibility of results using natural grass is likely to be lower than that required for Grade 2 of accuracy. In the case of dispute, measurements shall be carried out in the open air and on the artificial surface;
- measurement surface shall be a hemisphere with a radius, r , of 4 m;
- microphone array shall be six microphone positions as defined in Figure F.1 and Table F.1;
- environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C and the wind speed shall be less than 8 m/s and preferably less than 5 m/s;
- for measurements in the open air K_{2A} shall be taken as 0;
- for measurements indoors the value of K_{2A} , determined without artificial surface and in accordance with annex A of EN ISO 3744: 1995, shall be ≤ 2 dB, in which case K_{2A} shall be taken as 0.

F.3 A-weighted emission sound pressure level measurement

For the measurement of the A-weighted emission sound pressure level EN ISO 11201:1995 shall be used subject to the following modifications or additional requirements:

- reflecting surface shall be replaced by an artificial surface which complies with F.4.1 or by natural grass which complies with F.4.2. Reproducibility of results using natural grass is likely to be lower than that required for Grade 2 of accuracy. In the case of dispute, measurements shall be carried out in the open air and on the artificial surface;
- environmental conditions shall be within the limits specified by the manufacturers of the measuring equipment. The ambient air temperature shall be in the range from 5 °C to 30 °C, and the wind speed shall be less than 8 m/s and preferably less than 5 m/s;
- microphone shall be mounted at a height of (1600 ± 50) mm above the ground and positioned (700 ± 20) mm from the vertical centre line of the main feed intake opening as specified in Figure F.2. If the discharge is centrally downwards the microphone shall be located in line with any auxiliary feed intake opening. If the discharge is not centrally downwards the microphone shall be positioned at 180° to the direction of the discharge.

Dimensions in metres



Key

r radius of hemisphere

Figure F.1 — Microphone positions on the hemisphere (see Table F.1)

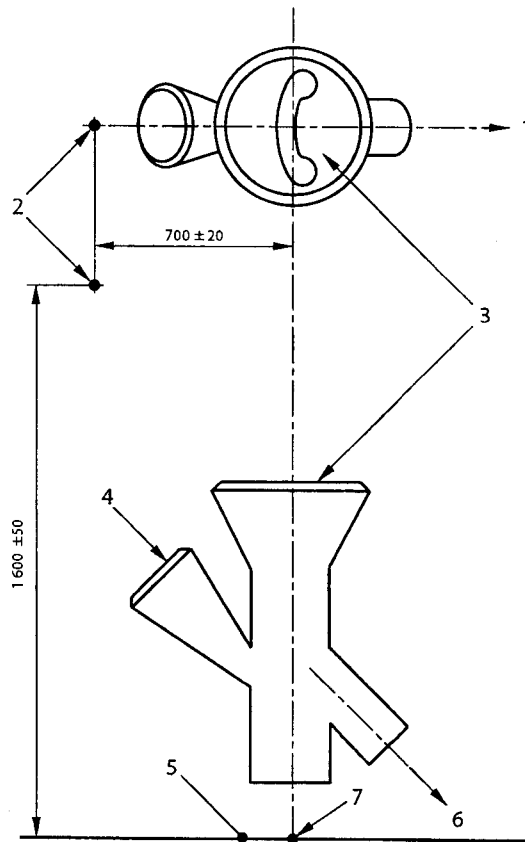
Table F.1 — Co-ordinates of microphone positions

Position No.	X r	Y r	Z
1	+ 0,7	+ 0,7	1,5 m
2	- 0,7	+ 0,7	1,5 m
3	- 0,7	- 0,7	1,5 m
4	+ 0,7	- 0,7	1,5 m
5	- 0,27	+ 0,65	0,71 r
6	+ 0,27	- 0,65	0,71 r

Microphones numbered 1 to 4 are not exactly on the hemisphere but a little bit outside. For the determination of the measured sound power level:

- microphones shall be set at the positions specified in Table F.1;
- the area of the measurement surface to take into account is that of a hemisphere with a radius of 4m, so assuming that all microphones are on this hemisphere.

Dimensions in millimetres



Key

- 1 Direction of discharge to be in line with the X axis of the microphone co-ordinate system
- 2 Microphone
- 3 Main feed intake opening
- 4 Auxiliary feed intake opening
- 5 Ground surface
- 6 Discharge direction
- 7 Centre of microphone co-ordinate system

NOTE For purposes of clarity the machine is not drawn to scale and is shown without ground supports etc.

Figure F.2 — Microphone position for measurement of sound pressure at the operator's ear and location of machine with respect to the microphone co-ordinate system

F.4 Requirements for test floor

F.4.1 Artificial surface

The artificial surface shall have absorption coefficients as given in Table F.2, measured in accordance with EN ISO 354:2003.

F.2 — Absorption coefficients

Frequencies in Hz	Absorption Coefficients	Tolerance
125	0,1	± 0,1
250	0,3	± 0,1
500	0,5	± 0,1
1 000	0,7	± 0,1
2 000	0,8	± 0,1
4 000	0,9	± 0,1

The artificial surface shall be placed on a hard, reflecting surface and have a size of at least 3,6 m × 3,6 m placed at the centre of the test environment. The construction of the supporting structure shall be such that the requirements for the acoustic properties are also met with the absorptive material in place. The structure shall support the operator to avoid compression of the absorbing material.

NOTE See annex G for example of a material and construction which can be expected to fulfil these requirements.

F.4.2 Natural grass

The test environment shall be covered, at least for the horizontal projection of the measurement surface used, with high quality natural grass. Before the measurements are taken, the grass shall be cut with a mower to a height of cut as near as possible to 30 mm. The surface shall be clean of grass clippings and debris and shall be visibly free of moisture, frost and snow.

F.5 Installation, mounting and operating conditions

Measurements shall be carried out on a new, normal production machine featuring standard equipment as provided by the manufacturer. If a collector is provided or available for the machine from the manufacturer, it shall not be fitted.

For engines:

- engine shall be run-in and warmed up until stable conditions are reached before the test is commenced;
- carburettor and ignition shall be set according to the instructions of the manufacturer.

For electric motors supplied from mains:

- machine shall be run until stable conditions are reached before the test is commenced;
- rated voltage of the upper limit of the rated voltage range and/or frequency shall be maintained during the test at 0,98 to 1,02 times the stated values. The supply voltage of mains powered machines is measured at the plug of the cable or cord supplied, not at the plug of any extension cable or cord.

EN 13683:2003 (E)

For electric motors supplied from batteries:

- noise measurements shall be started with fully charged batteries as specified by the manufacturer but shall not be continued when the battery voltage under load drops to lower than 0,9 times the battery voltage under load at the beginning of the measurements for lead-acid batteries, or to lower than 0,8 times for other batteries;
- battery voltage shall be measured at the battery terminals.

The test shall be carried out at the maximum operating speed (see 3.9).

An engine/motor speed indicator shall be used to check the speed of the engine. It shall have an accuracy of $\pm 2,5\%$ of the reading. The indicator and its engagement with the shredder/chipper shall not affect the operation during the test.

The shredder/chipper shall be in the normal stationary position on a horizontal surface and shall be tested using 2 pieces of dry pine ($12 \times 24 \times 200$) mm¹ for each test cycle. The operator shall stand in the designated operating position² and shall drop the test pieces simultaneously into the feed intake opening. The operator shall remain stationary while the measurements are made. Where there is more than one feed intake opening each opening shall be tested separately. Measurements shall only be made while there are test pieces in the machine and shall be of not less than 10 s duration. If necessary additional pairs of test pieces may be dropped into the machine in order to achieve a 10 s measurement period. All results except that from the feed intake opening giving the highest result shall be disregarded.

For the sound power level determination, the cutting means shall be above the centre of the hemisphere.

F.6 Measurement uncertainties and declaration of noise emission values

When measuring the sound power level or the emission sound pressure level at the operator position, tests shall be repeated to attain the required grade of accuracy, and until three consecutive A-weighted results give values within not more than 2 dB. The arithmetic average of these shall be the measured A-weighted sound power level or the emission sound pressure level of the machine respectively.

The uncertainties associated with the measurements shall be taken into account when deciding on the declared noise emission values.

NCTE The methodology used for taking uncertainties into account should be based on the use of measured values and measurement uncertainties. The latter are the uncertainty associated to the measurement procedure (which is determined by the grade of accuracy of the measurement method used) and the production uncertainty (variation of noise emission from one machine to another of the same type made by the same manufacturer).

F.7 Information to be recorded and reported

The information to be recorded and reported is that required by EN ISO 3744:1995 and EN ISO 11201:1995.

¹ These test pieces are different from that specified in the Directive 2000/14/EC on Noise of Equipment used Outdoors because it is known that these test pieces do give repeatable results as they do not significantly slow down the machine and are not influenced by the operator.

In the case that the machine being tested does not chip the test pieces the pieces should be left inside the machine untouched by any outside means until the measurements have been completed.

² The operator should not stand between the machine and any microphone.

Annex G (informative)

Example of a material and construction fulfilling the requirements for an artificial surface

G.1 Material

Mineral fibre, 20 mm thick, having an airflow resistance of $11 \text{ kN}\cdot\text{s}/\text{m}^4$ and a density of $25 \text{ kg}/\text{m}^3$.

G.2 Construction

As is shown in Figure G.1, the artificial flooring of the measurement site is sub-divided into nine joint planes, each of approximately $1,20 \text{ m} \times 1,20 \text{ m}$. The backing layer (a) of the construction as shown in Figure G.1 consists of chipboard, 19 mm thick, coated with a plastics material on both sides. Such boards are used, for example, for the construction of kitchen furniture. The cut edges of the chipboards should be protected against moisture by applying a coat of plastic paint. The outsides of the flooring are bordered by a two-legged aluminium section (d), its leg height being 20 mm. Sections of this profile material are also screwed to the edges of the joint planes where they serve as spacers and attachment points.

On the middle joint plane on which the machine is placed during measurement as well as any other place on which the operator can get to stand on, aluminium T-sections (c) with a leg length of 20 mm are mounted as spacers. These sections also provide exact markings which facilitate the alignment of the machine in the middle of the measurement site. The prepared boards are then covered with the insulating felt material (b) cut to size.

The felt flooring of the joint planes which are neither stood on nor driven over (type A surface in Figure G.1) are covered with a simple wire mesh fastened to the edge strips and to the attachment points; for this purpose, the sections should be provided with holes. Thus, the material is adequately attached, but it remains possible to replace the felt material should it become soiled. As a wire mesh, a so-called aviary wire (e) with a mesh width of 10 mm and a wire diameter of 0,8 mm has proved to be suitable. This wire appears to protect the surface adequately without affecting the acoustic conditions.

Protection by simple wire mesh is not, however, sufficient in the area subjected to traffic (type B surface in Figure G.1). For these surfaces, the use of wire grating of corrugated steel wire (f) with a diameter of 3,1 mm and a mesh width of 30 mm has proved to be suitable.

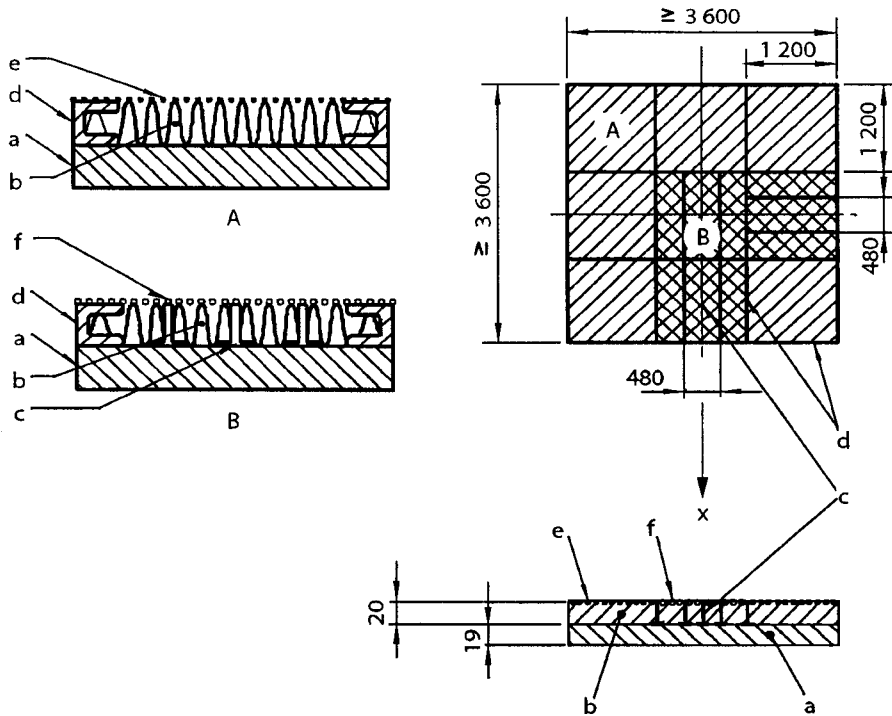
The construction of the measurement site as described above offers two advantages: it can be prepared without much time and effort, and all the materials are easily obtainable.

The fact that the microphone positions are not situated directly above the flooring of the measurement site allows the microphones to be easily mounted on stands, assuming that the ground is even and hard as, for example, an asphalt or concrete site.

When arranging the microphones, account has to be taken of the fact that the height of the microphones has to be determined in relation to the surface of the flooring of the measurement site. It shall, therefore, be 40 mm higher when measuring from the ground under the microphone.

Dimensions in millimetres

(unless otherwise stated all dimensions are approximate)



Key

- A This surface is not suitable to carry weight. Do not stand on or drive over
- B This surface is suitable to carry weight. May be stood on or driven over
- a Backing layer of plastics coated chipboard (nominally 19 thick)
- b Mineral wool fibre layer (nominally 20 thick)
- c Aluminium T-sections (nominally 3 thick × 20 high)
- d Aluminium U-sections (nominally 3 thick × 20 high)
- e Wire mesh (nominally 10 × 10 mesh made of 0,8 diameter steel wire)
- f Wire grating (nominally 30 × 30 mesh made of 3,1 diameter steel wire)

Figure G.1 — Sketch of the measurement surface covered with an artificial surface (not to scale)

Annex ZA (informative)

Relationship of this document with EC Directives

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EC Directive(s):

— Machinery Directive 98/37/EC, amended by Directive 98/79/EC.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

WARNING: Other requirements and other EC Directives may be applicable to the product(s) falling within the scope of this Standard.

Bibliography

- [1] EN 563, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces.*
- [2] EN 60335-1:1998, *Safety of household and similar electrical appliances — Part 1: General requirements ((IEC 60335-1:1983, modified)).*
- [3] EN ISO 11691:1995, *Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method (ISO 11691:1995).*
- [4] EN ISO 11820:1996, *Acoustics — Measurements on silencers in situ (ISO 11820:1996).*