

Australian Standard[®]

Wood processing machinery—Safety

Part 8: Finishing machinery—Milling tools and circular saw blades



This Australian Standard® was prepared by Committee SF-007, Guarding of Woodworking Machinery. It was approved on behalf of the Council of Standards Australia on 6 August 2007.

This Standard was published on 31 October 2007.

The following are represented on Committee SF-007:

- Australian Chamber of Commerce and Industry
 - Australian Industry Group
 - Australian Woodworking Industry Suppliers Association
 - Construction, Forestry, Mining and Energy Union
 - Department for Administrative and Information Services, SA
 - Department of Consumer & Employment Protection, WorkSafe Division, WA
 - Department of Justice, Tas.
 - Department of Labour, New Zealand
 - Furnishing Industry Association of Australia
 - Furnishing Training Australia
 - Furniture Teachers Advisory Group
 - National Distribution Union, New Zealand
 - National Safety Council of Australia
 - New Zealand Logging Industry Research Association
 - Safety Institute of Australia
 - Tasmanian Timber Promotion Board
 - Victorian Association of Forest Industries
 - Victorian WorkCover Authority
 - WorkCover New South Wales
-

This Standard was issued in draft form for comment as DR 07140.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

Keeping Standards up-to-date

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting **www.standards.org.au**

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at **mail@standards.org.au**, or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

Australian Standard[®]

Wood processing machinery—Safety

Part 8: Finishing machinery—Milling tools and circular saw blades

Originated as part of CZ10—1960.
Previous edition part of AS 1473—1991.
Revised and redesignated in part as AS 1473.8—2007.

COPYRIGHT

© Standards Australia

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Published by Standards Australia GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 8426 7

PREFACE

This Standard was prepared by the Standards Australia Committee SF-007, Guarding of Woodworking Machinery as a revision, in part, of AS 1473—1991, *Guarding and safe use of woodworking machinery*.

This Standard is one of a series of Standards dealing with the safety of woodworking machinery which has been developed as a result of requests from regulatory authorities for a new edition of this Standard.

This Standard sets out particular requirements for milling tools and circular saw blades. Additional requirements which are applicable to all woodworking machines are to be found in AS 1473.2, *Wood processing machinery—Safety, Part 2: Finishing machinery—Common requirements*.

In common with many of the Standards dealing with safety of machinery, this Standard is based upon documents released by the European Committee for Standardization, CEN. In using these documents the Committee is maintaining consistency with machinery safety Standards published in Australia.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
1 SCOPE	4
2 OBJECTIVE.....	4
3 REFERENCED DOCUMENTS	4
4 DEFINITIONS	5
5 SYMBOLS, ABBREVIATIONS AND NOTATION.....	11
6 LIST OF HAZARDS	11
7 DESIGN REQUIREMENTS	12
8 TOOL IDENTIFICATION	24
9 INFORMATION	26
10 REQUIREMENTS FOR THE SHANK OF SHANK-MOUNTED MILLING TOOLS.....	26

APPENDICES

A	NOTATION	31
B	PALMQVIST TOUGHNESS TEST	33
C	SAFE WORKING PRACTICE.....	34
D	MAINTENANCE AND MODIFICATION OF MILLING TOOLS RELATED COMPONENTS AND CIRCULAR SAW BLADES.....	37
E	MEASURING ECCENTRICITY AT CLAMPING DEVICES.....	38

STANDARDS AUSTRALIA

Australian Standard
Wood processing machinery—Safety

Part 8: Finishing machinery—Milling tools and circular saw blades

1 SCOPE

This Standard sets out the safety requirements for milling tools for woodworking machinery of the shank mounting, bore mounting or integrated spindle type, as well as for circular saw blades.

The Standard also sets out means for determining the maximum rotational speed for a given eccentricity at the clamping devices and a given tool shank strength. The means is applicable to milling tools having a cylindrical shank. Marking requirements for the tool are also specified. The maximum speed is applicable whether the tools are mounted horizontally or vertically.

This Standard does not apply to boring bits, eccentric single router cutters, cutters with a cutting circle of less than 16 mm and to tools used in rotary knife lathes and copying lathes where the hazard of ejection and contact with the tool is always prevented by a system of fixed guards and/or movable guards interlocked with guard-locking and/or self-closing guards.

2 OBJECTIVE

The objective of this Standard is to provide designers and manufacturers of wood-processing milling cutters, circular saw blades and shanks for shank-mounted tools with the technical means of minimizing the risks to the health and safety of machine operators and others working with, or otherwise near, wood-processing machinery using milling cutters and circular saw blades.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

- | | |
|-----------|---|
| 1654 | ISO system of limits and fits |
| 1654.2 | Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts |
| 1817 | Metallic materials—Vickers hardness test |
| 1817.1 | Part 1: Test methods (ISO 6507-1:1997, MOD) |
| 4024 | Safety of machinery |
| 4024.1301 | Part 1301: Risk assessment—Principles for risk assessment |

ISO

- | | |
|--------|--|
| 513 | Classification and application of hard cutting materials for metal removal with defined cutting edges—Designation of the main groups and groups of application |
| 1940 | Mechanical vibration—Balance quality requirements for rotors in a constant (rigid) state |
| 1940-1 | Part 1: Specification and verification of balance tolerances |

ISO

3002 Basic quantities in cutting and grinding

3002-1 Part 1 Geometry of the active part of cutting tools—General terms, reference systems, tools and working angles, chip breakers

4 DEFINITIONS

For the purpose of this Standard, the following definitions apply.

4.1 Adhesive fixing

The bonding of the tool components to the body which prevents their change of position relative to each other.

4.2 Auxiliary cutting parts

Additional cutting parts with a cutting width and a radial cutting edge projection to the body of less than 12 mm (e.g. grooving inserts, bevelling inserts, spurs).

4.3 Axial approach angle τ_a

The angle between a plane perpendicular to the axis of the tool and the axial approach flat (see Figure 1).

4.4 Axial cutting edge projection C_a

The distance measured axially between the axial cutting edge and the body (see Figure 2(a)) or the deflector (see Figure 2(d)).

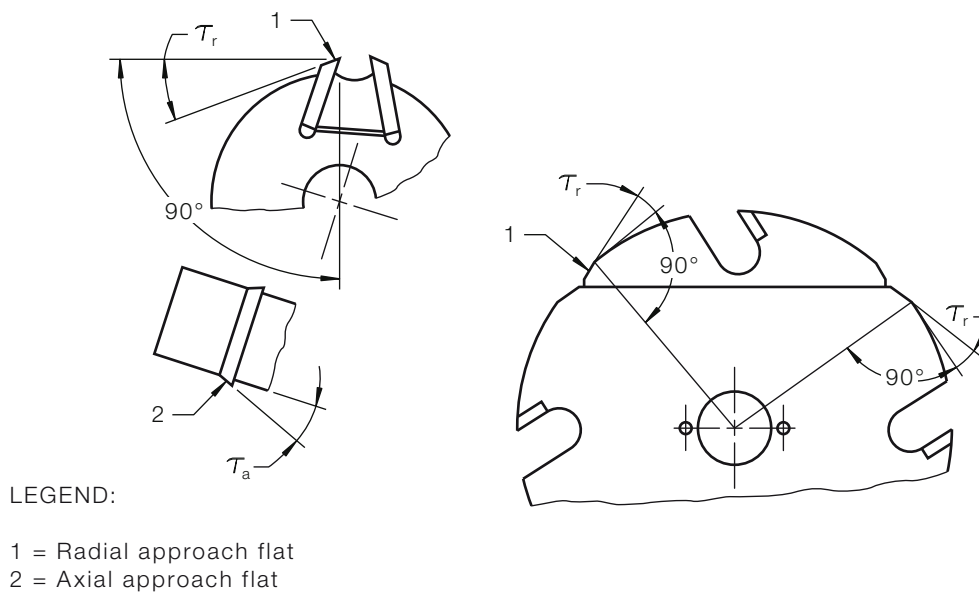


FIGURE 1 RADIAL AND AXIAL APPROACH FLATS

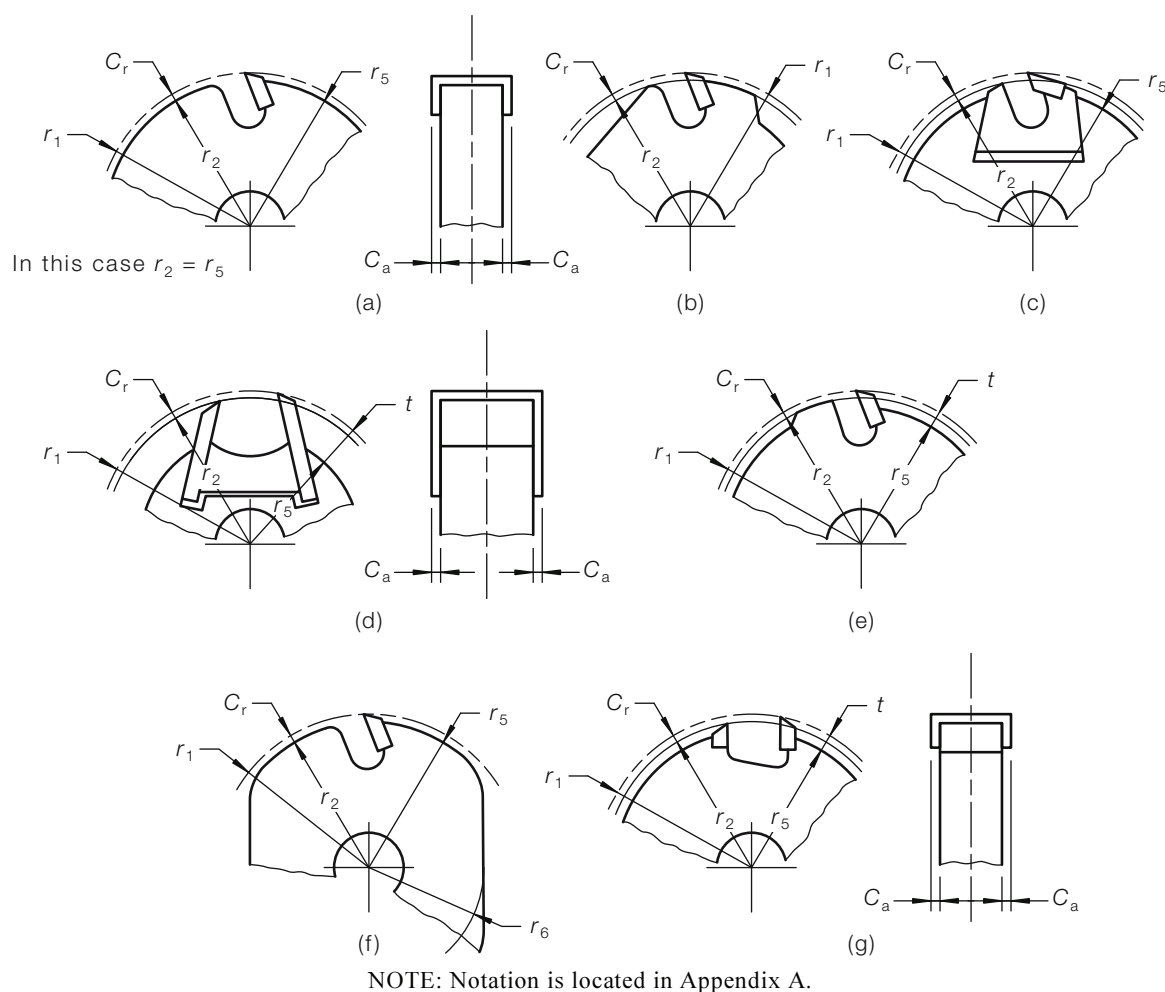


FIGURE 2 DEFLECTOR

4.5 Basic number of teeth

The number of teeth cutting in each part of the profile.

4.6 Body

The part of the tool which holds the cutting blades or inserts, or on which the cutting parts are formed (see ISO 3002-1).

4.7 Chip breaking item

A characteristic feature suitable to deflect the chip (e.g. to upset the chip) with the aim of reducing the presplitting of the workpiece material. The chip breaking item may be a separate or an integral element of the cutting part.

4.8 Circular saw blade (woodworking)

A rotating cutting tool for cross-cutting or ripping wood and similar materials through chip removal.

The tools cut on the periphery and on both flanks simultaneously, and may be—

- (a) a one piece tool;
- (b) a composite tool; or
- (c) a complex tool.

4.9 Complex tool

Tools where one or more cutting parts (inserts or blades) are exchangeably mounted in a body through detachable fixing elements. The cutting parts may be one piece or composite.

4.10 Composite tool (tipped tool)

Tools where the cutting parts (tips) are firmly connected by bonding to the body, e.g. by welding, brazing or adhesive fixing.

4.11 Cutting blade projection (t)

The difference between the radius r_1 of the cutting circle and the radius r_5 of the back supporting circle where $t = r_1 - r_5$ (see Figure 2).

4.12 Cutting diameter

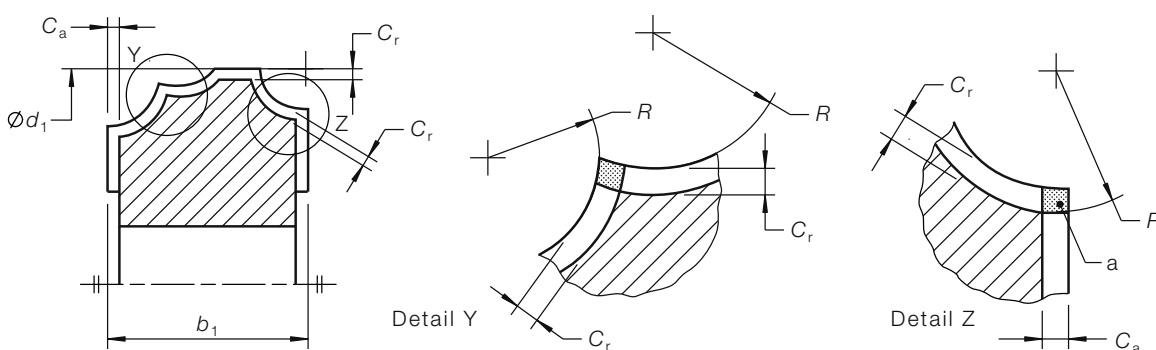
For tools where various blades can be mounted, the cutting diameter d_1 (cutting radius r_1) is the maximum possible value (see Figure 3).

4.13 Cutting part

The functional part or parts of the tool each comprised of chip producing elements. The cutting edges, face and flank are therefore elements of the cutting part. In the case of a multi-toothed cutter, each tooth has a cutting part.

4.14 Cutting width

For tools where various blades can be mounted, the cutting width b_1 is the maximum possible value (see Figure 3).



NOTE: Notation is located in Appendix A.

FIGURE 3 CUTTING DIAMETER AND CUTTING WIDTH

4.15 Deflector

A projecting part exchangeably mounted or firmly connected by bonding to the body or part of the body which performs chip thickness limitation (see Figures 2(b), (c), (d), (e) and (g)).

NOTE: The deflector can also be called a counter-knife.

4.16 Demountable power feed unit

A feed mechanism which is mounted on the machine so that it can be moved from the working position without the use of a spanner or similar additional device.

4.17 Ejection

The unexpected movement of the workpiece, parts of it or parts of the machine during processing.

4.18 Gullet width (*s*)

Distance from the cutting edge to the point at which the contour of the tool abandons the circle with radius r_2 (see Figure 2).

4.19 Hand feed

The manual holding and/or guiding of the workpiece or of a machine element incorporating a tool. Hand feed includes the use of a hand-operated carriage on which the workpiece is placed manually or clamped and the use of demountable power feed unit (see Clause 4.16).

4.20 Integrated feed

A feed mechanism for the workpiece or tool which is integrated with the machine and where the workpiece or machine element with incorporated tool are held and controlled mechanically during the machining operation.

4.21 Integrated tools

Tools where the body is part of the machine and only the cutting parts are exchangeable.

4.22 Kickback

A particular form of ejection (see Clause 4.17) and is describing the unexpected movement of the workpiece, or parts of it or parts of the machine opposite to the direction of feed during processing.

4.23 Loading the machine

The manual or automatic placing of the workpiece onto a carriage, magazine, lift, hopper, movable bed, conveyor or the presentation of the workpiece to an integrated feed device.

4.24 Maximum rotational speed

The maximum rotational speed for the operation for which the tool is designed.

4.25 Milling tool for woodworking

A rotating cutting tool, (e.g. milling cutter, planing cutter, thicknessing cutter) normally having its main feed direction perpendicular to the rotation axis, for working various surfaces on wood and similar materials through chip removal.

The cutting edge of the cutting part may be—

- (a) parallel to the axis of rotation;
- (b) square to the axis of rotation; or
- (c) a profile which is a combination of the two.

The tools may be—

- (i) a one piece tool;
- (ii) a composite tool;
- (iii) a complex tool; or
- (iv) in the form of a tool set.

4.26 Not round form tool

A tool where chip thickness limitation is performed by a deflector (see Figures 2(b), (c), (d), (e) and (g)) or where a cross-section of the body is not circular (see figure 2(f)).

4.27 One piece tool (solid tool)

Tools without bonded or detachable parts, the body and the cutting parts are one piece.

4.28 Radial approach angle (τ_r)

The angle between the approach flat and the tangent to the deflector circle at the deflector edge or to the body circle at the point where the radial approach flat begins (see Figure 6).

4.29 Radial and axial approach flats

A flat on the radial and/or axial surface of the deflector or of the body, in front of the deflector edge (see Figure 1).

4.30 Radial cutting edge projection $C(r)$

The difference between the deflector (not round form tools) or the body (round form tools) and the cutting edge measured in the direction of the normal to the profile (see Figures 2 and 3).

4.31 Round form tool

A tool where the body has a circular shape in any cross-section perpendicular to the rotational axis of the tool and which performs chip thickness limitation (see Figures 2(a) and 5) except auxiliary cutting parts with a deflector.

4.32 Round form tool set

A unit consisting of a number of individual not round form tools clamped together or fixed on a tool holder, e.g. screwed on a sleeve, forming a round form tool shape with radial gaps of less than 5 mm and axial gaps less than 15 mm and the top and the bottom side is a full round.

4.33 Separable fixing

4.33.1 Form lock fixing

A fixing where the relative change of position in the radial direction during rotation is prevented by the form and arrangement of the components (see Figure 4).

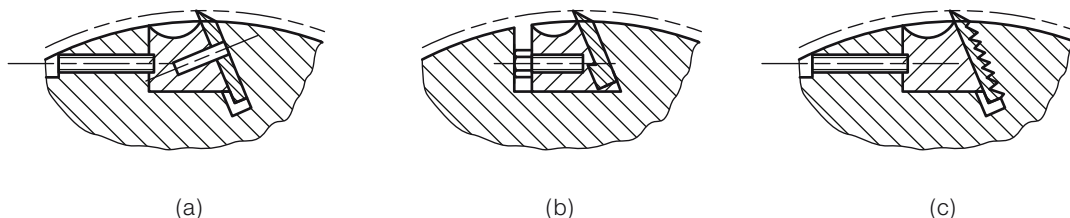
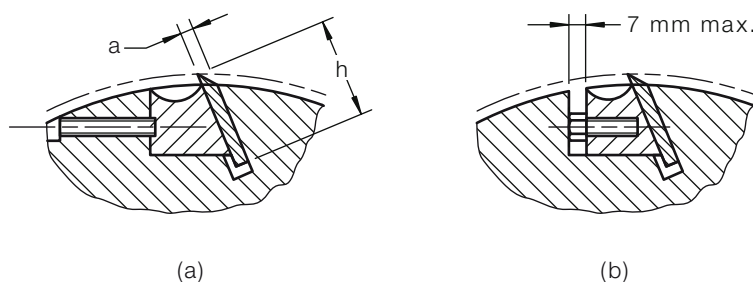


FIGURE 4 FORM LOCK FIXING

4.33.2 Friction lock fixing

A fixing where the relative change of position in a radial direction during rotation is prevented only by the friction forces (see Figure 5).



NOTE: Notation is located in Appendix A.

FIGURE 5 FRICTION LOCK FIXING

4.34 Similar materials

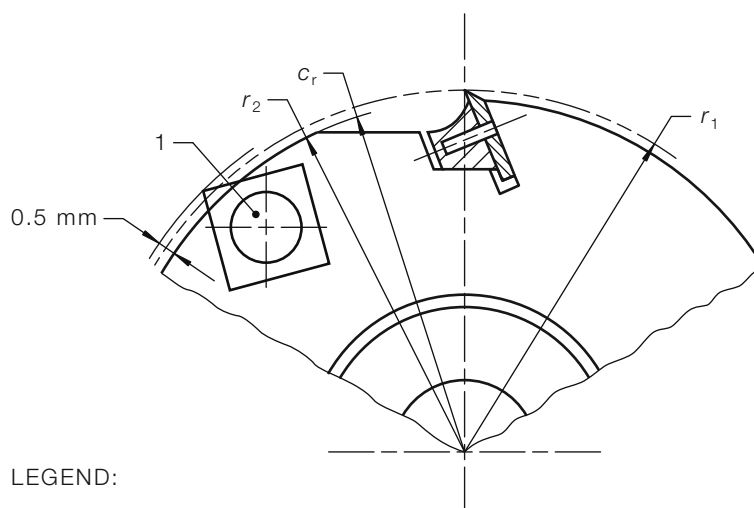
Materials with physical and technological characteristics similar to those of wood, such as cork, bone, wood-based materials as chipboard, fibreboard, plywood, etc. and for which the process for machining and chip or particle removal is similar, e.g. rubber, plastic and other stiff material.

4.35 Speed range

The minimum and maximum rotational speeds within which the tool spindle or tool is designed to operate.

4.36 Spur

A cutting part which operates both on its periphery and on its flank. The spur projects from the major cutting edge in radial, and if applicable, in axial direction. A spur is either a separate cutting part or a part of the major cutting edge (see Figure 6).



LEGEND:

1 = Screw at the choice of the manufacturer

NOTE: Notation is located in Appendix A.

FIGURE 6 MILLING TOOL WITH SPUR

4.37 Tools

All individual tools and tool sets for the mechanical removal of chips, e.g. circular saw blades, bandsaw blades, milling cutters, chain cutters. Tools also include devices for forming and shaping or chipless cutting.

4.38 Tool combination

A unit consisting of a number of loose tools connectable in a variable sequence or extendable in a variable position on a tool holder (e.g. sleeve, flange).

4.39 Tool set

A unit consisting of a number of individual tools clamped together on a tool carrier.

4.40 Woodworking machine

A machine or a combination of machines intended for cutting of wood and similar materials (see Clause 4.34) by chip removal, or chipless cutting, sanding and forming, laminating (including gluing and edging) or joining.

It includes equipment for noise and dust control that is integral with the machine.

A machine also includes auxiliary equipment, e.g. power feed units, reversing units magazines and hoppers, clamping devices and conveying and lifting equipment.

5 SYMBOLS, ABBREVIATIONS AND NOTATION

5.1 Symbols and abbreviations

The following symbols and abbreviations are used to identify materials used for milling tools and circular saws:

- (a) SP Alloyed tool steel (minimum 0.6% C and no more than 5% alloy constituents).
- (b) HL High alloyed tool steel (more than 5% alloy constituents, e.g. 12% Cr).
- (c) HS High speed steel (more than 12% alloy constituents, W, Mo, V, Co).
- (d) HW Uncoated hardmetal on tungsten carbide base (ISO 513).
- (e) HC Coated hardmetal (ISO 513).
- (f) ST Stellites.
- (g) DP Polycrystalline diamond (ISO 513).
- (h) DM Monocrystalline diamond.

5.2 Notation

The quantity symbols used in this Standard are listed in Appendix A.

6 LIST OF HAZARDS

A list of clause references for hazards associated with milling cutters is given in Table 1.

TABLE 1
HAZARDS

Hazard	Condition or causes of hazard related to the tool	Corresponding Clause of this Standard
Cutting and severing	Cutting hazard when mounting or dismounting the tool	7.1.7, 9
	Reduction of severity of injury of contact with the tool	7.2.1
Projection of parts	Disintegration or partial break up to tool body	7.1.2, 7.1.4, 7.1.5.2, 7.1.5.3, 7.2.3, 8.1, 8.2, C2, C4, C5 and C6
	Incorrect assembly of tool components	7.1.3, 7.1.5
	Movements of blades fixed by friction	7.1.3
	Fly in/out of blades or separate components	7.1.3, 7.1.4
	Dynamic unbalance of the tool while rotating	7.1.6.1, 7.2.4
	Wood kickback when machining	7.1.4.2, 7.2.1
	Fixing of the tool on the machine spindle	7.1.6.2, C5
	Modification of position of tool components	7.2.3, C65
Vibration	Dynamic unbalance of tool	7.1.6.1, 7.2.4

7 DESIGN REQUIREMENTS

7.1 General requirements for milling tools and circular saw blades

7.1.1 General

Tools shall be designed and made of such materials in order that they will withstand the forces and loads expected when used and maintained in compliance with the manufacturer's instructions.

7.1.2 Safety requirements and/or measures

One piece (solid), composite and complex tools shall be designed with a safety factor as given in Table 2.

For tools with a cutting radius of r_1 not greater than 20 mm, a load of 50 N/mm shall be assumed. For tools with a cutting radius of r_1 greater than 20 mm the following formula applies for the calculation of the cutting force per millimetre.

$$F_m = \frac{30 \times P}{r_1 \times b_1 \times n_{\max} \times \pi}$$

An overspeed type test is required for complex tools, see Clause 7.1.4.

TABLE 2
SAFETY FACTORS

Type of tool	Method of procedure	Safety factor
One piece (solid and composite tools)	Calculation of stresses or centrifugal test against fracture	Safety factor of 4 means $n_p = 2 \times n_{\max}$
Complex tools	Test procedure described in Clause 7.1.4	Safety factor of 2.25 means $n_p = 1.5 \times n_{\max}$