

This is a preview of "ISO 16089:2015". [Click here to purchase the full version from the ANSI store.](#)

First edition
2015-11-15

Machine tools — Safety — Stationary grinding machines

Machines-outils — Sécurité — Machines à meuler fixes



Reference number
ISO 16089:2015(E)

© ISO 2015

This is a preview of "ISO 16089:2015". Click here to purchase the full version from the ANSI store.



COPYRIGHT PROTECTED DOCUMENT

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

This is a preview of "ISO 16089:2015". [Click here to purchase the full version from the ANSI store.](#)

Contents

	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	3
3.1 General terms.....	3
3.2 Parts of grinding machines.....	5
3.3 Modes of safe operation (MSO).....	6
3.4 Types and groups of grinding machines defined in this International Standard.....	7
3.4.1 General.....	7
3.4.2 Group 1: manually controlled grinding machine without power operated axes and without numerical control.....	9
3.4.3 Group 2: manually controlled grinding machine with power operated axes and, if applicable, with limited numerically controlled capability.....	10
3.4.4 Group 3: numerically controlled grinding machine.....	11
3.5 Speeds and axes speed.....	12
4 List of significant hazards	13
4.1 General.....	13
4.2 Main hazard zones.....	14
4.3 Significant hazards and hazardous situations covered by this International Standard.....	14
5 Safety requirements and/or measures	18
5.1 General requirements.....	18
5.1.1 General.....	18
5.1.2 Requirements for guards for all groups of grinding machines.....	19
5.2 Specific requirements resulting from mechanical hazards identified in Table 2, Nos. 1.1 - 1.4, 1.6 and 1.7.....	19
5.2.1 Group 1 machines, manually controlled grinding machines without power operated axes and without numerical control.....	19
5.2.2 Group 2 machines, manually controlled grinding machines with power operated axes and, if applicable, with limited numerically controlled capability.....	22
5.2.3 Group 3 machines, numerically controlled grinding machines.....	22
5.2.4 Tool holding device.....	24
5.2.5 Workpiece holding.....	24
5.2.6 Vertical or slant axes under gravity.....	25
5.2.7 Modes of machine operation.....	25
5.2.8 Optional or additional equipment for grinding machines.....	29
5.3 Specific requirements resulting from electrical hazards.....	31
5.4 Specific requirements resulting from noise hazards.....	32
5.5 Specific requirements resulting from vibration hazards.....	32
5.6 Specific requirements resulting from radiation hazards.....	32
5.7 Specific requirements resulting from materials or substance hazards.....	33
5.7.1 General.....	33
5.7.2 Devices for the use of metalworking fluids.....	33
5.7.3 Measures against fire and explosion hazards.....	34
5.8 Specific requirements resulting from neglect of ergonomic principles hazards.....	36
5.9 Specific requirements resulting from unexpected start-up, over-run, or over-speed hazards.....	37
5.10 Specific requirements resulting from variation in the rotational speed hazards.....	39
5.11 Specific requirements resulting from failure of the power supply hazards.....	39
5.12 Specific requirements resulting from failure of the control circuit hazards.....	40
5.13 Specific requirements resulting from ejected fluids or objects hazards.....	43
5.13.1 General requirements.....	43

This is a preview of "ISO 16089:2015". [Click here to purchase the full version from the ANSI store.](#)

5.13.2	Guards to prevent ejection in the event of abrasive product breakage	43
5.13.3	Devices protecting against ejection of workpieces and workpiece parts.....	44
5.14	Specific requirements resulting from loss of stability hazards.....	45
5.15	Specific requirements resulting from slips, trips and fall of persons hazards.....	45
6	Verification of the safety requirements and/or protective measures.....	45
7	Information for use.....	48
7.1	Marking.....	48
7.2	Instruction for use.....	48
7.2.1	General.....	48
7.2.2	Tooling.....	51
7.2.3	Workpiece holding.....	51
7.2.4	Machine functions accessible from the NC panel.....	51
7.2.5	Restart.....	52
7.2.6	Noise.....	52
7.2.7	Vibration.....	53
7.2.8	Ancillary handling devices.....	53
7.2.9	Residual risks to be addressed by the machinery user.....	53
7.2.10	Installation instructions for the grinding machine.....	54
7.2.11	Cleaning instruction for the machine.....	54
Annex A	(normative) Abrasive product guards, work zone enclosures, and their combinations.....	55
Annex B	(informative) Impact test for guards — Bursting test.....	94
Annex C	(informative) Impact test for guards — Projectile impact.....	97
Annex D	(normative) Clamping methods for abrasive products and safety requirements for tool holding devices.....	101
Annex E	(informative) Noise reduction.....	112
Annex F	(informative) Noise emission determination.....	113
Annex G	(normative) Requirements for grinding machines for the machining of materials generating flammable and explosive dusts.....	114
Annex H	(informative) Measures for the use of flammable metalworking fluids.....	117
Annex I	(informative) Examples for the integration of extraction and fire extinguishing systems when using flammable metalworking fluids.....	120
Annex J	(informative) Functional safety — Example for rotational speed limit monitoring of the wheel spindle.....	122
Annex K	(informative) MSO 3 (Optional special mode for manual intervention under restricted operating conditions) - Examples.....	125
Bibliography	130

This is a preview of "ISO 16089:2015". [Click here to purchase the full version from the ANSI store.](#)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 10, *Safety*.

This first edition of ISO 16089 is an adaptation of European Standard EN 13218:2002+A1/AC:2010-04. Significant differences between the European Standard and ISO 16089 are as follows.

- a) Introduction of a subdivision of grinding machines into three groups, based on the degree of automation. Specific safety measures for safe design for each group of grinding machines.
- b) Introduction of the Mode of safe operation 3 (*optional special mode for manual intervention under restricted operating conditions*) with a separate selection device and specific safety measures, and a new informative Annex providing examples.
- c) Instead of the categories of EN 954-1, the required performance level according to ISO 13849-1 is defined for relevant safety functions.
- d) The decrease in the impact resistance of unprotected polycarbonate depending on the duration of use is shown in the form of an aging curve in Annex A.
- e) Measures for the use of flammable metalworking fluids are given in the new Annex H.
- f) Examples for the integration of extraction and fire extinguishing systems when using flammable metalworking fluids are given in the new Annex I.
- g) Example for rotational speed limit monitoring of the wheel spindle given in the new Annex K.

Introduction

In order to take technological progress into account, it was decided to revise EN 13218 for this purpose. Due to the worldwide use of these machines, an agreement was made by CEN/TC 143 and ISO/TC 39/SC 10. According to the Vienna Agreement, this revision was carried out as ISO 16089.

A decisive aspect for the preparation of this standard was the consideration of foreseeable misuse, e.g. by means of manipulation of protective devices.

Safety measures for grinding machines are, in particular, characterized by guards with interlocking and guard locking, to effectively counteract risks of fracture of ceramic tools. In some special cases of grinding operations, guards can be regarded as disturbing by the operator because they obstruct process monitoring. Then, by means of manipulation of the interlocking devices, automatic mode without guard can occur with dramatically increased hazards for the operator. To reduce the incentive for manipulation, the possibility of using a special mode (MSO 3) was provided in the operating mode concept for grinding machines such as in the preceding standard EN 13218. This implies the same strong safety measures as for the operating mode setting. These restrictions offer a significant motivation for switching back into automatic mode where higher speeds and feed rates are available for a more profitable production. Comparisons of risks show that the provision of a special mode presents a much lower risk than a manipulated automatic mode.

At the time this International Standard was developed, it was already foreseen that the information given in [A.3.2](#) on the wall thickness of abrasive product guards and in [A.3.5](#) on the work zone enclosure will probably be modified by an Amendment to this International Standard, depending on the result of further scientific research.