

DIN EN ISO 16090-1:2019-12 (E)

Machine tools safety - Machining centres, Milling machines, Transfer machines - Part 1: Safety requirements (ISO 16090-1:2017)

Contents	Page
European foreword	4
Foreword	5
Introduction	6
1 Scope	7
2 Normative references	8
3 Terms and definitions	10
3.1 General terms	10
3.2 Groups of machines	13
3.3 Parts of machines	14
3.4 Mode of safe operations	16
3.5 Maximum permissible spindle speed and feed rate	17
4 List of significant hazards	18
4.1 General	18
4.2 Main hazard zones	18
4.3 Significant hazards and hazardous situations covered by this document	18
5 Safety requirements and/or protective/risk reduction measures	23
5.1 General requirements	23
5.1.1 General	23
5.1.2 Required characteristics for guards of all machine groups	23
5.1.3 Power-operated moveable guards for user access	24
5.2 Specific requirements resulting from mechanical hazards	26
5.2.1 Protective measures for Group 1 machines	26
5.2.2 Protective measures for Group 2 machines	26
5.2.3 Protective measures for Group 3 and Group 4 machines	27
5.2.4 MSO of machine operation	29
5.2.5 Optional or additional equipment for machines	36
5.3 Specific requirements resulting from electrical hazards	44
5.4 Specific requirements resulting from noise hazards	45
5.5 Specific requirements resulting from radiation hazards	45
5.6 Specific requirements resulting from material or substance hazards	45
5.6.1 Combustible coolants	45
5.6.2 Minimum quantity lubrication (MQL)	47
5.6.3 Dry processing and combustible dust	47
5.6.4 Requirements for biological or microbiological hazards	47
5.7 Specific requirements resulting from neglect of ergonomic principles hazards	48
5.8 Specific requirements resulting from unexpected start-up, over-run or over-speed hazards	49
5.8.1 General	49
5.8.2 Starting	49
5.8.3 Normal stop	50
5.8.4 Emergency stop	50
5.8.5 Safety related parts of control system (SRP/CS)	50
5.8.6 Monitoring rotational speed limits and limits of linear and rotary movements	51
5.8.7 Requirements for electromagnetic compatibility of electrical equipment	51
5.9 Specific requirements resulting from failure of any power supply	51
5.10 Release of trapped and/or clamped persons	52
5.11 Specific requirements resulting from errors of fitting hazards	52
5.12 Specific requirements resulting from ejected fluids or parts	52

5.12.1	General requirements.....	52
5.12.2	Ejection of parts — Guard strength.....	53
5.12.3	Power-operated workpiece and tool clamping.....	53
5.12.4	Additional requirements for Group 3 and Group 4 machines.....	54
5.13	Specific requirements resulting from loss of stability hazards.....	54
5.14	Requirements resulting from slips, trips, and fall of persons hazards.....	54
5.15	Requirements resulting from accessibility for maintenance or troubleshooting on high parts of the machine.....	54
5.16	Requirements for machinery with operator cabins and perimeter fencing.....	55
5.16.1	General.....	55
5.16.2	Overall concept for entering/leaving machinery.....	55
5.16.3	Requirements for moveable/adjustable operator cabins and operation platforms.....	55
5.16.4	Requirements for perimeter fencing.....	58
5.17	Verification of the safety requirements and/or protective measures.....	58
6	Information for use.....	62
6.1	General.....	62
6.2	Marking.....	62
6.3	Instruction for use.....	63
6.3.1	General.....	63
6.3.2	Tooling.....	65
6.3.3	Workpiece clamping.....	66
6.3.4	Machine functions accessible from the NC panel.....	66
6.3.5	Restart.....	66
6.3.6	Noise.....	66
6.3.7	Residual risks to be addressed to the machinery user.....	67
6.3.8	Installations instructions of machinery.....	68
6.3.9	Cleaning instructions of machinery.....	68
6.3.10	Machinery with operator cabins and/or perimeter fencing.....	68
Annex A	(normative) Impact test method for guards on machines.....	69
Annex B	(informative) Equipment for impact test and examples of tested materials.....	72
Annex C	(informative) Illustrative figures as examples of machines.....	74
Annex D	(informative) Illustrative figures as examples of guards.....	83
Annex E	(informative) Examples of the integration of exhaust and extinguishing systems when using combustible coolants or combustible dust.....	90
Annex F	(informative) Provisions when using combustible coolants and combustible dust.....	92
Annex G	(normative) Gravity-loaded axes.....	96
Annex H	(informative) Examples: Concept for leaving/returning to a cabin (control station) at Group 3 and Group 4 machines.....	103
Annex I	(informative) Typical demand rates of safety functions for calculations according to Table 5 and Annex J.....	105
Annex J	(normative) Safety functions.....	110
Annex K	(normative) Noise emission measurement.....	157
Bibliography	159