

DIN EN 201:2010-02 (E)

Plastics and rubber machines - Injection moulding machines - Safety requirements

Contents		Page
Foreword		6
Introduction		7
1	Scope	8
2	Normative references	8
3	Terms and definitions	10
4	List of significant hazards	16
4.1	General	16
4.2	Mould area	18
4.3	Clamping mechanism area or area behind the mobile platen	19
4.4	Area of movement of core and ejector drive mechanisms outside both the mould area and the clamping mechanism area	19
4.5	Nozzle area	19
4.6	Plasticising and/or injection unit area	20
4.7	Discharge area	20
4.8	Hazards not associated with a particular area of the machine	20
4.8.1	Whiplash of flexible hoses	20
4.8.2	Release of fluids under pressure	20
4.8.3	Hazards during adjustment and servicing	21
4.8.4	Electrical hazards and hazards due to electromagnetic interference	21
4.8.5	Thermal hazards	21
4.8.6	Hazards generated by noise	21
4.8.7	Hazards generated by gases, fumes and dusts	21
4.8.8	Slip, trip and fall hazards	21
4.8.9	Hydraulic and pneumatic systems	21
4.8.10	Power operated guards	21
4.9	Additional hazards associated with specific machine design	22
4.9.1	Carousel machines	22
4.9.2	Shuttle-table machines/machines with sliding lower platen and turn-table machines	22
4.9.3	Multi-station machines with mobile injection unit	22
4.9.4	Cellular foam injection moulding machines	22
4.10	Additional hazards when using ancillary equipment	22
4.10.1	Power operated mould changing equipment	22
4.10.2	Power operated mould clamping devices	22
4.10.3	Fluid injectors	22
4.10.4	Other ancillary equipment	23
5	Safety requirements and protective measures	23
5.1	General	23
5.1.1	Emergency stop	23
5.1.2	Guards	24
5.1.3	Electro-sensitive protective equipment (ESPE) in the form of light curtains	25
5.1.4	Two-hand control devices	25
5.1.5	Hold-to run control devices associated with reduced speed of the dangerous movement	26
5.1.6	Pressure sensitive mats, floors and edges	26
5.1.7	Common requirements for automatic monitoring	26
5.1.8	Movements caused by gravity during production	26
5.2	Mould area	27

5.2.1	Hazards due to the closing movement of the platen during production	27
5.2.2	Sides of the machine where a cycle cannot be initiated	28
5.2.3	Hazards due to movements other than the closing movement of the platen during production	28
5.2.4	Use of control guards	30
5.2.5	Thermal hazards	30
5.2.6	Additional safety requirements for machines with a downstroking platen	30
5.2.7	Additional requirements for machines where whole body access is possible between the interlocking guard or light curtain for the mould area and the mould area itself	31
5.2.8	Additional requirements for machines where whole body access is possible to the mould area	34
5.2.9	Additional requirements for machines with L-Type configuration during production	35
5.3	Clamping mechanism area or area behind the mobile platen	36
5.3.1	Basic safety requirements	36
5.3.2	Additional safety requirements for machines with an upstroking platen	36
5.4	Area of movement of core and ejector drive mechanisms outside the mould area and outside the clamping mechanism area	37
5.5	Nozzle area	37
5.5.1	Mechanical hazards	37
5.5.2	Thermal hazards	37
5.6	Plasticising and/or injection unit area	38
5.6.1	Mechanical hazards	38
5.6.2	Thermal hazards	38
5.6.3	Mechanical and/or thermal hazards	39
5.7	Discharge area	39
5.8	Safety requirements and/or protective measures against hazards not associated with a particular area of the machine	40
5.8.1	Whiplash of flexible hoses	40
5.8.2	Release of fluids under pressure	41
5.8.3	Hazards during adjustment and servicing	41
5.8.4	Electrical hazards and hazards due to electromagnetic interference	41
5.8.5	Thermal hazards	41
5.8.6	Hazards generated by noise	41
5.8.7	Hazards generated by gases, fumes and dusts	42
5.8.8	Slip, trip and fall hazards	42
5.8.9	Hydraulic and pneumatic systems	42
5.8.10	Power operated guards	42
5.9	Additional safety requirements and/or protective measures associated with specific machine design	43
5.9.1	Carousel machines	43
5.9.2	Shuttle-table machines / machines with sliding lower platen and turn-table machines	43
5.9.3	Multistation machines with mobile injection unit	43
5.9.4	Cellular foam injection moulding machines	44
5.10	Additional safety requirements and/or protective measures when using ancillary equipment	44
5.10.1	Power operated mould changing equipment	44
5.10.2	Power operated mould clamping devices	44
5.10.3	Fluid injectors	46
5.10.4	Other ancillary equipment	46
6	Verification of the safety requirements and/or protective measures	47
7	Information for use	49
7.1	Instruction handbook	49
7.1.1	Emergency stop	49
7.1.2	Stopping performance	49
7.1.3	Stopping time	49
7.1.4	Light curtains	49
7.1.5	Parking brakes	49
7.1.6	Moulds and extensions	50
7.1.7	Movements of cores and ejectors	50
7.1.8	Thermal hazards in the mould area	50

7.1.9	Maintenance operations on vertical machines	50
7.1.10	Machines where whole body access is possible	50
7.1.11	Presence detecting devices in the mould area	50
7.1.12	Plasticising and/or injection unit	50
7.1.13	Machines with L-Type configuration	51
7.1.14	Flexible hose assemblies	51
7.1.15	Adjustment and servicing	51
7.1.16	Exhaust system	51
7.1.17	Designated access and working positions	51
7.1.18	Non-permanent safe means of access	51
7.1.19	Automatic feeding of material	52
7.1.20	Manual feeding of material	52
7.1.21	Magnetic mould clamping	52
7.1.22	Ancillary equipment	53
7.1.23	Applying ergonomic principles when using ancillary equipment	53
7.1.24	Bursting of moulded parts	53
7.1.25	Cellular foam injection moulding	53
7.1.26	Hydraulic system cleaning	53
7.1.27	Noise emission	54
7.1.28	Splashing hazards where two-hand control devices are used	54
7.2	Marking	54
Annex A (normative) Movable interlocking guards type I (non-electrical axis)		56
A.1	Interlocking function	57
A.2	Quality of the components	57
Annex B (normative) Movable interlocking guards type II (non-electrical axis)		58
B.1	Interlocking function	59
B.2	Quality of the components	59
B.3	Automatic monitoring requirements	59
Annex C (normative) Movable interlocking guards type III (non-electrical axis)		60
C.1	Movable interlocking guard with three position detectors	60
C.1.1	Interlocking function	61
C.1.2	Quality of the components	61
C.1.3	Additional requirements for the second shut-off device in Figure C.1	61
C.2	Movable interlocking guard with two position detectors	62
C.2.1	Interlocking function	63
C.2.2	Quality of the components	63
C.2.3	Additional requirements for the second shut-off device in Figure C.2	63
C.3	Automatic monitoring requirements	63
C.3.1	Common requirements (see also 5.1.7)	63
C.3.2	Additional automatic monitoring requirements (Figure C.1)	64
C.3.3	Additional automatic monitoring requirements (Figure C.2)	64
Annex D (normative) Movable interlocking guards type I (electrical axis)		65
D.1	Principle of interlocking corresponding to type I, using one electromechanical component	65
D.2	Principle of interlocking corresponding to type I, using the motor control unit	67
Annex E (normative) Movable interlocking guards type II (electrical axis)		69
E.1	Principle of interlocking corresponding to type II, using one electromechanical component	69
E.2	Principle of interlocking corresponding to type II, using the motor control unit (version A)	71
E.3	Principle of interlocking corresponding to type II, using the motor control unit (version B)	73

Annex F (normative) Movable interlocking guards type III (electrical axis)	75
F.1 Principle of interlocking corresponding to type III, using electromechanical components	75
F.2 Principle of interlocking corresponding to type III, using one electromechanical component and the motor control unit	77
F.3 Principle of interlocking corresponding to type III, using the motor control unit (version A)	79
F.4 Principle of interlocking corresponding to type III, using the motor control unit (version B)	81
Annex G (normative) Electro-sensitive protective equipment in the form of a light curtain	83
G.1 Mode of operation of the light curtain	83
G.2 Automatic monitoring requirements	84
Annex H (normative) Two-hand control device	85
H.1 Mode of operation of the two hand control	85
H.2 Automatic monitoring requirements	86
Annex J (normative) Acknowledgement systems	87
J.1 Single acknowledgement system	87
J.2 Double acknowledgment system	87
Annex K (normative) Noise test code	88
K.1 Introduction	88
K.2 Measurement of the A-weighted emission sound pressure level at the usual operating position	88
K.3 Determination of the A-weighted sound power level	88
K.4 Installation and mounting conditions for noise measurement	88
K.5 Operating conditions	89
K.5.1 Plastic processing machines	89
K.5.2 Rubber processing machines	90
K.6 Information to be reported	90
K.7 Declaration and verification of noise emission values	91
Annex L (normative) Warning signs	92
Annex M (normative) Use of proportional valves for the platen movement	93
M.1 Design	93
M.2 Mode of operation	93
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC	94
Annex ZB (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC	95
Bibliography	96