



# SLOVENSKI STANDARD

## SIST EN 201:2000/A2:2005

01-november-2005

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### Stroji za predelavo gume in plastike – Stroji za brizgalno vlivanje – Varnostne zahteve – Dopolnilo A2

Plastics and rubber machines - Injection moulding machines - Safety requirements

Kunststoff- und Gummimaschinen - Spritzgießmaschinen - Sicherheitsanforderungen

Machines pour le caoutchouc et les matières plastiques - Machines à injecter - Prescriptions de sécurité

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#### **ICS:**

83.200

Oprema za gumarsko industrijo in industrijo polimernih materialov

Equipment for the rubber and plastics industries

**SIST EN 201:2000/A2:2005**

en

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ICS 83.200

English version

## Plastics and rubber machines - Injection moulding machines - Safety requirements

Machines pour le caoutchouc et les matières plastiques -  
Machines à injecter - Prescriptions de sécurité

Kunststoff- und Gummimaschinen - Spritzgießmaschinen -  
Sicherheitsanforderungen

This amendment A2 modifies the European Standard EN 201:1997; it was approved by CEN on 20 June 2005.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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| <b>Contents</b>   | <b>Page</b> |
|---|-------------|
| Foreword .....  | 3           |
| 2 Normative references .....  | 4           |
| 3 Terms and definitions .....   | 4           |
| 4 List of significant hazards .....   | 4           |
| 5 Safety requirements and/or protective measures .....  | 5           |
| 6 Verification of safety requirements and/or measures .....   | 8           |
| 7 Information for use .....   | 9           |
| Annex A (normative) Additional requirements for protection devices type III .....   | 10          |
| Annex G (normative) Interlocking of guards for injection moulding machines with one or more electrical axes .....               | 11          |
| G.1 Principle of interlocking corresponding to type III, using electromechanical components.....                                | 11          |
| G.2 Principle of interlocking corresponding to type III, using one electromechanical component and the motor control unit ..... | 12          |
| G.3 Principle of interlocking corresponding to type III, using the motor control unit.....                                      | 13          |
| G.4 Principle of interlocking corresponding to type I, using one electromechanical component.....                               | 14          |
| G.5 Principle of interlocking corresponding to type I, using the motor control unit.....  | 15          |
| G.6 Principle of interlocking corresponding to type II, using one electromechanical component.....                              | 16          |
| G.7 Principle of interlocking corresponding to type II, using the motor control unit.....                                       | 17          |

SIST EN 201:2000/A2:2005  
<https://standards.iteh.ai/catalog/standards/sist/44868e85-d58f-4d65-bc5b-6a5534a37f0b/sist-en-201-2000-a2-2005>

## Foreword

This European Standard (EN 201:1997/A2:2005) has been prepared by Technical Committee CEN/TC 145 “Plastics and rubber machines”, the secretariat of which is held by UNI.

This Amendment to the European Standard EN 201:1997 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2006, and conflicting national standards shall be withdrawn at the latest by January 2006.

This amendment updates EN 201:1997 with regard to injection moulding machines with one or more electrical axes.

The following movements, driven by an electrical axis, are not considered:

- vertical movements of the platen;
- horizontal movements of the platen where the guards for the mould area are not interlocking guards with guard locking.

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

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## 2 Normative references

In Clause 2, add the following references:

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

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997)*

EN ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005).*"

## 3 Terms and definitions

In Clause 3, add the following terms and definitions:

### "3.9

#### **electrical motor**

any type of motor using electrical energy, e.g. servo or linear motor

### 3.10

#### **motor control unit**

unit to control the movement and standstill of an electrical motor, with or without an integrated electronic device, e.g. frequency converter, contactor

### 3.11

#### **electrical axis**

system consisting of an electrical motor, a motor control unit and any additional contactors -

[SIST EN 201:2000/A2:2005  
6a5534a37f0b/sist-en-201-2000-a2-2005](https://standards.iteh.ai/SIST/EN/201:2000/A2:2005/6a5534a37f0b/sist-en-201-2000-a2-2005)

### 3.12

#### **standstill**

condition under which there is no movement of a machine part with an electrical axis

### 3.13

#### **safe standstill**

standstill during which additional measures are taken to prevent unexpected start-up

### 3.14

#### **safety related input**

input to a motor control unit used to interrupt the energy supply to the drive of the electrical axis."

## 4 List of significant hazards

In Clause 4, add the following subclause:

### "4.3.7 Machines with one or more electrical axes

Mechanical hazards connected with the movement of machine parts with electrical axes.

Electrical or electromagnetic disturbances generated by the motor control unit which are liable to create failures in the control system."

## 5 Safety requirements and/or protective measures

*In the hanging text of Clause 5, modify in second paragraph, at the end of second sentence as follows:*

"(see 5.3.1, 5.3.2 and 5.3.7.1)."

*In Clause 5, add the following subclauses:*

### **5.3.7 Machines with one or more electrical axes**

#### **5.3.7.1 Emergency stop**

The emergency stop shall function as a category 1 stop of EN 60204-1:1997, 9.2.2. Emergency stop devices shall be in accordance with EN 60204-1:1997, 10.7.

#### **5.3.7.2 Electrical axis for the horizontal movement of the platen**

##### **5.3.7.2.1 Safe standstill when a guard for the mould area is open**

When one of the interlocking guards with guard locking for the mould area specified in 5.3.7.2.2.1 is open, safe standstill shall be achieved by interrupting the energy supply to the movement of the platen by two channels according to G.1, G.2 or G.3 or according to category 4 of EN 954-1:1996.

The interruption by both channels shall be independent from the programmable controller. The following shall be used:

- contactor(s) in the power supply to the electrical motor of the motor control unit; and/or
- safety related input(s) to the motor control unit.

Automatic monitoring of the safety related components is required so that in case of a fault in one of those components, it is not possible to initiate the next movement. Automatic monitoring shall be carried out at least once during each movement cycle of the movable guard.

##### **5.3.7.2.2 Prevention of access to hazardous areas created by the movement of the platen**

###### **5.3.7.2.2.1 Mould area**

Access to the area between the platens shall be prevented by interlocking guards with guard locking.

Guard locking shall remain effective until standstill has been detected (see Annex G).

For the guard locking device well tried components according to category 1 of EN 954-1:1996 shall be used. The components shall be designed to withstand a minimum force of 1 000 N, applied e.g. when trying to open one of the guards when the guard locking is still effective.

Detection of standstill shall be safe against single fault. This shall be done by:

- monitoring two independent standstill signals; or
- standstill detection according to category 3 of EN 954-1:1996; or
- permanent monitoring of the change of position of the platen by means of a motor encoder.

### 5.3.7.2.2.2 Clamping mechanism area

Where access to the platen and its drive mechanism is prevented by movable guards (see 5.2.2), these shall be interlocking guards according to G.6 or G.7 or according to category 3 of EN 954-1:1996.

In the case of dangerous run-down, i.e.  $t$  (access time)  $< T$  (overall system stopping performance as defined in EN 999:1998, 3.2), the guards for the clamping mechanism area shall be interlocking guards with guard locking.

Guard locking shall remain effective until standstill has been detected. Detection of standstill shall be safe against single fault, as specified in 5.3.7.2.2.1, 4<sup>th</sup> paragraph.

In the case of an interlocking guard without guard locking for the clamping mechanism area the access time ( $t$ ) shall be calculated as follows:

$$t = \frac{d}{v} + \Delta t$$

where

$t$  is the access time in s;

$d$  is the distance between guard and dangerous point in m;

$v$  is 1,6 m/s, approach speed see EN 999:1998;

$\Delta t$  is 100 ms, to take into account the time necessary to open the guard sufficiently, to gain access to the protected area.

When calculating or measuring the overall system stopping performance for the movement of the platen and its drive mechanism, the worst case shall be taken into account related to speed, mass, temperature. See 7.1.9.

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### 5.3.7.3 Electrical axis for the movement of the plasticizing and/or injection unit

For this movement, the interlocking of the guard for the nozzle area shall be according to G.4 or G.5 or according to category 1 of EN 954-1:1996 and the interlocking of the guards for the mould area shall be according to G.6 or G.7 or according to category 3 of EN 954-1:1996.

In the case of dangerous run-down, i.e.  $t$  (access time)  $< T$  (overall system stopping performance as defined in EN 999:1998, 3.2), the guard for the nozzle area shall be an interlocking guard with guard locking.

Guard locking shall remain effective until standstill has been detected. The detection of standstill shall be according to category B of EN 954-1:1996.

In the case of an interlocking guard without guard locking for the nozzle area the access time shall be calculated as specified in 5.3.7.2.2.2.

When calculating or measuring the overall system stopping performance for the movement of the plasticizing and/or injection unit, the worst case shall be taken into account related to speed, mass, temperature. See 7.1.9.



#### 5.3.7.4 Electrical axis for the rotation of the plasticizing screw

For this movement, the interlocking of the guard for the nozzle area shall be according to G.4 or G.5 or according to category 1 of EN 954-1:1996 and the interlocking of the guard for the mould area shall be according to G.6 or G.7 or according to category 3 of EN 954-1:1996.

Guard locking is not required because the run-down is not dangerous.

If the machine is designed for processing rubber only, a motor control unit according to category B of EN 954-1:1996 without a contactor is sufficient.

#### 5.3.7.5 Electrical axis for the linear movement of the injection screw or plunger

For this movement, the interlocking of the guard for the nozzle area shall be according to G.4 or G.5 or according to category 1 of EN 954-1:1996 and the interlocking of the guard for the mould area shall be according to G.6 or G.7 or according to category 3 of EN 954-1:1996.

Guard locking is not required because the run-down is not dangerous.

#### 5.3.7.6 Electrical axes for the movement of cores and ejectors

For the movement of cores and ejectors and/or their drive mechanisms, the interlocking of the guards outside the mould area shall be according to G.4 or G.5 or according to category 1 of EN 954-1:1996 and the interlocking of the guards for the mould area shall be according to G.6 or G.7 or according to category 3 of EN 954-1:1996.

In the case of dangerous run-down, i.e.  $t$  (access time)  $<$   $T$  (overall system stopping performance as defined in EN 999:1998, 3.2), the guards shall be interlocking guards with guard locking.

Guard locking shall remain effective until standstill has been detected. The detection of standstill shall be according to category B of EN 954-1:1996.

In the case of interlocking guards without guard locking, the access time shall be calculated as specified in 5.3.7.2.2.2.

When calculating or measuring the overall system stopping performance for the movement of cores and ejectors, the worst case shall be taken into account related to speed, mass, temperature. See 7.1.9.

#### 5.3.7.7 Requirements for the automatic monitoring circuit

##### 5.3.7.7.1 Requirements for the automatic monitoring circuit where Annex G is applied

The following shall be automatically monitored at least once during each movement cycle of the movable guard:

- change of state of the position detectors of the guard (not applicable to Figures G.4 and G.5 if S1 is a well tried component);
- position of the contactors or the information given by the motor control unit;
- position of the guard locking device, if applicable;
- information given by the standstill detection, if applicable.

If a single fault occurs, the automatic monitoring shall prevent the initiation of any further movement.