

EUROMAP 72

Horizontal Injection Moulding Machines

Integration and Use of Magnetic Clamping Systems

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(10 pages)

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1 Scope and purpose

1.1 Scope

This recommendation shall apply to all MCSs (Magnetic Clamping System(s)), manufactured after the date of publication of this document, that are installed on a HIMM (Horizontal Injection Moulding Machine).

1.2 Purpose

This recommendation is intended to facilitate the design, installation and normal use of a new MCS on a HIMM. This recommendation identifies and addresses known hazards to personnel and equipment related to a MCS which is installed on a HIMM. Moreover the responsibilities for the different parties concerned are given.

2 Definitions

2.1 Air gap

The distance between the MCS and the mould base.

2.2 Breakaway force

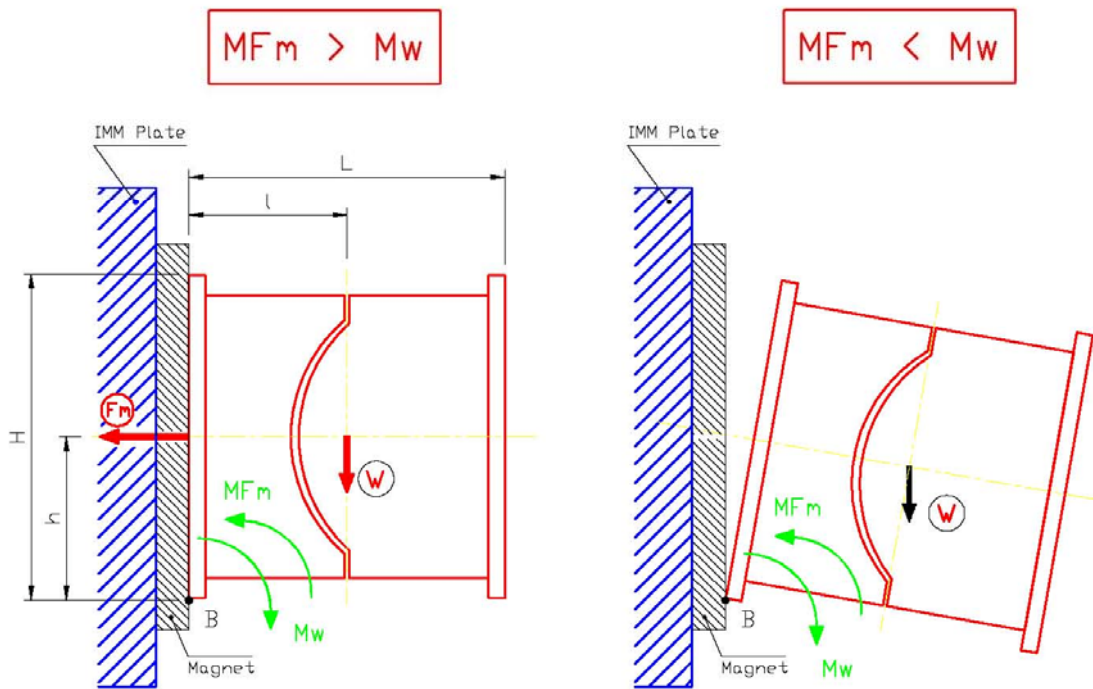
The force that is necessary to open the mould.

2.3 Opening force

The maximum force that the HIMM can apply to open a mould.

2.4 Cantilever effect

The tendency of a mould or a mould half to rotate off the platen under its own weight around point B (see Figure 1).



B = Rotation Point
 W = Mould Weight
 Fm = Real Magnetic Clamping Force
 L = Mould Horizontal Extension
 l = Center of the mass Distance
 H = Mould Vertical Extension
 h = Center of the mass Distance
 MFm = Anti Rotation Moment
 Mw = Rotation Moment (Cantilever)

$$MFm = Fm \cdot h$$

$$Mw = W \cdot l$$

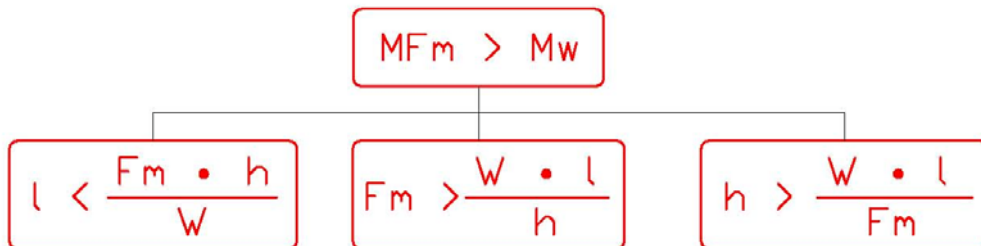


Figure 1: Cantilever effect

2.5 Magnetic clamping system force

The force retaining the mould to the MCS.

2.6 Mould change mode

A selectable mode of operation of the HIMM, which limits various speeds and forces for the purpose of mould changing.

3 Factors affecting unintended mould detachment

3.1 Main factors to be considered with the risk assessment

1. Temperature at holding surface
2. Lack of visual verification
3. Minimum thickness of mould base
4. Ability to verify mould clamping
5. Mould base material
6. Mould contact area
7. Electrical interface

3.2 Hazards

The following letters are used to identify the responsibilities of the manufacturer of the different parts of the system and of the plastics processor:

- (A) – MCS manufacturer
- (B) – Mould manufacturer
- (C) – HIMM manufacturer
- (D) – Plastics processor

3.2.1 Factors affecting Magnetic Clamping Force

- Mould base material (B) (D)
- Mould base plate thickness (B) (D)
- Conditions of mating surfaces (mould and MCS) – i.e., material type, deflection, air gap, contamination (oil, rust, grease, etc.) (A) (B) (C) (D)
- Mould contact area (B) (D)
- Heat (D)

3.2.2 Factors that could cause mould slippage

- Magnetic clamping force (see 3.2.1)
- Mould weight (D)
- Contact area friction (A) (B) (D)
- Mould design (B) (D)

3.2.3 Factors that could cause the mould to be pulled from the MCS

- Magnetic clamping force (see 3.2.1)
- Increased mould breakaway force due to overpacking (D)
- Mechanical interference between the two halves of the mould that may restrict opening (D)
- Mould halves strapped together during opening movement of the platen (D)
- Mould design (B) (D)

3.2.4 Factors that could cause the mould to be pushed from the MCS

- Magnetic clamping force (see 3.2.1)
- Nozzle force **(C) (D)**
- Machine ejector force, stroke and speed **(C) (D)**
- Misalignment of ejectors **(D)**
- Mould design **(B) (D)**

3.2.5 Factors that could cause the mould to be peeled off the MCS

- Magnetic clamping force (see 3.2.1)
- Cantilever effect **(D)**
- Nozzle or ejector force causing cantilever force **(B) (D)**
- Mould design **(B) (D)**

4 General specification of MCS

4.1 Information and warnings

The MCS manufacturer shall supply the following information and/or warnings for proper use of the MCS in user documentation and/or on safety signs:

- 1) Intended use
- 2) Only trained and qualified personal shall be allowed to operate the MCS
- 3) Magnetic clamping force for smallest/largest mould under ideal conditions
- 4) A method to estimate the magnetic clamping force for a particular mould
- 5) Mould and/or base plate material requirements
- 6) Minimum base plate thickness
- 7) A formula to calculate allowable cantilever force from extended mould (see figure 1)
- 8) Required minimum contact area of mould, taking into account e.g. holes
- 9) Required conditions of mating surfaces
- 10) Limit temperature for the magnetic force specified
- 11) Allowable ejector force and importance of properly adjusting the ejector stroke and alignment
- 12) Allowable nozzle force
- 13) Overpacking the mould will increase the breakaway force
- 14) Mould change procedure(s)
- 15) Warn users that the magnetic field exerts a high force on ferrous objects placed close to the MCS surface and could create pinch points
- 16) Warn users not to magnetise the MCS without the mould in contact with the MCS surface
- 17) Optimum magnetic clamping force for each mould is achieved when the magnetic field is built with the surfaces already in contact
- 18) Watches, credit cards, video, cassette tapes, TV screen, computer monitor, floppy disks, reed relays (or similar devices), pacemakers, hearing aids or other medical devices can be damaged or affected by the use of the MCS, instructions and warnings should be provided by the manufacturer
- 19) Cannot re-locate, re-install or switch MCS from one HIMM to another without first contacting the MCS manufacturer
- 20) Recommended maintenance schedule
- 21) MCS shall be switched off when HIMM is switched off.

4.2 Magnetic clamping force with power off

Magnetic clamping force shall be maintained with loss of electrical power.

4.3 Surface contact

A means (e.g. a sensor) shall be provided on the MCS on the fixed as well as on the moveable platen to detect proper contact of the mould mounting surface with the MCS.

4.4 Temperature

Temperature can cause reduction in magnetic clamp force.

A temperature sensor shall be provided with the MCS to – in case that the limit value for the temperature is passed – provide an alarm before magnetic clamping force can fall to an unsafe level.

4.5 MCS Detection of involuntary mould movement

The MCS should be designed so that if the MCS detects a fault it is impossible to resume operation of the HIMM without first demagnetising and then remagnetising the MCS in accordance with the MCS supplier recommended procedures.

4.6 Documentation

Documentation for the proper installation and use of the MCS shall be provided with the MCS.

4.7 Identification

The MCS shall be clearly marked with a serial number, electrical ratings, temperature maximum, model number, weight of magnetic plate, name of the manufacturer, and year of manufacture.

5 Integration and use of MCSs

5.1 Data to be supplied by the plastics processor

The design of a MCS is application driven, based on the HIMM, the mould, and the process. The following data should be provided to the MCS manufacturer for the selection of a MCS:

- 1) Clamping force of HIMM
- 2) Opening force of the HIMM
- 3) Drawings of the platens of the HIMM to include tie bar spacing, ejector sizes and locations
- 4) Weight and dimensions of the largest mould
- 5) Weight and dimensions of the smallest mould with the maximum weight
- 6) Weight and dimensions of the moulds having the highest cantilever effect (see Figure 1)
- 7) Location and forces of all injection units
- 8) Mould orientation horizontal, vertical or both
- 9) Maximum mould temperature

- 10) Maximum ejector force
- 11) Maximum nozzle force
- 12) Size(s) and use of centring ring in the fixed and moving platens
- 13) Size(s) and use of location rings on the mould halves
- 14) Large holes/voids in mould base plates
- 15) Mould base material
- 16) Electric main power supply voltage and frequency available to supply the MCS
- 17) HIMM electrical interface signals.

In addition to the above data, the following should be supplied:

- Controller location and cable length
- Type and model # of the machine
- Platen flatness
- Squareness and parallelism of mould and machine
- Loading style
- Loading side
- Machine serial number
- Machine brand
- Distance from side of the platen to the mould area guard.

5.2 Minimum HIMM conditions for MCS operation

Magnetisation or demagnetisation of the MCS shall require the following HIMM conditions:

- 1) Mould area guards closed, unless alternative safety measures are taken
- 2) Ejectors fully retracted
- 3) Injection unit retracted
- 4) Mould change mode selected.

5.3 Demagnetisation of MCS

Release of the mould from the MCS shall not be possible with a single action. Two separate actions shall be required (e.g. pushing two different buttons) to release the mould from the MCS.

5.4 Procedures following an alarm of the MCS

The procedures shall include:

- Secure the mould from falling
- Identification of the fault
- Demagnetising
- Verify that the fault is removed or repair the system
- Follow the procedure defined in the manual to magnetise the system

5.5 Plastics processors responsibilities

The plastics processor shall follow the information and warnings provided by the manufacturer in clause 4.1, and provide training for anyone who will use, or maintain the MCS. The plastics processor shall ensure by adequate supervision that correct operating procedures are being followed.

The plastics processor shall set up a checklist to ensure that operators are kept aware of procedures to follow in operating the MCS safely.

The plastics processor shall ensure that the periodic maintenance schedule as recommended by the MCS manufacturer is followed.

6 Safety signs

Safety signs shall be according to

EUROMAP 64 — Injection moulding machines - Warning Signs

EUROMAP 68 — Injection Moulding Machines - Prohibition Signs

EUROMAP

Europäisches Komitee der Hersteller von Kunststoff- und Gummi-
maschinen

European Committee of Machinery Manufacturers for the Plastics
and Rubber Industries

Comité Européen des Constructeurs de Machines pour Plastiques
et Caoutchouc

Comitato Europeo Costruttori Macchine per Materie Plastiche e
Gomma

See you again

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