American National Standard

for Plastics Machinery -

Extrusion Blow Molding Machines – Safety Requirements for Manufacture, Care, and Use

ANSI/SPI B151.15-2003



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ANSI/SPI B151.15-2003
Revision of
ANSI/SPI B151.15-2000

American National Standard
for Plastics Machinery –

Extrusion Blow Molding Machines – Safety Requirements for Manufacture, Care, and Use

Sponsor

The Society of the Plastics Industry, Inc.

Approved October 15, 2003

American National Standards Institute, Inc.

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Foreword (This foreword is not part of American National Standard ANSI/SPI B151.15-2003.)

This standard is a revision of *American National Standard for Plastics Machinery - Extrusion Blow Molding Machines - Safety Requirements for Construction, Care, and Use*, ANSI/SPI B151.15-2000. The standard was revised because:

1) Some paragraphs required modification and some paragraphs were added to conform more closely to changes in technology;

2) Some paragraphs required modification for clarity and intent.

The project on safety requirements for the manufacture, care, and use of extrusion blow molding machines was initiated under the auspices of the Extrusion Blow Molding Section of the Machinery Division, and the Safety Committee of the Molders Management Division, of the Society of the Plastics Industry, Inc. (SPI).

Both divisions of the SPI have long been concerned with operator safety on plastics processing equipment. Accordingly, each section of the divisions has established a standards development committee charged with the task of establishing necessary standards.

A standard treating the manufacture, care, and use of extrusion molding machines is complicated by the wide variety and sizes of machines manufactured and in use, and by the virtually infinite combinations of parts being produced, the production methods used, and the operating conditions existing in industry today.

The primary objective of this standard is to minimize hazards to personnel associated with machine activity by establishing requirements for the manufacture, care, and use of these machines.

To accomplish this objective, the committee decided to approach the problem of machine safety from two directions:

1) Eliminating by design certain recognized hazards and establishing standard approaches to design so that machines available from competitive manufacturers will have similar operational characteristics;

2) Safeguarding the machine to protect personnel from recognized hazards.

To assist in the interpretation of these requirements, responsibilities have been assigned to the manufacturer, the remanufacturer, the modifier, and the employer.

Recognizing the impossibility of updating equipment and changing operation methods allied with existing machines immediately after approval date of this standard, a 3-year period has been provided to employers for updating machines.

Recognizing the impossibility of immediate updating of design and manufacturing methods, Clauses 5 and 8 shall become effective one year after the approval date of this standard.

Suggestions for improvement of this standard will be welcome. They should be sent to the Society of the Plastics Industry, Inc, 1801 K Street, NW, Suite 600K, Washington, DC 20006-1301.

Consensus for this standard was achieved by use of the Canvass Method.

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The following organizations recognized as having an interest in the standardization of extrusion blow molding machines were contacted prior to the approval of this standard. Inclusion in this list does not necessarily imply that the organization concurred with the submittal of the proposed standard to ANSI.

Alcona Associates
American Safety & Equipment
Association for Manufacturing Technology
Ford Visteon Division
Moody & Associates
Packaging Machinery Manufacturers Institute
Robotic Industries Association
Society of the Plastics Industry: Machinery Division

The Blow Molding Section, Standards Development Committee of the Machinery Division, The Society of the Plastics Industry, Inc, which was responsible for this standard, had the following members:

Douglas L. Sten, Chairperson
(Uniloy Milacron, Inc.)

Glenn Atkinson
(Husky IMS)
Ronald Beaulieu
(Improved Blowmolding)
Karl Bruning
(Bekum America)
Frank Kennedy
(Davis Standard)
Tim Koury
(Blue Water Plastics, Inc.)
Robert Monteith
(Milacron, Inc.)
Peter Schmidt
(Krupp Plastics & Rubber Machinery/USA)

Others who worked with the Blow Molding Section of the Machinery Division on the development of this standard were:

Walt Bishop, The Society of the Plastics Industry, Inc.
Secretariat to the committee

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Explanation of Standard Format

American National Standard ANSI/SPI B151.15-2003 uses a two-column format to provide both specific requirements and supporting information.

The left column, designated "Standard Requirements," is confined solely to these requirements and is printed in bold type.

The right column, designated "Explanatory Information," contains only information that is intended to clarify the standard. This column is not a part of the standard.

Operating rules (safe practices) are not included in either column unless they are of such a nature as to be vital safety requirements, equal in weight to other requirements, or guides to assist in compliance with the standard.

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American National Standard
for Plastics Machinery –

Extrusion Blow Molding Machines – Safety Requirements for Manufacture, Care, and Use

STANDARD REQUIREMENTS

1 Scope, Purpose, and Application

1.1 *Scope*

The requirements of this standard shall apply to all EBMMs that process plastic materials to form a parison that is blown into the shape of a mold cavity held by a clamp(s). Safety requirements for the manufacture of ancillary equipment for EBMMs are not covered by this standard.

1.2 *Purpose*

The purpose of this standard is to minimize hazards to personnel.

1.3 *Application*

Extrusion Blow Molding Machines shall be referred to as EBMMs throughout this standard.

1.3.1 *New Installations*

The requirements of this standard pertaining to manufacture shall apply to all new or remanufactured EBMMs installed in the United States of America. Date of manufacture of the new or remanufactured machine (month and year) shall be affixed permanently and legibly to the machine along with the name of the manufacturer or remanufacturer. Compliance shall be achieved within one year after the approval date of this standard.

EXPLANATORY INFORMATION

(Not part of *American National Standard for Plastics Machinery – Extrusion Blow Molding Machines – Safety Requirements for Manufacture, Care, and Use,* ANSI/SPI B151.15-2003.)

E1.3 *Application*

Inquiries with respect to the application of, or substantive requirements of, this Standard should be addressed to the Society of the Plastics Industry, Inc., 1801 K Street, NW, Suite 600K, Washington, DC 20006-1301.

E1.3.1 *New Installations*

EBMMs may be manufactured or remanufactured anywhere in the world.

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1.3.2 *Former Installations*

Existing EBMMs that do not comply with this standard shall be modified by the employer in accordance with the requirements of clauses 6, 7 and 8 of this standard. The employer shall be responsible for bringing existing EBMMs into compliance with this standard within three years after the approval date of this standard. The effective date is established by the standards-developing organization and not by the American National Standards Institute.

1.3.3 *All Installations*

An employer shall not permit an EBMM to be operated unless it is in compliance with this standard.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI Z535.3-2002, *Criteria for Safety Symbols*

ANSI Z535.4-2002, *Product Safety Signs and Labels*

ANSI Z97.1-1984 (R1994), *Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test*

ANSI/NFPA 79-2002, *Electrical Standard for Industrial Machinery*

E2 *Bibliography*

ANSI B11 TR1-1993, *Ergonomic Guidelines for the Design, Installation and Use*

ANSI/ASME B20.1-2003, *Safety Standards for Conveyors and Related Equipment*

ANSI/SPI B151.27-2003, *Plastics Machinery – Robots Used with Horizontal Injection Molding Machines – Safety Requirements for the Integration, Care, and Use*

AN-105, *SPI Recommended Guidelines for Guarding of Safety Circuits in Programmable Controllers*

AN-108, *SPI Recommended Guideline for Using Hydraulic Accumulators on Injection Molding Machines*

AN-134, *SPI Recommended Guideline for Technical Manuals Supplied with Plastics Machinery and Related Equipment*

AN-137, *SPI Recommended Guideline for Safety Signs for Plastics Machinery and Related Equipment*

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3 Definitions

3.1 ***Alarm***

An indication that a failure or misadjustment of a device has occurred.

3.2 ***Automatic Cycle***

A selectable mode of operation of the EBMM that allows it to perform more than one cycle.

3.3 ***Barrel***

The cylinder portion of the plasticating unit within which the material is processed.

3.4 ***Clamp Unit***

That portion of the EBMM that holds the two halves of the mold and opens and closes the mold.

3.5 ***Control Circuit***

The means controlling sequential motion/cycling of the EBMM by signaling the device (hydraulic/pneumatic valving, electric servo motors, etc.) to effect EBMM motion.

3.6 ***Control Reliability***

A method of ensuring the effective integration of the performance of guards, devices and control systems for safety.

3.7 ***Control Systems***

Sensors, manual input and mode selection elements, interlocking and decision making circuitry and output elements provided to the EBMM operating devices or mechanisms.

3.8 ***Cooling Station***

The part of the machine in which the hollow articles are cooled after being withdrawn from the blow mold.

3.9 ***Cutting Device***

The apparatus that cuts the parison at the exit of the extrusion head.

3.10 ***Cycle***

A complete movement from the initial start position back to that same start position of the EBMM.

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3.11 ***Delivery Station***

The part of the machine in which the hollow plastic articles are withdrawn from the molds and removed from the machine.

3.12 ***Die Head***

The section of an EBMM (general extruder) where the melt is transformed into a hollow parison(s).

3.13 ***Double Acknowledgment System***

A hardwired safety reset control button located outside of the point of operation that can only be actuated after all the operator's gates are closed. This control button is positioned to afford a clear view of the point of operation. Cycle start shall only be possible after closing the relevant operator's gate(s), followed by: (a) actuating the safety reset control button and then (b) activating the cycle start button. Actuating the safety reset control button shall not initiate movement in the point of operation and shall be monitored to ensure proper sequence of operation.

E3.13 *Double Acknowledgment System*

A control system that is initiated prior to each cycle in the semi-automatic mode and only during cycle start in the automatic mode.

3.14 ***EBMM***

Extrusion Blow Molding Machine.

3.15 ***Emergency Stop Button***

A red, mushroom-shaped button that, when depressed, will stop all EBMM hazardous movement/motion.

E3.15 *Emergency Stop Button*

The word "stop" may be interpreted to include movement to a next position or opening of a clamp or both if, by doing so, danger of injury is reduced.

3.16 ***Employer***

Any person who contracts, hires, or is responsible for the personnel associated with EBMM installation, operation, service, troubleshooting, setup and/or maintenance.

3.17 ***Extrusion Unit***

That portion of the EBMM that plasticizes and then extrudes material through a die head in between the molds.

3.18 ***Finishing Station***

The part of the machine in which excess material flash is removed from the hollow plastic article.

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3.19 ***Fixed Guard***

A guard requiring the use of tools for removal.

3.20 ***Guard***

A physical barrier that prevents access to areas of the EBMM where known hazards exist.

3.21 ***Hardwired Electrical Interlock***

An electrical interlock that operates independently of any programmable device(s).

3.22 ***Hazardous Movement***

Any movement/motion that can cause injury.

3.23 ***Installer***

The party that is responsible for the placement and preparation for the use of an EBMM.

3.24 ***Instructions***

Documentation for the installation, operation, maintenance, setup and safe use of the EBMM.

3.25 ***Interlock***

An arrangement whereby the status of one control or mechanism allows or prevents the operation of another.

3.26 ***Large EBMM***

EBMMs into which whole body access between the clamps may be expected during normal operations.

3.27 ***Maintenance Personnel***

Individuals who are trained and authorized by the employer to provide preventative maintenance and other technical services of a required skill level.

3.28 ***Manufacturer***

A person(s) whose business is the manufacture of new EBMMs for installation in the United States of America.

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3.29 *Mechanical Latch*

A device that will prevent unintentional closing of power-operated gate(s).

3.30 *Modification*

For the purposes of this standard, any changes to a product that affects personnel safety is considered a modification.

E3.30 *Modification*

Modification is intended to include adding, deleting, converting, or altering the original product. This could affect such areas as control systems (electrical, hydraulic, pneumatic, etc.), EBMM motions, walkways, ladders, enclosures, platforms, guards, etc. Anything that has been added, moved or removed, converted, or altered which affects the interface between the EBMM and personnel constitutes modification.

3.31 *Modifier*

Any person who performs a modification to an EBMM.

3.32 *Mold Area*

The zone between the platens.

3.33 *Monitor Device*

A device used to verify the correct function of another device.

3.34 *Movable Guard*

A guard that may be moved or removed without the use of tools.

3.35 *Operator*

An individual who is trained and authorized by the employer in the use of an EBMM to perform production work.

3.36 *Operator's Gate*

A movable barrier arranged to guard the operator from point of operation.

E3.36 *Operator's Gate*

The operator's gate may be opened and closed with each EBMM cycle.

3.37 *Operator's Station(s)*

The specified area from which the operator(s) initiates EBMM controls.

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3.38 *Parison*

The hollow plastic tube from which an article is blow molded.

3.39 *Plastic*

Any material processed by the EBMM.

3.40 *Platen*

The stationary or moving member of an EBMM to which the mold is fastened.

3.41 *Point of Operation*

The immediate area in which the plastic article is formed, conveyed and/or trimmed.

3.42 *Power Circuit*

The source of energy providing sequential motion or motion of EBMM.

3.43 *Presence-Sensing Device*

A device that is capable of detecting an intrusion into a specified area.

3.44 *Purging*

The clearing of plasticized material from the extrusion unit/die head.

3.45 *Rear Guard*

A barrier arranged to guard the rear mold area.

3.46 *Remanufacture*

The restoration of a complete EBMM to conformance with clauses 5 and 8 of this standard.

3.47 *Remanufacturer*

Any person whose business is the redesign and/or reconstruction of the EBMM for installation in the United States of America.

3.48 *Repair*

The restoration of a portion of EBMM to original function using original design by replacement or reworking of worn or damaged parts.

E3.48 *Repair*

Repair may include such items as replacement or rework of an extrusion unit, barrel, screw, pump, motor, tie bars, clamp cylinders, valves, seals, gaskets, timers, relays, etc.

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3.49 *Robot*

A multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks.

3.50 *Rotary Machines*

A machine in which the molds move on a circular or similar path.

3.51 *Safety Sign*

A visual alerting device in the form of a sign, label, decal, placard, or other marking that advises the observer of the nature and degree of the potential hazard(s) that can cause injury or death.

3.52 *Semi-Automatic Cycle (Single Cycle)*

A selectable mode of operation of the EBMM that allows it to perform one complete cycle and then stop.

3.53 *Set-Up Personnel*

Individuals who are trained and authorized by the employer to prepare the EBMM and all ancillary equipment for production.

3.54 *Shall*

The word "shall" is to be understood as denoting a mandatory requirement.

3.55 *Should*

The word "should" is to be understood as denoting a recommendation.

3.56 *Vapors*

Gas or steam formed by processing plastic.

4 Instructions - Responsibility for

4.1 *Manufacturer*

It shall be the responsibility of the manufacturer to furnish instructions with the EBMM.

E4 *Instructions*

This documentation includes the proper installation, operation, maintenance, service, set-up, trouble-shooting and safety of the EBMM.

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4.2 *Modifier*

It shall be the responsibility of the modifier to furnish instructions specific to the modification of the EBMM.

4.3 *Remanufacturer*

It shall be the responsibility of any remanufacturer to furnish instructions with the remanufactured EBMM.

5 Manufacture, Remanufacture, and Modifications

5.1 *Responsibility*

5.1.1 *Manufacture*

The manufacture of new EBMMs shall be in accordance with clauses 5 and 8 of this standard.

5.1.2 *Remanufacture*

The remanufacture of a complete EBMM shall be in conformance with clauses 5 and 8 of this standard.

E5.1.2 *Remanufacture*

Typically consists of the following:

a) Complete dismantling of the EBMM.

b) Cleaning and carefully inspecting all parts.

c) Reworking worn part(s) to as-new condition or replacing with new part(s).

d) Reconditioning slides, tie rods, ways, linkages, cylinders, barrels, screws, etc. to meet applicable standards and guidelines.

5.1.3 *Modification*

The modification made to existing EBMMs shall be in accordance with clause 8, and the parts of clause 6 of this standard which apply to the modification. Any modification shall not reduce the level of safety existing on the EBMM at the time of manufacture or remanufacture.

E5.1.3 *Modification*

An example would be a change from an electric drive system to a hydraulic drive system.

5.1.4 *Repair*

Repair shall not reduce the level of safety of the EBMM.

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5.2 *Mold Area Guarding*

5.2.1 *Operator's Gate(s)*

An operator's gate shall be provided as a barrier to keep an operator away from hazardous moving parts, the mold and the hot parison while the EBMM is operating. The operator's gate shall be closed before the EBMM can be operated. Safety interlocks shall be provided in accordance with 5.2.2 and 5.2.3 of this standard.

5.2.1.1 *Power-Operated Gate(s)*

When a power-operated gate is used, the exposed leading edge(s) shall incorporate a pressure-sensitive switch or equivalent safety device such that when the switch is activated the gate motion stops or reverses.

- The power assist mechanism shall not lessen the effectiveness of the operator's gate.

- The pressure-sensitive switch or equivalent safety device shall be designed into the circuit such that a failure of the switch duplicates actuation of the switch.

- Closure of a power-operated gate shall not directly initiate an EBMM cycle.

Exception: **When a part removal system is used, clamp closure may be initiated by a part removal system.**

5.2.2 *Electrical Interlock*

A hardwired electrical interlock shall be provided that shall prevent hazardous clamp and tooling movement when the operator's gate is opened sufficiently to permit access to the mold area. The safety interlock shall be so located to prevent inadvertent actuation. When an EBMM is powered by sources other than hydraulics or pneumatics, an additional independently controlled electrical safety interlocking system shall be provided. A monitoring device shall be provided to verify the operation of the safety interlock(s). When improper operation is detected, the cycle shall be inhibited and an alarm shall be activated.

E5.2.1.1 *Power-Operated Gate(s)*

The EBMM may have more than one operator's gate.

E5.2.2 *Electrical Interlock*

Tooling equipment includes, but is not limited to blow pins, strippers, punches and deflashers.

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Exception: **Motion of a part removal system (for EBMMs where the gate must be opened for part removal) and extrusion unit operation are permitted with the operator's gate open.**

5.2.3 ***Hydraulic or Pneumatic Interlock***

When hydraulic or pneumatic power is used to cause motion, then at least one hydraulic or pneumatic interlock shall be provided to prevent hazardous clamp and tooling movement when the operator's gate is opened sufficiently to permit access to the mold area. The safety interlock shall be so located to prevent inadvertent actuation. A monitoring device shall be provided to verify the operation of the safety interlock. If improper operation is detected, the cycle shall be inhibited and an alarm shall be activated.

Exception: **Motion of a part removal system (when a gate must be opened for part removal) and extruder unit operation are permitted with the operator's gates open.**

5.2.4 ***Emergency Stop Button***

At least one emergency stop button shall be provided at the operator station(s).

5.2.5 ***Reset***

Resetting an interlock shall not directly initiate a cycle.

5.2.6 ***Rear Guard***

The mold area opposite the operator of the EBMM shall have a rear guard with two safety interlocking systems that separately interrupt the control circuit and the power circuit to prevent all hazardous movement when the guard is opened or removed. When a fixed guard is used, safety interlocks are not required.

E5.2.6 *Rear Guard*

A rear guard should be so placed on the EBMM as to leave sufficient space between the guard and either the platens or the frame of the EBMM to allow clearance for water lines and other necessary items connected to the molds.

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5.2.7 *Top Guard*

A top guard shall be installed when it would be possible for a person standing on the floor or platform to reach over the top of the gate or guard and into a hazardous area. When the top guard is movable, the two safety interlocking systems shall be provided that shall prevent all hazardous movements when the top guard is opened or removed. When a fixed guard is used, safety interlocks are not required.

5.2.8 *Additional Safety for Large EBMMs*

One of the following shall be provided:

- **Presence-sensing device (see 3.43)**
- **Mechanical latch (see 3.29)**
- **Double acknowledgment system (see 3.13)**

5.2.8.1 *Emergency Stop*

Where it is possible to stand between the operator's gate and the mold area, an emergency stop device shall be provided in a location that is readily accessible from this area.

5.2.8.2 *Inadvertent Blow Air Release*

Blow air pressure shall be monitored so that the opening of the molds shall only be possible when the blow air pressure is reduced.

5.2.9 *Parts Discharge Opening*

The parts discharge opening shall be guarded to prevent access to hazards through this opening. When conveyors or other parts removal devices require modification of the guards, additional guarding shall be added to prevent access to hazards.

5.2.10 *Window*

When a window is used in a gate or guard to provide visibility, the window material shall conform to ANSI Z97.1.

E.5.2.8 *Additional Safety for Large EBMMs*

Double acknowledgment may be required for every cycle during semi-auto mode or to start/restart automatic mode.

E5.2.9 *Parts Discharge Opening*

The presence of a conveyor or chute may function as a guard (see ANSI/ASME B20.1). When access to the parts discharge area is possible through or around the chute or conveyor, additional guarding (e.g., presence-sensing devices) or interlocked perimeter guarding should be provided.

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5.3 *General Guarding (Other than Mold Area Guarding)*

5.3.1 *Guards*

Guards shall be provided where hazards exist. When a guard is movable, a safety interlock shall be provided that will stop hazardous motion when opened or removed.

E5.3.1 *Guards*

Guards requiring tools to be removed need not be interlocked.

5.3.2 *Extruder Feed Openings*

All extruder feed openings for plastic materials shall be guarded.

E5.3.2 *Extruder Feed Openings*

The feed hopper may function as a guard.

5.3.3 *Electrical Systems*

EBMMs shall be in accordance with the requirements of ANSI/NFPA 79.

5.3.4 *Extruder Barrel Covers*

A cover or barrier shall be provided to prevent inadvertent contact with high voltage and/or high temperatures when the extruder unit is in the normal operating position.

5.3.5 *Window*

When a window is used in a gate or guard to provide visibility, the window material shall conform to ANSI Z97.1.

5.4 *Safety Signs*

All new safety signs shall be designed and constructed in accordance with clause 8.

5.5 *Setting Movements*

5.5.1 Blowmolding machines shall be designed to enable setting movements to be undertaken from outside the closed guards.

5.5.2 Where there are points on machines at which the setting movements can only be undertaken with guards opened, the following shall be met:

5.5.2.1 An operating mode selector shall be provided that can be locked in the set-up mode with a removable key. The selector shall be hard wired and monitored to ensure proper operations.

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5.5.2.2 The key for the mode selector shall only be issued to person(s) trained in set-up operations.

5.5.2.3 Hazardous movement/motion required for the setting shall only be possible by means of a hold-to-run control device.

E5.5.2.3 Such movement/motion required for setting might be that of:

a) the blow mold and its parts

b) the blow pin or blow needle

c) individual blow station (multistation machines)

d) rotary wheel

e) parison-drop

5.5.2.4 When a hold-to-run control device is fitted on a portable control unit, it shall be capable of being taken into the point of operation. An enabling device and an additional emergency stopping device shall be fitted on such a control unit. The emergency stopping device shall act on all hazardous movements associated with setting operations.

5.5.2.5 When a hold-to-run control device is not on a portable unit, it shall be permanently fixed in such a position that the set-up person has a clear view of the point of operation.

5.5.2.6 A hold-to-run control device shall only be operable when the mode selector device is in the setting mode.

5.5.2.7 The setting speeds shall be designed not to exceed 1 inch/second (25 mm/second).

5.5.2.8 A pneumatic drive for the setting movements that create a hazard shall not be permitted to function in this mode.

5.5.2.9 Valves that could override set-up speed restrictions through activation by hand or tool shall be made inaccessible (i.e., guarding).

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6 Former Installations

6.1 *Responsibility*

It is the responsibility of the employer to see that all EBMMs are modified to bring them into conformity with the requirements of clauses 6, 7, and 8, within three years of the approval date of this document.

6.2 *Mold Area Guarding*

6.2.1 *Operator's Gate(s)*

An operator's gate shall be provided as a barrier to keep an operator away from hazardous moving parts, the mold and the hot parison while the EBMM is operating. The operator's gate shall be closed before the EBMM can be operated. Safety interlocks shall be provided in accordance with 6.2.2 and 6.2.3 of this standard.

6.2.1.1 *Power-Operated Gate(s)*

When a power-operated gate is used, the exposed leading edge(s) shall incorporate a pressure-sensitive switch or equivalent safety device such that, when the switch is activated, the gate motion stops or reverses.

- The power assist mechanism shall not lessen the effectiveness of the operator's gate.

- The pressure-sensitive switch or equivalent safety device shall be designed into the control circuit such that a failure of the switch duplicates actuation of the switch.

- Closure of a power-operated gate shall not directly initiate an EBMM cycle.

Exception: **When a part removal system is used, clamp closure may be initiated by a part removal system.**

E6.2.1.1 *Power-Operated Gate(s)*

The EBMM may have more than one operator's gate.

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6.2.2 *Electrical Interlock*

A hardwired electrical interlock shall be provided that will prevent hazardous clamp and tooling movement when the operator's gate is opened sufficiently to permit access to the mold area. The safety interlock shall be so located to prevent inadvertent actuation. When an EBMM is powered by sources other than hydraulics or pneumatics, an additional independently controlled electrical safety interlocking system shall be provided. A monitoring device shall be provided to verify the operation of the safety interlock(s). When improper operation is detected, the cycle shall be inhibited and an alarm shall be activated.

Exception: **Motion of a part removal system (for EBMMs where a gate must be opened for part removal) and extruder unit operation are permitted with the operator's gate open.**

6.2.3 *Hydraulic or Pneumatic Interlock*

When hydraulic or pneumatic power is used to cause motion, then at least one hydraulic or pneumatic interlock shall be provided to prevent hazardous clamp and tooling movements when the operator's gate is opened sufficiently to permit access to the mold area. The safety interlock shall be so located to prevent inadvertent actuation. A monitoring device shall be provided to verify the operation of the safety interlock. If improper operation is detected, the cycle shall be inhibited and an alarm shall be activated.

Exception: **Motion of a part removal system (when a gate must be opened for part removal) and extruder unit operation are permitted with the operator's gates open.**

6.2.4 *Emergency Stop Button*

At least one emergency stop button shall be provided at the operator station.

6.2.5 *Reset*

Resetting an interlock shall not directly initiate a cycle.

E6.2.2 *Electrical Interlock*

Tooling equipment includes, but is not limited to, blow pins, strippers, punches and deflashers.

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6.2.6 *Rear Guard*

The mold area opposite the operator of the EBMM shall have a rear guard with two safety interlocking systems that separately interrupt the control circuit and the power circuit to prevent all hazardous movements when the guard is opened or removed. When a fixed guard is used, safety interlocks are not required.

E6.2.6 *Rear Guard*

A rear guard should be so placed on the EBMM as to leave an opening between the guard and either the platens or the frame of the EBMM to allow clearance for water lines and other necessary items for connecting to the molds.

6.2.7 *Top Guard*

A top guard shall be installed when it would be possible for a person standing on the floor or platform to reach over the top of the gate or guard and into a hazardous area. When the top guard is movable, two safety interlocking systems shall be provided that will prevent all hazardous movement when the top guard is opened or removed. When a fixed guard is used, safety interlocks are not required.

6.2.8 *Additional Safety for Large EBMMs*

One of the following shall be provided:

- **Presence-sensing device (see 3.43)**
- **Mechanical latch (see 3.29)**
- **Double acknowledgment system (see 3.13)**

6.2.8.1 *Emergency Stop*

Where it is possible to stand between the operator's gate and the mold area, an emergency stop device shall be provided in a location that is readily accessible from this area.

6.2.8.2 *Inadvertent Blow Air Release*

Blow air pressure shall be monitored so that the opening of the molds shall only be possible when the blow air pressure is reduced.

6.2.9 *Parts Discharge Opening*

The parts discharge opening shall be guarded to prevent access to hazards through this opening. When conveyors or other parts removal devices require modifications of the guards, additional guarding shall be added to prevent access to hazards.

E6.2.9 *Parts Discharge Opening*

The presence of a conveyor or chute may function as a guard (see ANSI/ASME B20.1). When access to the parts discharge area is possible through or around the chute or conveyor, additional guarding (e.g., presence-sensing devices) or interlocked perimeter guarding should be provided.

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6.2.10 *Window*

When a window is used in a gate or guard to provide visibility, the window material shall conform to ANSI Z97.1.

6.3 *General Guarding (Other than Point of Operation Guarding)*

6.3.1 *Guards*

Guards shall be provided where hazards exist. When a guard is movable, a safety interlock shall be provided that will stop hazardous motion when opened or removed.

E6.3.1 *Guards*

Guards requiring tools to be removed need not be interlocked.

6.3.2 *Extruder Feed Openings*

All extruder feed openings for plastic materials shall be guarded.

E6.3.2 *Extruder Feed Openings*

The feed hopper may function as a guard.

6.3.3 *Electrical Systems*

EBMMs shall be in accordance with the requirements of ANSI/NFPA 79.

6.3.4 *Extruder Barrel Covers*

A cover or barrier shall be provided to prevent inadvertent contact with high voltage and/or high temperatures when the extruder unit is in the normal operating position.

6.3.5 *Window*

When a window is used in a gate or guard to provide visibility, the window material shall conform to ANSI Z97.1.

6.4 *Safety Signs*

All new signs shall be designed and constructed in accordance with clause 8 of this standard.

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6.5 ***Setting Movements***

6.5.1 Blowmolding machines shall be designed to enable setting movements to be undertaken from outside the closed guards.

6.5.2 Where there are points on machines at which the setting movements can only be undertaken with guards opened, the following shall be met:

6.5.2.1 An operating mode selector shall be provided that can be locked in the set-up mode with a removable key. The selector shall be hard wired and monitored to ensure proper operations.

6.5.2.2 The key for the mode selector shall only be issued to person(s) trained in set-up operations.

6.5.2.3 Hazardous movement/motion required for the setting shall only be possible by means of a hold-to-run control device.

E6.5.2.3 Such movement/motion required for setting might be that of:

a) the blow mold and its parts

b) the blow pin or blow needle

c) individual blow station (multistation machines)

d) rotary wheel

e) parison-drop

6.5.2.4 When a hold-to-run control device is fitted on a portable control unit, it shall be capable of being taken into the point of operation. An enabling device and an additional emergency stopping device shall be fitted on such a control unit. The emergency stopping device shall act on all hazardous movements associated with setting operations.

6.5.2.5 When a hold-to-run control device is not on a portable unit, it shall be permanently fixed in such a position that the set-up person has a clear view of the point of operation.

6.5.2.6 A hold-to-run control device shall only be operable when the mode selector device is in the setting mode.

6.5.2.7 The setting speeds shall be designed not to exceed 1 inch/second (25 mm/second).

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6.5.2.8 A pneumatic drive for the setting movements that create a hazard shall not be permitted to function in this mode.

6.5.2.9 Valves that could override set-up speed restrictions through activation by hand or tool shall be made inaccessible (i.e., guarding).

7 Care and Use - Responsibility for

7.1 *Training of Maintenance Personnel*

It shall be the responsibility of the employer to ensure the original and continuing competence of personnel caring for, inspecting, and maintaining EBMM.

E7.1 *Training of Maintenance Personnel*

While much general literature exists to provide a good foundation for training of maintenance personnel, it should be noted that these EBMMs have features not necessarily identical to those of other machinery.

7.2 *Training of Operators, Setup and Supervisory Personnel*

It shall be the responsibility of the employer to train and instruct personnel in the safe method of operation of the safety devices and procedures, as described in clauses 5, 6, 7, and 8, before starting work on any operation covered in this standard. The employer shall ensure by trained supervision that proper operating and setup procedures are being followed.

E.7.2 *Training of Operators, Setup and Supervisory Personnel*

The employer should consider setting up a checklist to ensure that operators are kept aware of procedures to follow in operating the EBMM safely. This checklist should be kept in the instruction manual of the EBMM, and periodically (e.g., per shift) the employer should have operators perform a check off from this list.

7.3 *Inspection and Maintenance*

It shall be the responsibility of the employer to perform periodic (e.g., per shift) inspection of EBMM to ensure that the safeguards are maintained in the proper operating condition.

E.7.3 *Inspection and Maintenance*

The employer should follow instructions provided by the manufacturer, modifier and/or remanufacturer.

7.4 *Work Area*

The employer shall provide clearance between EBMMs so that movement of one operator will not interfere with the work of another. Ample room for cleaning of EBMMs and handling of material, work pieces, and scrap shall also be provided. All surrounding floors shall be maintained in a good, clean and dry condition.

E7.4 *Work Area*

The handling of raw materials, parts in process, finished parts, scrap, and waste is a part of every plastics plant operation. Proper materials handling is important for the safety and performance of EBMMs and EBMM operators.

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7.5 *Parts Discharge Area*

When exposure to a hazard is created by the addition of a parts discharge area, the employer shall provide the proper safeguards.

E7.5 *Parts Discharge Area*

The wide variety of ancillary equipment (e.g., conveyors, chutes, robots) that may be added to existing EBMMs in operation is determined by the employer.

7.6 *Ventilation*

A means shall be provided by the employer to vent the vapors away from the work area.

7.7 *Ancillary Equipment*

It shall be the responsibility of the employer to ensure that the use of ancillary equipment for handling or access at EBMMs, (e.g., conveyors, lifts, take-out devices, deflashers, robots) shall not reduce the level of safety embodied in this standard.

E7.7 *Ancillary Equipment*

See E7.5.

7.8 *Personal Protective Equipment*

Personnel shall wear a face shield, protective gloves, protective clothing and/or any other personal protective equipment for protection against hazards associated with an EBMM.

8 Safety Signs

All new signs shall conform to ANSI Z535.3 and Z535.4 in color, format, size and content, where feasible.

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