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ANSI/SPI B151.20-1999

American National Standard

for Plastic Sheet Production Machinery –
Manufacture, Care & Use

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ANSI/SPI B151.20-1999
Revision of
ANSI/SPI B151.20-1982

American National Standard for Plastic Sheet Production Machinery – Manufacture, Care & Use

Sponsor

The Society of the Plastics Industry, Inc.

Approved August 11, 1999

American National Standards Institute, Inc.

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Foreword (This foreword is not part of American National Standard ANSI/SPI B151.20-1999.)

A standard treating the manufacture, care and use of plastic sheet production machines is complicated by the wide variety and size of machines manufactured and in use, and by the virtually infinite combinations of parts being produced, production methods being used and 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 a decision was made to approach the problem of machine safety as follows:

1. Eliminate by design certain recognized hazards and the establishment of standard approaches to design so those machines available from competitive manufacturers will have similar operational characteristics.

2. Safeguard machine where recognized hazards cannot be designed out for technical or operational reasons.

3. Warn where elimination or safeguarding of hazards is not technically or operationally feasible.

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

Recognizing the impossibility of updating equipment and changing operation methods allied with existing machines immediately after the 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 4 and 6 shall become effective one year after the approval date of this standard.

Evidence of consensus on this standard was secured by using the Canvass Method.

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

The Society of the Plastics Industry Extrusion Section Standards Committee was responsible for developing this standard.

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Explanation of Standard Format

This standard uses a two-column format to provide both specific requirements and supporting information.

The left column, designated "Standard Requirement" is confined solely to these requirements and is printed in bold type. Where supporting photographs or sketches are required, they are designated as "figures."

The right column, designated "Explanatory Information" contains only information that is intended to clarify the standard. This is *not* a part of the standard. Where supplementary photographs or sketches are required, they are designated as "illustrations."

Operating rules (safe practices) are not included in either column unless they are of such 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 ANSI/SPI B151.20-1999

American National Standard for Plastic Sheet Production Machinery –

Manufacture, Care and Use

STANDARD REQUIREMENTS

EXPLANATORY INFORMATION

1. Scope, Purpose, Application

1.1 *Scope*
Requirements of this standard shall apply to the primary sheet production machinery (Machinery).

Safety requirements of ancillary equipment used with the Machinery are not covered by this standard.

E1.1 *Scope*
Inquiries with respect to the application or Substantive requirements of the standard should be addressed to:

The Society of the Plastics Industry
1801 K Street, NW
Washington, DC 20006

1.2 *Purpose*
The purpose of this standard is to identify and address known hazards to personnel working on or adjacent to the Machinery.

1.3 *Application*

1.3.1 *New Installation*
The requirements of this standard pertaining to manufacture shall apply to all new or remanufactured Machinery installed in the United States of America. Compliance shall be achieved within one year of the approval date of this standard. Date of shipment (month/year) shall be affixed to the Machine permanently and legibly along with the name of the manufacturer or remanufacturer.

1.3.2 *Existing Installations*
The employer is responsible for bringing existing Machines into compliance with the requirements of this standard within three years of the approval date of this standard with the following exception:

The 4 inch dimension referred to in sections 3.13 and 5.3.1.2 shall be changed to 3 inches.

E1.3.2 *Existing Installations*
If modifications are required to achieve this reduced dimension, the employer is strongly urged to use 4 inches if at all possible.

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It is not the intent of this standard to require existing installations to be in total compliance with the latest revision of ANSI/NFPA 79-1997 *American National Standard Electrical Standard for Industrial Machinery.* Only requirements that address personnel safety require updating.

1.3.3 *All Installations*
An employer shall not operate a Machine or permit it 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 Z535.3-1998, *Criteria for Safety Symbols* *

ANSI Z535.4-1998, *Product Safety Signs and Labels* *

ANSI/NFPA 79-1997, *Electrical Standard for Industrial Machinery* *

OSHA 1910.93[2)]

3. Definitions

3.1 *Alarm*
A visual or audible warning device

3.2 *Emergency Stop Device*
A trip rod, cord, button or other device that when Activated stops all hazardous movement associated with the specified machine.

E2. Related References

SPI/AN-137, SPI Recommended Guideline for Safety Signs for Plastics Machinery & Related Equipment[1)]

CFR Title 29, Subpart 2, Part 1910.1042 [2)]

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* For electronic copies of some standards, visit ANSI's Electronic Standards Store (ESS) at www.ansi.org. For printed versions of all these standards, contact Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, (800) 854-7179.

[1)] Available from The Society of the Plastics Industry, Literature Sales Dept., 1801 K Street, NW, Washington, DC 20006.

[2)] Available from the National Archives and Records Administration, Code of Federal Regulations, Pennsylvania Ave. at 7th Street, Washington, DC 20408.

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3.3 *Employer*
Any person who contracts, hires, or is responsible for the personnel associated with the operation and maintenance of the Machine

3.4 *Guard*
A barrier, cover, enclosure or other device placed over areas where hazards exist

E3.4 *Guard*
Other devices may include presence sensing devices.

3.4.1 *Fixed Guard*
A guard requiring the use of tools for removal from the Machinery.

E3.41 *Fixed Guard*
A fixed guard includes, but is not limited to, one that is fastened to the framework of the machine or floor.

3.4.2 *Movable Guard*
A guard that may be moved or removed without the use of tools.

E3.4.2 *Movable Guard*
A movable guard is generally connected by mechanical means to the machine frame or an adjacent fixed element (i.e., hinges or slides).

3.5 *Instructions*
Documentation for the installation, operation, care, maintenance and safe use of the Machine.

3.6 *Interlock*
An arrangement whereby the operation of one control or mechanism brings about or prevents the operation of another.

3.7 *Local Control*
A control device located in full view of the component being controlled.

E3.7 *Local Control*
The operator must be able to see the hazard.

3.8 *Maintenance Personnel*
Individuals, who by virtue of their training and skills are qualified to inspect, maintain and repair the Machinery.

3.9 *Manufacturer*
Any person whose business is the manufacture of the Machinery covered in this standard for installation in the United States of America.

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3.10 *Modification*
For the purpose of this standard, any change to the Machinery that affects personnel safety is considered a modification

3.11 *Modifier*
Any person who performs a modification to a Machine.

3.12 *Nip, Counter Rotating*
The point between two counter-rotating rolls.

3.13 *Nip, Fixed Member*
The point between a fixed member and a driven roll where the distance between the two is 4 inches or less.

3.14 *Nip, Web Generated*
The contact point between a web surface and a rotating roll

3.15 *Nip, Wedging*
A fixed member nip where the distance between the fixed member and the surface of the roll decreases in the direction of rotation.

3.16 *Operator*
An individual who uses the Machinery to perform production work.

3.17 *Pinch Point*
Any point at which it is possible for a part of the body to be caught between a moving part and a fixed part or between two moving parts except nips.

3.18 *Polishing Roll Stand*
A machine equipped with two or more metal rolls revolving in opposite directions and capable of nipping plastic melt used for heat transfer and/or sizing.

E3.18 *Polishing Roll Stand*
The machine may have additional capabilities such as polishing, embossing and laminating.

3.19 *Presence-Sensing Device*
A device that is capable of detecting an intrusion into specified areas

E3.19 *Presence-Sensing Device*
Examples of presence-sensing devices include: Safety mat, interlocked platform, photoelectric beam, or other similar devices.

3.20 *Pull Roll Stand*
A machine or a part thereof consisting of two nipping rolls that revolve in opposite directions and are used to pull the web after leaving the preceding equipment.

E3.20 *Pull Roll Stand*
A pull roll stand is also known as a draw roll.

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3.21 *Reach Point*
The farthest point an operator is expected to be able to touch when outside of the machine or on a walkway. Areas that may only be reached by deliberately crawling into the machine or otherwise contorting the body are not considered within the reach point of the operator.

3.22 *Remanufacture*
A substantial restoration of a specific machine.

.

E3.22 *Remanufacture*
Remanufacture typically consists of the following: 1) Substantial dismantling of the machine; 2) Cleaning and carefully inspecting all parts; 3) Reworking worn parts to as new condition or replacing with new parts to meet applicable standards and guidelines; 4) Substantially reconditioning or replacing power system components to meet applicable standards and guidelines; 5) Inspecting all electrical and control systems and replacing component/systems as required; 6) Removing modifications that are not in conformance with clauses 5 & 7 of this standard and informing the employer of the removal.

3.23 *Remanufacturer*
Any person whose business is the redesign and/or remanufacture of a specific machine for installation in the United States of America.

3.24 *Repair*
The restoration of a portion of a specific machine to original function using original design by replacement or re-working of worn or damaged parts.

E3.24 *Repair*
Repair may include such items as replacement or rework of safety devices, drives, controls meters, etc.

3.25 *Safety Signs*
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.

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3.26 *Shall*
The word "shall" denotes a mandatory requirement.

3.27 *Should*
The word "should" denotes a recommendation.

3.28 *S Wrap*
An "S" wrap is formed between two counter-rotating rolls either touching or not, when the web passes around the first roll, through the space between the two rolls,around the second roll, and continues. This is opposed to the web simply passing through the nip between the two rolls without wrapping either.

3.29 *Traversing*
The motion of a Machine from a non-production position to a production position and vice versa.

E3.29 *Traversing*
Traversing does not include machine motions inherent in production operation (i.e., oscillating and rotation).

3.30 *Web*
The film or sheet passed through the Machinery.

4. Care

4.1 *Instructions*

4.1.1 *Manufacturer*
It shall be the responsibility of the manufacturer to furnish instructions with the Machinery.

4.1.2 *Modifier*
It shall be the responsibility of the person modifying the Machinery to furnish instructions specific to the modification.

4.1.3 *Remanufacturer*
It shall be the responsibility of the remanufacturer to furnish instructions with the Machinery.

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4.2 *Training of Maintenance Personnel*
It shall be the responsibility of the employer to ensure the original and continuing competence of personnel installing, inspecting and maintaining the Machinery.

E4.2 *Training of Maintenance Personnel*
Much general literature exists to provide a good foundation for training of personnel. It should be noted that various Machines have unique features; therefore, reference to the manufacturer's or remanufacturer's manual is very important.

4.3 *Inspection and Maintenance*
It shall be the responsibility of the employer to establish and follow a program of periodic and regular inspections of the Machinery to ensure that all safeguards are in proper operating condition and are properly adjusted.

E4.3 *Inspection and Maintenance*
To meet the requirements of this subclause, it is recommended that a visual inspection of operations and safeguards be made. In addition, an operational inspection should be made of all safety interlocks and emergency stop devices. Each manufacturer, modifier, or remanufacturer should have a recommended preventative maintenance program for the Machinery. This program can be used as a basis for periodic operational inspections and maintenance. In the absence of such a program, the employer should fulfill this requirement.

5. Manufacture, Remanufacture and Modification

5.1 *Responsibility*

5.1.1 *Manufacture*
The manufacture of new Machinery shall be in accordance with clauses 5 and 7 of this standard.

5.1.2 *Remanufacture*
The remanufacture of existing Machinery shall be In accordance with clauses 5 and 7 of this standard.

5.1.3 *Modification*
Modification(s) made to existing Machinery shall be in accordance with clause 7 and the applicable parts of clause 5 of this standard. Any modification shall not reduce the level of safety existing on the Machine prior to that modification

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5.1.4 *Repair*
Repair shall not reduce the level of safety of the Machine(s).

5.2 *Guarding, General*

5.2.1 *Access Openings*
Hazardous areas that are accessible shall be guarded. When the guard is not fixed it shall be interlocked to stop hazardous motion exposed by moving or removing the guard. Where safeguarding of hazards is not technically or operationally feasible these hazardous areas shall be color coded.

E5.2.1 *Access Openings*
Examples of hazardous areas may include but are not limited to moving or rotating motor driven parts such as gears, sheaves, belts, chains shafts, drive couplings and pinch points.

5.2.2 *Rotating Shaft Extension*
Rotating shaft extensions shall be smooth and shall not project more than one-half of the diameter of the shaft unless guarded. Smooth roll journals fitted with rotary joints and piping and presenting no significant hazard are excepted from these requirements.

5.2.3 *Rotary Unions*
Rotary unions carrying heated fluids shall be guarded to protect operators from hazards associated with seal failure.

E5.2.3 *Rotary Unions*
See also 6.5

5.2.4 *Cutting Devices*
All web-cutting devices within the reach point during normal production operation shall be guarded to the extent technically and operationally feasible. A means shall be provided to prevent unintentional movement during thread-up, blade change or other adjustment. Blade holders shall be color coded and a safety sign shall be provided.

5.3 *Guarding, Nips*

5.3.1 *Counter-Rotating Nips*
The inrunning side of the counter-rotating nips shall be guarded to prevent a person from being caught in the nips and shall have an Emergency Stop Device readily accessible to that person. The guard shall not form a wedging nip.

Safety signs shall be provided to warn of the nips. Where roll ends are exposed they shall be color coded to warn of the hazards.

E5.3.1 *Counter-Rotating Nips*
Acceptable safeguarding devices include but are not limited to:
- vacuum box
- air knife or similar accessory which blocks access to the nip.
- fixed or moveable guard.
- presence-sensing device that, when activated, shall open the nip.
- die extensions, deckles or any combination of the above.

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5.3.1.1 *Inrunning Nips with Associated Flat Dies*
Process considerations require access to the nip area

Safety signs, color-coded roll ends and a readily accessible Emergency Stop Device shall be provided.

In view of the large number of dies and operating considerations, which may be used on a given line, it shall be the sole responsibility of the employer to safeguard the primary nip. See 6.2.

E5.3.1.1 *Inrunning Nips Associated with Flat Dies*
Process considerations include but are not limited to access for die/roll adjustment, visual inspection, etc.

5.3.1.2 *Nip Roll Opening*
There shall be a minimum of 4 inches (4") between roll surfaces in the open position.

5.3.1.3 *Nip Roll Closing*
If operator-accessible nip rolls are closed by local control, no alarm or delay is required. If local control is not used, then a local preclose alarm shall be used. The preclose alarm circuit shall be designed such that an alarm of three seconds duration sounds prior to immediate roll closing.

5.3.1.4 *Emergency Conditions*
Activation of the Emergency Stop device shall initiate stopping and opening of the driven rolls provided that this does not create additional hazards.

E5.3.1.4 *Emergency Conditions*
See 5.3.1.2

5.3.1.4.1 *Opening Time*
Minimum roll opening shall be achieved within three (3) seconds from the time the command is given.

5.3.1.4.2 *Maximum Stopping Distance*
The rolls shall stop in a distance of less than 1.75% of the maximum line speed as measured on the surface of the roll.

E5.3.1.4.2 *Maximum Stopping Distance*
For example, at 100 fpm, the rolls must stop within 1.75 feet (or 21") of surface travel.

5.3.1.5 *Independently Moveable Guards*
Where guard motion is independent of roll movement, the guard shall be interlocked to prevent closing of the rolls when the guard is not in place and shall open the roll if the guard is withdrawn from its effective position. Closing of the guard shall not of itself cause the rolls to close. Rotation of the rolls is permitted with the rolls open independent of guarding.

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5.3.1.6 *Nip-Powered Moveable Guards*
Guards that move open and closed with rolls, and are within the operator's reach point shall meet the requirements of nip roll closing given in 5.3.1.3

5.3.2 *Nip, Fixed Member*
Where a nip exists within the operator's reach point that can cause physical injury, a guard shall be provided. The guard shall come within ¼ inch of the moving surface and not create a hazard.

E5.3.2 *Nip, Fixed Member*
See 5.3.1.1 for flat dies.

5.3.3 *Nip, Web Generated*
Where a web-generated hazard exists within the operator's reach point, the hazards shall be guarded. Where it is not technically or operationally feasible to guard this nip, an Emergency Stop Device readily accessible to that person from any point across the full width of the nip shall be provided. In areas where operator access is required predominantly for start-up purposes, guarding or an Emergency Stop Device is not required.

E5.3.3 *Nip, Web Generated*
An example of a case where guarding is not required is the conveying section of a sheet line.

5.3.4 *Start-up/Thread-up*
If movement of the roll is necessary during start-up/ thread-up, rotation and closing of the nip shall be permitted with the guard out of position, provided that a local hold-to-maintain-close control and low speeds are used.

E5.3.4 *Start-up/Thread-up*
Appropriate start-up/thread-up instruction and training should be provided.

5.4 *Operation Safeguards*

5.4.1 *Protrusions*
Any mechanical element that creates a hazard by protruding into any passageway shall be color coded.

5.4.2 *Traversing Machines*
There shall be a 3-second minimum delay during which an alarm is activated to warn the operator and others when the Machines are about to move. An alarm shall be activated during the traversing motion. After the 3-second delay, intermittent motion of the machine can continue without repeating the delay requirement. After stopping, motion of machine may be resumed within 12 seconds without the 3-second delay.

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5.5 *Electrical*

5.5.1 *Electrical Systems*
Machines shall be designed and built to the requirements of ANSI/NFPA 79.

5.5.2 *Power Loss*
Power loss shall not initiate hazardous machine motion. Restoration of power shall not re-start the machine.

6. Use

6.1 *Ancillary Equipment*
It shall be the responsibility of the employer to ensure that use of ancillary equipment does not reduce the level of safety of the Machine

6.2 *Dies*
The employer shall ensure that all die installations are adequately guarded.

A flat die and/or its extensions typically blocks access to the nip and provides the guarding function. When blocking access to the nip, the flat die may create a wedging nip that is not technically or operationally feasible to guard.

Where a die narrower than the nip rolls fails to guard the outside face of the nip, die extensions, deckles or other safeguards shall be provided to achieve the same guarding function.

6.3 *Instruction of Operators*
The employer shall train and instruct operators in the safe methods of operation, as well as provide instruction on the safety devices provided, before they start work on the machinery covered by this standard. The employer shall make all instructions available to the operator and maintenance personnel.

E6.3 *Instruction of Operators*
The employer should consider setting up a checklist to ensure operators are kept aware of procedure to follow in operating the Machine safely. This checklist should be kept with the Machine instruction manual and periodically (such as every 6 months), the employer should have operators review the instructions and sign-off on the list.

6.4 *Personal Protective Equipment*
Employer shall evaluate hazards requiring personal protective equipment and ensure its use.

6.5 *Work Area*
Adequate clearance for operation and maintenance shall be provided around the Machinery.

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6.6 *Electrostatic Treater*
The electrostatic treater electrode zone shall be exhaust vented to maintain ozone levels in accordance with OSHA 1910.93. The electrostatic treater shall have means provided to prevent operation when the exhaust fan is not operating or when the electrode is accessible. Any access openings shall be in conformance with 5.2.1.

E6.6 *Electrostatic Treater*
Refer to Federal Register, Code of Federal Regulations Title 29, Subpart 2 of part 1910.1042 for further specific personnel requirements regarding ozone exposure.

7. Signs and Plates

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

7.2 *Safety Sign Wording and Location*
Safety signs shall contain sufficient information to be understood and be located as close to the actual hazard as practical

E7.2 *Safety Sign Wording and Location*
See SPI AN-137.

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