ANSI/PMMI B155.1-2016

Safety Requirements for Packaging and Processing Machinery

Secretariat and Standards Developing Organization
PMMI The Association for Packaging and Processing Technologies
11911 Freedom Drive, Suite 600
Reston, VA 20190-5629, USA

Approved as an American National Standard on November 18, 2016

American National Standards Institute, Inc
1899 L Street, NW, 11th floor
Washington, DC 20036
By approving this American National Standard, the ANSI Board of Standards Review confirms that the requirements for due process, consensus, balance and openness have been met by the Association for Packaging and Processing Technologies (PMMI), the ANSI-accredited standards developing organization.

American National Standards are developed through a consensus process. Consensus is established when substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward resolution. This process brings together volunteers or seeks out the views of persons who have an interest in the topic covered by this standard. While PMMI administers the process and establishes procedures to promote fairness in the development of consensus, it does not write the document and it does not independently test, evaluate or verify the accuracy or completeness of any information or the soundness of any judgments contained in its standards or guidelines.

American National Standards are promulgated through ANSI for voluntary use; their existence does not in any respect preclude anyone, whether they have approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards. However, users, distributors, regulatory bodies, certification agencies and others concerned may apply American National Standards as mandatory requirements in commerce and industry.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of an American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the Secretariat (PMMI).

NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. You may contact the Secretariat for current status information on this standard.

Individuals interested in obtaining up-to-date information on standards can access this information at www.nssn.org (or by contacting ANSI). NSSN - A National Resource for Global Standards provides a central point to search for standards information from worldwide sources and can connect those who seek standards to those who supply them.

PMMI makes no warranty, either expressed or implied as to the fitness of merchantability or accuracy of the information contained within this standard, and disclaims and makes no warranty that the information in this standard will fulfill any of your particular purposes or needs. PMMI disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, application or reliance on this standard. PMMI does not undertake to guarantee the performance of any individual manufacturer or seller’s products or services by virtue of this standard, nor does it take any position with respect to the validity of any patent rights asserted in connection with the items which are mentioned in or are the subject of this standard, and PMMI disclaims liability for the infringement of any patent resulting from the use of or reliance on this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

In publishing or making this standard available, PMMI is not undertaking to render professional or other services for or on behalf of any person or entity, nor is PMMI undertaking to perform any duty owed by any person or entity to someone else. Anyone using this standard should rely on his or her own independent judgment, or as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. In addition to performing the risk assessment process described by this standard, the responsible personnel should also make an independent determination as to whether a machine, activity or condition complies with the applicable legal requirements in the relevant jurisdiction(s).

PMMI has no power, nor does it undertake to police or enforce conformance to the requirements of this voluntary standard. PMMI does not certify, test or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of conformance to any health or
safety-related information in this standard shall not be attributable to PMMI and is solely the responsibility of the certifier or maker of the statement.

This standard is available from www.ansi.org.

Published by:

PMMI The Association for Packaging and Processing Technologies
11911 Freedom Drive, Suite 600
Reston, VA 20190-5629, USA

© Copyright 2016. Association for Packaging and Processing Technologies All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.
American National Standard

Safety Requirements for Packaging and Processing Machinery

Approved as an American National Standard on November 18, 2016

American National Standards Institute, Inc
1899 L Street, NW, 11th floor
Washington, DC 20036
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>0  FOREWORD</td>
<td>8</td>
</tr>
<tr>
<td>1  SCOPE AND PURPOSE</td>
<td>11</td>
</tr>
<tr>
<td>1.1 SCOPE</td>
<td>11</td>
</tr>
<tr>
<td>1.2 PURPOSE</td>
<td>11</td>
</tr>
<tr>
<td>2  NORMATIVE REFERENCES</td>
<td>11</td>
</tr>
<tr>
<td>3  DEFINITIONS</td>
<td>13</td>
</tr>
<tr>
<td>4  RESPONSIBILITIES</td>
<td>18</td>
</tr>
<tr>
<td>4.1 GENERAL</td>
<td>18</td>
</tr>
<tr>
<td>4.2 COLLABORATIVE EFFORTS</td>
<td>19</td>
</tr>
<tr>
<td>4.3 RESPONSIBILITIES OF THE COMPONENT SUPPLIER, MACHINE SUPPLIER AND</td>
<td>20</td>
</tr>
<tr>
<td>THE MACHINE USER</td>
<td></td>
</tr>
<tr>
<td>4.4 RESPONSIBILITIES OF THE COMPONENT USER / MACHINE SUPPLIER</td>
<td>20</td>
</tr>
<tr>
<td>4.5 QUALIFIED PERSONS</td>
<td>21</td>
</tr>
<tr>
<td>4.6 SPECIFICATIONS</td>
<td>21</td>
</tr>
<tr>
<td>4.7 DESIGN, CONSTRUCTION AND INFORMATION FOR OPERATION AND MAINTENANCE</td>
<td>21</td>
</tr>
<tr>
<td>4.8 INSTALLATION, COMMISSIONING AND START-UP</td>
<td>21</td>
</tr>
<tr>
<td>4.9 RISK REDUCTION MEASURES</td>
<td>21</td>
</tr>
<tr>
<td>4.10 OPERATION AND MAINTENANCE</td>
<td>21</td>
</tr>
<tr>
<td>4.11 TRAINING OF USER PERSONNEL</td>
<td>21</td>
</tr>
<tr>
<td>4.12 CLEANING AND SANITIZATION</td>
<td>22</td>
</tr>
<tr>
<td>4.13 OPERATIONAL WORKING SPACE</td>
<td>22</td>
</tr>
<tr>
<td>4.14 EXISTING (LEGACY) EQUIPMENT</td>
<td>22</td>
</tr>
<tr>
<td>4.15 MODIFYING OR REBUILDING MACHINERY</td>
<td>22</td>
</tr>
<tr>
<td>4.16 SUPPLIERS OF USED MACHINERY</td>
<td>23</td>
</tr>
<tr>
<td>4.17 DECOMMISSIONING AND LIFE CYCLE ACTIVITIES</td>
<td>23</td>
</tr>
<tr>
<td>4.18 PERSONNEL RESPONSIBILITY</td>
<td>23</td>
</tr>
<tr>
<td>5  REQUIREMENTS FOR DESIGN, CONSTRUCTION, RECONSTRUCTION, MODIFICATION,</td>
<td>23</td>
</tr>
<tr>
<td>INSTALLATION, OPERATION AND MAINTENANCE OF MACHINERY</td>
<td></td>
</tr>
<tr>
<td>5.1 GENERAL</td>
<td>23</td>
</tr>
<tr>
<td>5.2 SUPPLIER</td>
<td>23</td>
</tr>
<tr>
<td>5.3 USER</td>
<td>23</td>
</tr>
<tr>
<td>5.4 INSTALLATION</td>
<td>23</td>
</tr>
<tr>
<td>5.5 INTEGRATOR / MODIFIER / REBUILDER</td>
<td>23</td>
</tr>
<tr>
<td>6  THE RISK ASSESSMENT PROCESS</td>
<td>23</td>
</tr>
<tr>
<td>6.1 GENERAL</td>
<td>23</td>
</tr>
<tr>
<td>6.2 PREPARE FOR/SET LIMITS OF THE ASSESSMENT</td>
<td>25</td>
</tr>
<tr>
<td>6.3 IDENTIFY HAZARDS</td>
<td>25</td>
</tr>
<tr>
<td>6.4 ASSESS INITIAL RISK</td>
<td>27</td>
</tr>
<tr>
<td>6.5 REDUCE RISK</td>
<td>29</td>
</tr>
<tr>
<td>6.6 ASSESS RESIDUAL RISK</td>
<td>32</td>
</tr>
<tr>
<td>6.7 ACHIEVE ACCEPTABLE RISK</td>
<td>32</td>
</tr>
<tr>
<td>6.8 VALIDATE RISK REDUCTION MEASURES</td>
<td>33</td>
</tr>
<tr>
<td>6.9 DOCUMENT THE RESULTS</td>
<td>33</td>
</tr>
<tr>
<td>7  SPECIFIC RISK REDUCTION METHODS</td>
<td>33</td>
</tr>
<tr>
<td>7.1 ACCESS TO MACHINERY</td>
<td>33</td>
</tr>
<tr>
<td>7.2 CONTROL SYSTEMS PERFORMING A SAFETY FUNCTION</td>
<td>34</td>
</tr>
<tr>
<td>7.3 CONTROL SYSTEMS DESIGN REQUIREMENTS</td>
<td>35</td>
</tr>
</tbody>
</table>
7.4 Material Conveyance .................................................................................................................. 36
7.5 Electromagnetic Compatibility (EMC) .......................................................................................... 36
7.6 Electrical ....................................................................................................................................... 36
7.7 Emergency Stop .......................................................................................................................... 37
7.8 Ergonomics / Human Factors ..................................................................................................... 37
7.9 Safeguards .................................................................................................................................... 37
7.10 Lifting of Machines, Component Parts and Materials ............................................................... 37
7.11 Hydraulic and Pneumatic (Including Vacuum) Systems ............................................................. 38
7.12 Pressure Vessels ........................................................................................................................ 39
7.13 Ladders and Platforms .............................................................................................................. 39
7.14 Control of Hazardous Energy (Lock Out, Tag Out and Alternative Methods) ......................... 39
7.15 Lubrication ............................................................................................................................... 39
7.16 Mechanical Power Transmission ............................................................................................... 40
7.17 Modified Atmospheres ............................................................................................................. 40
7.18 Noise ........................................................................................................................................ 40
7.19 Industrial Robots ....................................................................................................................... 41
7.20 Lasers, Radiation and Magnetic Fields .................................................................................... 41
7.21 Sanitation and Hygiene ............................................................................................................ 41
7.22 Stability ..................................................................................................................................... 42
7.23 Thermal Systems ...................................................................................................................... 42
7.24 Visibility ..................................................................................................................................... 42
7.25 Ventilation of Airborne Contaminants .................................................................................... 43

8 INFORMATION FOR OPERATION, CLEANING AND MAINTENANCE OF MACHINERY ............................................................. 43
8.1 General ....................................................................................................................................... 43
8.2 Manuals ..................................................................................................................................... 43
8.3 Machinery Safety Signs and Labels .......................................................................................... 43
8.4 Nameplate ................................................................................................................................ 43
8.5 Information for Personal Protective Equipment (PPE) ............................................................ 43
8.6 Information for Verification ....................................................................................................... 43

9 TRAINING ..................................................................................................................................... 44
9.1 General ..................................................................................................................................... 44
9.2 Training Elements ..................................................................................................................... 44
9.3 Operator Training ....................................................................................................................... 46
9.4 Maintenance Personnel Training ............................................................................................. 46
9.5 Cleaning and Sanitization Personnel Training ........................................................................ 46
9.6 Supervisor Training .................................................................................................................. 46
9.7 Retraining .................................................................................................................................. 47

10 PERSONAL PROTECTIVE EQUIPMENT .................................................................................... 47

ANNEX A Risk Assessment Procedure for Hygienic Design (Informative) ........................................ 48
ANNEX B (Informative) Other Risk Scoring Systems .................................................................. 49
ANNEX C (Informative) List of Packaging and Processing Machinery Hazards .......................... 53
ANNEX D (Informative) Guidance for the Risk Assessment Process .......................................... 57
ANNEX E (Informative) Sharing Information About Residual Risk .............................................. 60
ANNEX F (Informative) Information for Use – Manual Content Outline ...................................... 64
ANNEX G (Informative) Sample Risk Assessment Documentation ............................................. 67
ANNEX H (Informative) Standards References Useful in Design: ................................................ 68
ANNEX I (Informative) Examples of Good and Bad Hygienic Design Features ............................ 73
<table>
<thead>
<tr>
<th>ANNEX</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>(INFORMATIVE) SAMPLE STATEMENT OF CONFORMITY</td>
<td>88</td>
</tr>
<tr>
<td>K</td>
<td>(INFORMATIVE) REFERENCES</td>
<td>89</td>
</tr>
<tr>
<td>L</td>
<td>(INFORMATIVE) LIST OF EN (EUROPEAN NORM) PACKAGING MACHINERY STANDARDS</td>
<td>91</td>
</tr>
<tr>
<td>M</td>
<td>(INFORMATIVE) LIST OF SOME OF THE “TYPE C” HARMONIZED STANDARDS UNDER THE “EU MACHINERY DIRECTIVE” FOR FOOD PROCESSING, PLASTIC AND PAPER MANUFACTURING</td>
<td>92</td>
</tr>
<tr>
<td>N</td>
<td>(INFORMATIVE) STANDARDS VISUAL MAPPING (FROM ANSI B11.0 ANNEX K)</td>
<td>95</td>
</tr>
</tbody>
</table>
0 Foreword
(This foreword is not part of the requirements of American National Standard ANSI/PMMI B155.1-2016)

This standard was promulgated by The Association for Packaging and Processing Technologies (PMMI) as a voluntary standard to establish safety requirements for machinery.

The first version of this standard was approved by the PMMI membership on 27 September 1972. It was approved as an American National Standard by ANSI on 6 August 1973. The standard has been reviewed and revised with subsequent approvals by the ANSI Board of Standards Review in 1979, 1986, 1994, 2000, 2006, 2011 and 2016.

This version of the standard has been harmonized with international (ISO) and European (EN) standard ISO 12100. Suppliers meeting the requirements of ANSI/PMMI B155.1-2016 may simultaneously meet the requirements of ISO 12100.

The B155.1 standard can be associated with the ISO “A-B-C level” structure as described immediately below, and as shown in Figure 1 below.

  - **Type-A standards** (basis standards) give basic concepts, principles for design, and general aspects that can be applied to machinery.
  - **Type-B standards** (generic safety standards) deal with one or more safety aspects or one or more types of safeguards that can be used across a wide range of machinery.
  - **Type-C standards** (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

This B155.1 standard on general safety requirements common to packaging and processing machines is primarily an “A-level” standard in that it applies to a broad array of packaging and processing machines and contains very general requirements. However, in many areas it also contains very specific requirements typical of a type-C standard.

[Figure 1 - A / B / C Organization of Standards]

This standard is intended for readers with differing levels of familiarity with standards and the risk assessment process. The requirements of the machine specific ANSI standards are grouped according to those that apply to the supplier (i.e., manufacturer, rebuilder, modifier) and user. Some are shared between the supplier and user and are so indicated.

The objective of the B155.1 standard is to eliminate injuries to personnel packaging and processing systems by establishing requirements for the design, construction, reconstruction, modification, installation, set-up, operation and maintenance of packaging and processing machinery systems. Responsibilities have been assigned to the supplier, the user and the user personnel to implement this standard. This standard is not intended to replace good judgment and personal responsibility. Personnel skill, attitude, training and experience are safety factors that should be considered by the user.
"Safe" is the state of being protected from recognized hazards likely to cause serious physical harm. There is no such thing as being absolutely safe, that is, a complete absence of risk, and therefore there is no machinery, including packaging and processing machinery, that is absolutely safe in the sense of being completely devoid of all conceivable risks. All machinery contains hazards, and some level of residual risk. However, the risk associated with those hazards should be reduced to an acceptable level. To achieve this goal, senior management should allocate appropriate personnel, time and resources to permit the risk assessment process to be successfully completed. Senior management holds the ultimate responsibility to determine the level(s) of acceptable risk.

This standard guides packaging and processing machinery suppliers and users through a risk assessment process designed to ensure that reasonably foreseeable hazards are identified and corresponding risks are reduced to an acceptable level. In this standard the terms “acceptable” and “tolerable” are used as synonyms. Although engineers have long applied an informal risk assessment framework, this standard introduces a formal method to conduct and document the risk assessment process.

This standard identifies some preparations that need to be made before a risk assessment begins, and presents the basic risk assessment process in a step by step approach to assist in achieving this goal.

The outcome of completing the risk assessment process should be:

- Packaging and processing machinery ready to ship, install or use with risks reduced to an acceptable level;
- Awareness devices, warning labels, instruction manual(s) and information for operation and maintenance; and
- Documenting the results of the risk assessment process.

This standard does not use the term “and/or” but instead, the term “or” is used as an inclusive disjunction, meaning one or the other or both.

**Normative requirements**

The normative requirements appear aligned to the left margin. To meet the requirements of this standard, machinery suppliers and users must conform to these normative requirements. These requirements typically use the verb “shall.”

**Informative Notes**

The informative or explanatory text in this standard appears indented, in italics, in a reduced font size and colored blue (for those with electronic or color printed versions), all of which are in an effort to provide a visual signal to the reader that this is informative text, not normative text, and is not to be considered part of the requirements of this standard; this text is advisory in nature only. The suppliers, the users and the machines themselves are not required to conform to the informative text. The informative text is presented in this manner in an attempt to enhance readability. Informative annexes contain guidance but do not contain requirements.

**Effective Date**

The following information on effective dates is informative guidance only, and is not a normative part of this standard. The committee recognizes that suppliers and users will need some period of time, after the approval date on the title page of this document, to develop new designs, or modify existing designs or manufacturing processes in order to incorporate the new or revised requirements of this standard into their product development or production system.

The committee recommends that suppliers complete and implement design changes for new packaging and processing machinery within 6 months of the publication of this standard.

The committee also recommends that users confirm that packaging and processing machinery has acceptable risk within 6 months of the publication date of this standard. If the risk assessment process shows that modification(s) is necessary, refer to the requirements of this standard to implement risk reduction measures for appropriate risk reduction.
PMMI B155.1 Standard Committee Members

Chair
John Uber
Mettler Toledo

Vice Chair
Jerry Barnes
BABBCO

Secretary
Fred Hayes
PMMI The Association for Packaging and Processing Technologies

Delegates
Steve Blackowiak Buhler Group
Stanford Brubaker Liberty Mutual Insurance
Tim Caudle Sealed Air
Randall Cotton Big Heart Pet Brands
Eric Cummings Ross Controls (National Fluid Power Association)
Danny Deighton Eli Lilly
Sonny Dela Nestle USA
Raad Asmaro FANUC Robotics America, Corp
David Felinski B11 Standards Inc
Lawrence Halprin Keller and Heckman LLP
Joseph Kirby Intelligrated
Karen Larue Procter & Gamble
Larry Luciano Luciano Packaging Technologies (IOPP)
Bruce Main design safety engineering inc
Carla Silver Merck
Wayne Solberg Rockwell Automation
Pete Squires Schneider Packaging Equipment
Michael Steele R.A Jones
Matt Swanson Campbell Soup
Alex Vigdorovich MGS Machine Corporation
Robert Wittnebel Krones Inc

Alternates
Bill Buck Schneider Packaging Equipment
Doris Mayer Krones Inc
John Yacoub Mettler Toledo
Denise Rockhil National Fluid Power Association (NFPA)
Mark Lewandowski Procter & Gamble
Scott Bradley Nestle
Eric Ney Big Heart Pet Brands
1 Scope and Purpose

1.1 Scope
This standard specifies basic terminology, principles and a methodology for achieving safety in the design and the use of machinery. It specifies principles of the iterative process of risk assessment and risk reduction to help designers, integrators and users of machinery in achieving this objective. These principles are based on knowledge and experience of the design, use, incidents, accidents and risks associated with machinery. Procedures are described for identifying hazards and estimating and evaluating risks during relevant phases of the machine life cycle, and for the elimination of hazards or the provision of sufficient risk reduction. Guidance is given regarding the documentation and verification of the risk assessment process.

Informative Note: As used in this standard, ‘machinery’ includes both packaging and processing machinery as defined in clause 3.

The requirements of this standard apply to new, modified or rebuilt industrial and commercial:

- processing machinery used to produce food, beverage and pharmaceutical products;
- packaging machinery that performs packaging functions for primary, secondary, and tertiary (transport/distribution) packaging;
- coordination of the packaging functions that take place on the production line; and
- packaging-related converting machinery.

The standard does not include packaging or processing machinery used by retail consumers.

1.2 Purpose
This standard describes procedures for identifying hazards, assessing risks, and reducing risks to an acceptable level over the life cycle of the machinery. These procedures include requirements for documenting conformance to this standard and the results of the risk assessment process.

Informative Note: See clause 6 for additional information on the risk assessment process.

Deviations from the requirements of this standard shall be based on a documented risk assessment demonstrating acceptable risk. The requirements of this standard shall not inhibit innovation provided acceptable risk is achieved.

2 Normative References
The following standards contain provisions which constitute additional requirements of this American National Standard and are incorporated into this standard by reference. 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 editions of the standards indicated below.

Informative Note: For additional information see Annexes H, K, L, M and N.

ANSI B11.19-2010 Performance Criteria for Safeguarding
NFPA 70-2014 National Electrical Code
NFPA 79-2015 Electrical Standard for Industrial Machinery
ANSI Z136.1-2014 Standard for Safe Use of Lasers
ANSI A1264.1-2007 Safety Requirements for Industrial Fixed Stairs, Floor and Wall Openings and Industrial Railings and Toe Boards
ANSI A14.3-2008 Safety Requirements for Fixed Ladders
ANSI Z535.4-2011 American National Standard for Product Safety Signs and Labels
ANSI Z535.6-2011 Product Safety Information in Product Manuals, Instructions and Other Collateral Materials
ANSI/ASSE Z244.1-2016 The Control of Hazardous Energy – Lockout, Tagout and Alternative Methods