

ANSI B11.1–2009

American National Standard for Machines

Safety Requirements for Mechanical Power Presses

Secretariat and Standards Developing Organization:

The Association For Manufacturing Technology
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Approved: April 7, 2009
by the American National Standards Institute



AMERICAN NATIONAL STANDARDS

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Foreword

(This foreword is not part of the requirements of American National Standard B11.1–2009)

The objective of this standard is to eliminate injuries to personnel from mechanical power press production systems by establishing requirements for the construction of mechanical power presses, and requirements for the set-up, operation and maintenance of the production systems in which presses are used. This standard should be used by builders, users, modifiers, and rebuilders, as well as by the appropriate authority having jurisdiction. Responsibilities have been assigned to the supplier (i.e., the manufacturer, the rebuilder and the modifier), the user, and the user personnel to implement this standard (see flowchart in the Introduction).

The words "safe" and "safety" are not absolutes. While the goal of this standard is to eliminate injuries, it is recognized that risk cannot be reduced to zero in any human activity. This standard is not intended to replace good judgment and personal responsibility. Operator skill, attitude, training, and experience are safety factors that must be considered by the user.

The safeguarding of press production systems in stamping operations is complicated by the wide variety of operations and operating conditions, due to the variations in size, speed and type of press used; the size, thickness and kind of pieces to be worked; the design and construction of dies; the required accuracy of the finished work; the skill of operators; the length of run; and the method of feeding, including part and scrap removal. Because of these varying factors in the operations and in the workplace, a wide variety of point-of-operation safeguarding methods (guards and protective devices) has been covered in this standard.

Point-of-operation safeguarding, the single most important factor in the elimination of injuries from presses, can only be determined by the user. A production system consists of the press as one component, dies (tooling) as another component, feeding methods (including part or scrap removal) as a third component, and point-of-operation safeguarding as the fourth component. The vital fourth component can be evaluated for effectiveness only after the first three components and operator involvements are known. Since this information is known only by the user, the responsibility for conformance with clause 8 has been assigned accordingly. The assignment of responsibility of the user for proper point-of-operation safeguarding has existed since the first B11.1 standard, approved in 1922.

Mechanical power presses and associated equipment technologies are continuously evolving. This standard reflects the most commonly used and time-tested state of the art at the time of its approval. The inclusion or omission of language relative to any evolving technology, either in the requirements or explanatory area of this standard, in no way infers acceptance or rejection of such technologies.

HISTORY

The project on Safety Standard for Power Presses, B11, was initiated under the procedures of the American Engineering Standards Committee (which became the American Standards Association, the United States of America Standards Institute, and in 1969 the American National Standards Institute), with the National Safety Council as sponsor. The first standard, bearing the title *Safety Code for Power Presses and Foot and Hand Presses*, was developed by Sectional Committee B11 and was approved on November 13, 1922. Only two purposes of that "code" were listed. The first and primary use was for state industrial commissions in developing their workplace codes. The second use was as an operating guide for users operating press production systems. Revisions of the standard were issued on November 11, 1926; October 22, 1937; January 12, 1948; January 19, 1960; February 17, 1971; January 22, 1982; April 4, 1988; and November 6, 2001.

The philosophy underlying the 1971 standard was hands-out-of-die operation (HOOD). After the adoption of the 1971 standard by ANSI and its reference by OSHA regulations, many users documented an absolute inability to meet the hands-out-of-die objective. Accordingly, in 1974 OSHA modified the HOOD requirement, and subsequent versions of the ANSI B11.1 standard incorporate that modification. However, HOOD should be considered in the application of the press production system, with appropriate

safeguarding, to enhance the safe operation of mechanical power presses.

In this 2009 edition of the standard, the B11.1 Subcommittee reviewed the B11.1 2001 standard to incorporate current mechanical power press safety practice, and to increase explanatory material related to the standard. New areas that have been added include requirements for risk assessment and risk reduction for increasingly complex automatic press production systems that may include tandem and transfer presses with use of perimeter safeguarding. In addition, new pressroom technology including direct drive servo presses has been incorporated. The current edition also integrates NFPA 79 requirements directly within the standard, including two hand control and stop function requirements, moving parts (other than point-of-operation) and safeguarding supplier responsibilities. Finally, the current edition of ANSI B11.1 provided new requirements for slide locks, moving bolsters and scrap chutes.

Subsequent to beginning the revision of B11.1, the ANSI B11 Accredited Standards Committee (ASC) authorized creation of an overarching (“A-level”) standard dealing with general safety requirements for the entire series of machines. ANSI B11 was approved in August 2008. Since B11.1 was already well into its revision at that point, the B11 ASC agreed to allow this current (2009) version of the ANSI B11.1 standard to proceed absent integration with the ANSI B11 “A-level” standard.

Effective Date

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

The subcommittee recommends that suppliers complete and implement design changes for new machine tools and machine tool systems within 30 months of the approval of this standard.

The subcommittee recommends that users should evaluate whether an existing machine tool and machine tool system has acceptable risk within 30 months of the approval date of this standard using generally recognized risk assessment methods. If the risk assessment shows that modification(s) is necessary, refer to the requirements of this standard or the machine specific standard to implement protective measures for appropriate risk reduction.

Inquiries with respect to interpretations of this standard, and suggestions for its improvement, are welcomed and should be sent to the Association For Manufacturing Technology, 7901 Westpark Drive, McLean, Virginia 22102–4269, Attention: B11 Secretariat.

This standard was processed and submitted for ANSI approval by the B11 Accredited Standards Committee on Safety Standards for Machines. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time this standard was approved as an American National Standard, the ANSI B11 Accredited Standards Committee was composed of the following member organizations:

John W. Russell, PE, CSP, Chairman
Gary D. Kopps, Vice-Chairman
David A. Felinski, Secretary

Organizations Represented

Aerospace Industries Association of America
Aluminum Extruders Council
American Society of Safety Engineers
Association For Manufacturing Technology

Name of Representative

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The Boeing Company	Don R. Nelson	Joe Oberuc
Canadian Standards Association	Elizabeth Rankin	Tom Eastwood
Can Manufacturers Institute	Geoff Cullen	Jenny Day
Deere and Company	Gary D. Kopps	Scott Fowler
General Motors Corporation	Michael Douglas	Michael Taubitz
Metal Building Manufacturers Association	Charles M. Stockinger	Charles E. Praeger
Metal Powder Industries Federation	Dennis R. Cloutier, CSP	Teresa F. Stillman
National Institute for Occupational Safety and Health	Richard S. Current, PE	James R. Harris, PE
Occupational Safety & Health Administration	Kenneth Stevanus	Robert Bell
Packaging Machinery Manufacturers Institute	Charles F. Hayes	Maria Ferrante
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Precision Metalforming Association	William E. Gaskin	James G. Barrett, PhD
		Christen A. Carmigiano
Presence Sensing Device Manufacturers Association	James V. Kirton	Michael S. Carlson
Rockwell Automation	Michael B. Miller	Steve Dukich
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OMRON Scientific Technologies Incorporated	Frank Webster	Christopher Soranno
Sheet Metal & Air Conditioning Contractors Natl. Assn.	Michael McCullion	Roy Brown
System Safety Society	John Etherton; PhD, PE	Rod Simmons, PhD
Tooling and Manufacturing Association	Daniel Kiraly	
Toyota Motor Manufacturing North America	Barry Boggs	Todd Mills

At the time this standard was approved, the ANSI **B11.1 Subcommittee** had the following members who participated in the development of this revision:

Dennis Cloutier, Co-Chairman	Cloutier Consulting
Russell Bensman, Co-Chairman	The Minster Machine Company
Cindy Haas, B11.1 Secretary	The Association For Manufacturing Technology
James G. Barrett, PhD	Link Systems
Kelyn Brown	Dana Holding Corporation.
Stanford A. Brubaker	Liberty Mutual Insurance Group
Scott Buchanan	Toyota Engineering and Manufacturing America
Lee Burk	Pilz Automation Safety L.P.
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Wayne Casebolt	General Motors Corporation
Gary Dunn	Dunn Consulting
Dennis Ebens	Danray Products LLC
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Jim Van Kessel, P.Eng.	JVK Industrial Automation Inc.

Walter Veugen
Ron Walters
Robert Weaver

Veugen Integrated Technologies Ltd.
Chrysler Corporation
Schuler Incorporated

Explanation of the format, and ANSI B11 conventions

The standard uses a two-column format to provide supporting information for requirements. The material in the left column is confined to “Standards Requirements” only, and is so captioned. The right column, captioned “Explanatory Information” contains information that the writing Subcommittee believed would help to clarify the requirements contained in the standard. This column should not be construed as being a part of the requirements of this American National Standard.

As in all American National Standards, the term “SHALL” denotes a requirement that is to be strictly followed in order to conform to this standard; no deviation is permitted. The term “SHOULD” denotes a recommendation, a practice or condition among several alternatives, or a preferred method or course of action.

Similarly, the term “CAN” denotes a possibility, ability or capability, whether physical or causal, and the term “MAY” denotes a permissible course of action within the limits of the standard.

B11 conventions: Operating rules (safe practices) are not included in either column of this standard unless they are of such nature as to be vital safety requirements, equal in weight to other requirements, or guides to assist in conformance with the standard. The B11 standards generally use the term “OR” as an inclusive disjunction, meaning *one or the other or both*, but on occasion will use the term “and/or” to emphasize the fact that both are fully intended in cases where the Subcommittee believed it was imperative to make that clear. A distinction between the terms “*individual*” and “*personnel*” is drawn. Individual includes personnel (employees, subcontractors, consultants, or other contract workers under the indirect control of the supplier or user) but also encompasses persons who are not under the direct or indirect control of the supplier or user (e.g., visitors, vendors, etc.).

Suggestions for improvement of this standard will be welcome. They should be sent to AMT-The Association For Manufacturing Technology, 7901 Westpark Drive, McLean, VA 22102 - Attention: B11 Secretariat.

Introduction

The requirements of this ANSI standard 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. Figure 1 provides an overview of this standard and in particular the responsibilities of and requirements for the supplier and user, including the user personnel. Numbers in parentheses denote the particular clause or subclause of the standard.

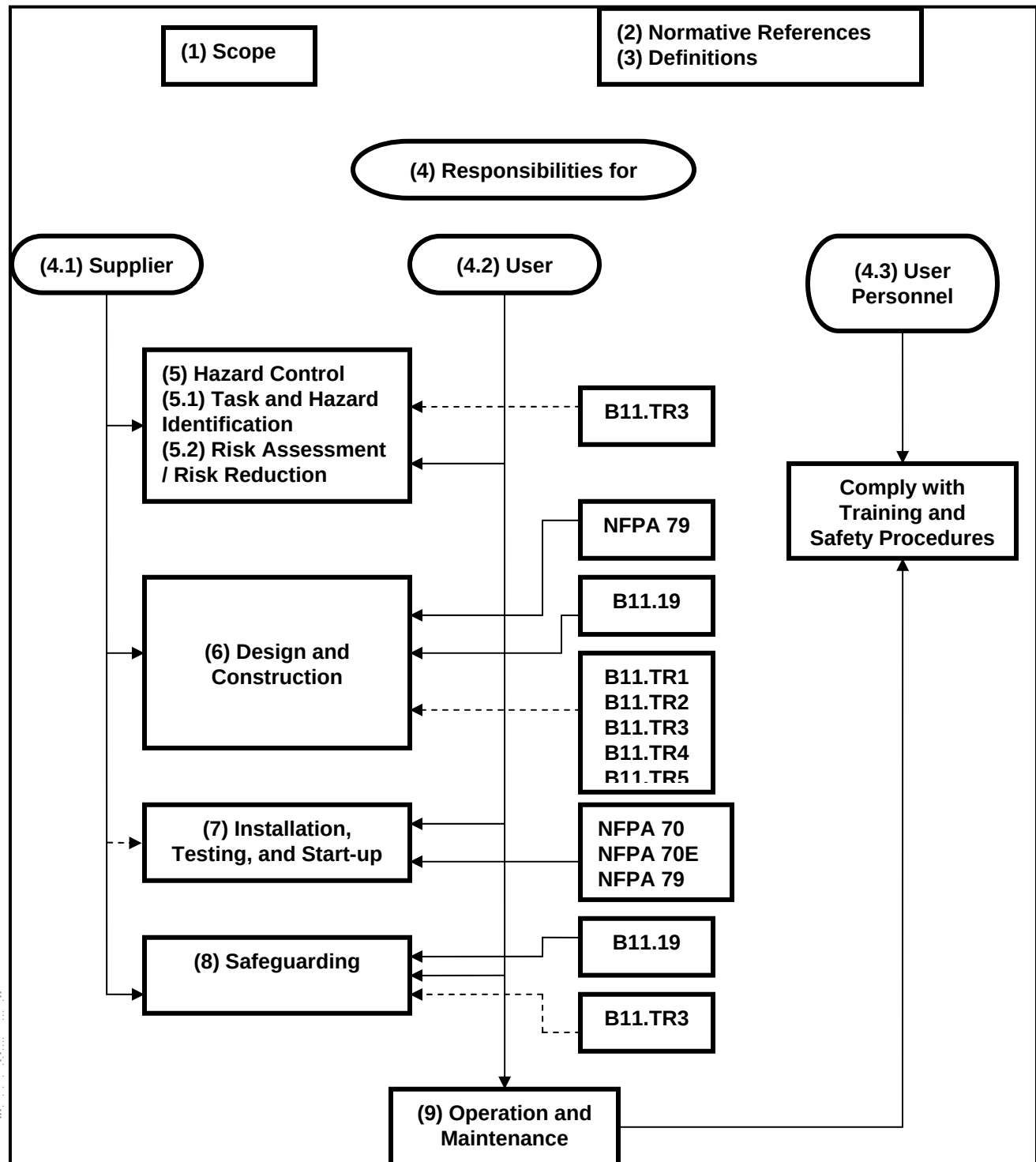


Figure 1 – General layout of the standard showing the various responsibilities

Notes for Figure 1:

- 1) Scope – Provides the boundaries or limits of the standard (i.e., what is/is not included).
- 2) Normative references – Other standards which in whole or in part provide additional requirements when referenced in the normative text (i.e., left-hand column of clauses 4 – 9) of this standard.
- 3) Definitions – Terms used in this standard, together with their definitions (terms used in the same context as are generally understood and commonly used in everyday English are not defined).
- 4) Responsibility – The general responsibilities of the supplier (builder), user, and the user personnel are listed in clause 4 together with which of the remaining clauses they have primary responsibility.
- 5) Hazard control (task/hazard identification & risk assessment/risk reduction) – Although clause 5 is intended to require a shared responsibility between supplier and user, the requirements of this clause may fall primarily on either entity (see B11.TR3 for further explanation of hazard/task identification and risk assessment/risk reduction).
- 6) Design and construction – It is assumed that the supplier will be responsible for the requirements of clause 6 with the understanding that the user may add to or modify these requirements through the purchase agreement.
- 7) Installation, testing and start-up – Although the requirements of clause 7 are predominantly the responsibility of the user, the supplier will normally provide assistance either directly (providing personnel) or indirectly (instruction materials).
- 8) Safeguarding – This is normally a shared responsibility but often, either the supplier or the user will provide the requirements of clause 8.
- 9) Operation and maintenance – The user is normally responsible for the requirements of clause 9 with possible assistance from the supplier for training.

A solid line between a block showing reference standard(s) and a block showing a normative clause denotes part of the requirements. A dashed line denotes an informative reference.

American National Standard for Machine Tools - Safety Requirements for Mechanical Power Presses

STANDARDS REQUIREMENTS

1 Scope

The requirements of this standard apply only to those mechanically powered machines, commonly referred to as mechanical power presses, which transmit force mechanically to cut, form, or assemble metal or other materials by means of tools or dies attached to or operated by slides.

1.1 Inclusions

The requirements of this standard shall apply to:

- Mechanical power presses (as above);
- transfer presses;
- tandem line presses;
- presses used in production cells;
- automatically fed presses;
- manually fed presses.

1.2 Exclusions

Excluded from the requirements of this standard are the following:

- a) bulldozer
- b) cold header and cold former
- c) eyelet machine
- d) forging presses and hammer

EXPLANATORY INFORMATION

(Not part of the requirements of this American National Standard for Machine Tools – Safety requirements for Mechanical Power Presses - ANSI B11.1 – 2009)

E1

See Annex A, Figures A.1 and A.2.

The requirements of this standard are aimed at eliminating injuries to operator, maintenance, and set-up personnel, while working on or adjacent to a mechanical power press.

This standard does not establish requirements for personal protective equipment that may be needed for specific operations.

E1.1

See also, Annex A, Figures A.18 and A.20.
See also, Annex A, Figure A.19.

E1.2

These exclusions exempt machines that normally do not have the characteristics of mechanical power presses, or are addressed by specific standards. If a machine is not addressed by a specific B11 standard, see ANSI B11 (*General Safety Requirements*) for guidance.

a) A slow-acting horizontal mechanical press with a large bed used for bending, straightening, etc. The work, which is done between dies, can be either hot or cold. The machine is closely allied to a forging machine.

b) Cold headers and cold formers perform many operations such as shearing, heading, upsetting, extruding, trimming, forming, cold working or warm forming material by means of tools and dies. See ANSI B11.7.

c) An automatic multiple station transfer feed machine for making drawn stampings by use of cam-driven adjustable plungers, acting from above and below the workpiece, and to which individual tool elements are attached.

d) See ANSI B24.1.

STANDARD REQUIREMENTS	EXPLANATORY INFORMATION
e) high-energy-rate press	e) A class of press equipment wherein high ram velocities resulting from the sudden release of a compressed gas against a free piston impart impact energy to the workpiece.
f) hot-bending and hot-metal press	f) A press used to form heated metal and that does not include forging operations
g) hydraulic power press	g) Hydraulic power presses transmit force hydraulically to cut, form or assemble metal or other materials by means of tools or dies attached to or operated by slides. See ANSI B11.2.
h) iron worker and detail punch	h) These include combination multi-purpose machines that punch, shear, notch, cope and form metals or other materials. See ANSI B11.5.
i) metal shear	i) These include mechanically, hydraulically, hydro-mechanically, pneumatically or manually powered shears used to cut material by a shearing action, and which utilize a fixed blade(s) and non-rotary moving blade(s). See ANSI B11.4.
j) pneumatic power press	j) An air- or gas-powered machine that shears, punches, forms, draws, or assembles metal by means of dies actuated by slide(s). See ANSI B11.2.
k) powdered-metal press	k) These include mechanically or hydraulically powered machines that are designed, modified, or converted for the compressing of metallic or nonmetallic powders. See ANSI B11.16.
l) press welder	l) A pneumatically powered gap-frame type of machine that positions parts for assembling by means of resistance welding. Welding fixtures are mounted in the machine with the stationary portion bolted to the frame and the movable portion bolted to the platen.
m) power press brake	m) Press brakes are designed and constructed for the specific purpose of bending metal. To achieve this purpose, the press brake is provided with • a plate-type ram and a plate-type bed with standard provisions for attaching standardized (general purpose) press brake tooling, and • means for operator control of die-closing (cycle control). This machine is sometimes referred to as a "bending brake" or a "brake press." See ANSI B11.3.
n) riveting machine	n) An electrically or pneumatically powered machine specifically designed to insert and clinch fasteners, commonly called rivets.
o) turret and plate-punching machine	o) A semiautomatic or automatic NC or CNC punch press that holds punches and dies in a movable turret so that a variety of hole shapes and sizes can be punched without having to manually change the tools.

STANDARD REQUIREMENTS

p) wire termination machine

q) welding press

EXPLANATORY INFORMATION

p) Generally, a bench mounted semiautomatic machine tool that mechanically makes efficient electrical interconnections. These fall into one of two general categories:

- Crimping machines that mechanically attach a solderless terminal to an electrical wire permanently by the proper application of forces through the correct tooling for the wire terminal and wire being used. This process is generally referred to as "crimping."
- Insertion machines that can apply wire, pins, or other types of products into solderless terminals or circuit boards. In most cases, an interference fit is required while in other cases, some clearance is maintained when solder-flow techniques are applied later. This process is generally referred to as "insertion."

q) A mechanically powered machine that positions parts for assembling by means of resistance welding. The machine consists of a frame with an ascending platen. Welding fixtures are mounted in the press, with the upper portion bolted to a stationary-mounting surface which is part of the frame, and the lower portion bolted to the face of the platen.

Machines are usually "two post" or "four post," based on the number of members that connect the machine base to the superstructure. The drive is arranged to stop at the top of the platen cycle for the welding process, and at the bottom of the cycle for the unloading and loading process.

STANDARD REQUIREMENTS

EXPLANATORY INFORMATION

2 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements subject to this American National Standard should apply the most recent editions of the normative documents listed below.

This standard is intended to be used in conjunction with the following American National Standards:

ANSI / ASSE Z244.1–2003 (R2008), *Control of hazardous energy – Lockout/tagout and alternative methods*

ANSI B11.19-2003, *Performance Criteria for Safeguarding*.

ANSI B15.1-2006, *Safety Standard for Mechanical Power Transmission Apparatus*.

ANSI / ASME Boiler and Pressure Vessel Code, 2001. (Division 1, Section VIII)

ANSI / IESNA-RP-7-2001, *Industrial Lighting*.

NFPA 70–2008, *The National Electrical Code*

NFPA 70E-2004, *Electrical Safety Requirements for Employee Workplaces*.

NFPA 79-2007, *Electrical Standard for Industrial Machinery*.

NFPA T2.25.1-R2-2005 Pneumatic Fluid Power Systems.

NFPA T2.24.1-R1 Hydraulic Fluid Power Systems.

2.1 Informative References

The following documents to the right are not normative references, but may be helpful in conforming to the requirements of this standard.

E2 Informative references

A reaffirmation of ASME B15.1-2000.

NOTE: At the time of publication of ANSI B11.1, the B11 Accredited Standards Committee had agreed to subsume the requirements in B15.1 into both ANSI B11.19 (above) and ANSI B11 (below). Both standards are under active revision and are both expected to be approved as revised American National Standards in 2010.

E2.1

STANDARD REQUIREMENTS

EXPLANATORY INFORMATION

29 CFR 1910.147, *Control of hazardous energy (lockout / tagout)* (For more information, go to www.osha.gov)

29 CFR 1910.333(b), *Selection and Use of Electrical Work Practices* (For more information, go to www.osha.gov)

ANSI / ASME B20.1–2006, *Safety Standard for Conveyors and Related Equipment*

ANSI B24.1–1985 (R1991), *Safety Requirements for Forging Machinery*

ANSI B11-2008, *General Safety Requirements Common to ANSI B11 Machines*

ANSI B11.2–1995 (R2005), *Machine Tools—Hydraulic Presses—Safety Requirements for Construction, Care & Use*

ANSI B11.3–2002, *Safety Requirements for Press Brakes*

ANSI B11.4–2003, *Safety Requirements for Shears*

ANSI B11.5–1988 (R2002), *Machine Tools — Iron Workers — Safety Requirements for Construction, Care and Use*

ANSI B11.7–1995 (R2005), *Machine Tools—Cold Headers and Cold Formed—Safety Requirements for Construction, Care and Use*

ANSI B11.TR1–2004, *Ergonomic Guidelines for the Design, Installation and Use of Machine Tools.*

ANSI B11.TR3–2000, *Risk Assessment and Risk Reduction – A guide to estimate, evaluate and reduce risks associated with machine tools.*

NOTE: At the time of publication of ANSI B11.1, the B11 Accredited Standards Committee had agreed to subsume the guidance contained in B11.TR3 and place it into ANSI B11 (above). This standard is under active revision and is expected to be approved as a revised American National Standard in 2010.

ANSI B11.TR4–2004, *Selection of Programmable Electronic Systems (PES/PLC) for Machine Tools*

NFPA T2.24.1-R1-2005 *Hydraulic Fluid Power Systems*

NFPA T2.25.1-R2-2005 *Pneumatic Fluid Power Systems*

ANSI Z535.1–2006, *Safety Colors*

ANSI Z535.2–2007, *Environmental and Facility Safety Signs*

ANSI Z535.3–2007, *Criteria for Safety Symbols*

ANSI Z535.4–2007, *Product Safety Signs and Labels*

ANSI Z535.5–2007, *Accident Prevention Tags and Labels*

ANSI Z535.6–2006, *Product Safety Information on Product Manuals, Instructions, etc.*

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3 Definitions

For the purposes of this standard, the following definitions shall apply.

3.1 access control: A means of restricting the access to various control functions or parameters to designated authorized individuals.

3.2 actuating means [actuating control]: Operator control used to initiate or control press motion.

3.3 adjustable barrier guard: A guard with provisions for adjustment to accommodate various jobs or tooling set-ups.

3.4 antirepeat: A function of the control system or device that limits the machine to a single cycle. Antirepeat requires the release of all actuating controls before another cycle can be initiated.

3.5 automatic cycling: The intended cycles or continued cycling of the press that does not require action by the operator to occur.

3.6 automatic single cycle: An operating mode where the press control system is given single-cycle actuating signals by an automatic feeding mechanism or other auxiliary equipment without action by an operator after initial start.

3.7 barrier: A device or object that provides a physical restriction from a hazard.

3.7.1 awareness barrier: An attachment that warns personnel of an approaching or present hazard by physical contact.

3.8 bed: The stationary member of the press that supports the dies and other associated equipment.

3.9 bolster: A plate(s), attached to the press bed, having T-slots, tapped holes or other means for attaching die components.

E3.1 See also, **supervisory control** (3.112) and 9.7.

E3.2 See also *foot control; foot pedal; two-hand control; two-hand trip; one-hand control; one-hand trip; PSD and stop control.*

E3.3 See Annex A, Figure A.13 for an example of an adjustable barrier guard.

E3.4 Antirepeat is the control equivalent of a single cycle mechanism, with the additional requirement of the release of all actuating controls to enable a new cycle. The function of antirepeat is to prevent the successive cycles that could occur if the antirepeat control did not exist.

E3.6 Automatic single cycle does not include the actuation of a cycle with presence-sensing device initiation (PSDI).

Automatic single cycle is often used when automatic feeding or parts removal equipment cannot operate fast enough to insert or remove material with the press cycling continuously. See also, 6.3.4.3.7 and 6.4.3.7.

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3.10 brake: A mechanism for stopping, slowing or preventing motion.

3.10.1 brake, holding: A friction brake that is used in Servo Press systems to hold slide and attachment(s) at any position of the stroke with the servo drive system de-energized. May also be used in conjunction with the servo drive system during an "immediate stop" to cease slide motion. (See 6.1.3(2))

3.11 brake monitor: See *stopping-performance monitor*.

3.12 break: The term "break" when used in conjunction with PSDI operations refers to one intrusion into, and subsequent withdrawal from the presence-sensing device sensing field.

3.13 clutch: An assembly that, when engaged, transmits torque to impart motion from a driving member to a driven member.

3.14 concurrent: Acting in conjunction; used to describe a situation where two or more controls exist in an operated condition at the same time.

3.15 continuous cycling: Un-interrupted multiple cycles of the slide without intervening stops at the end of individual cycles.

3.15.1 continuous mode: An operating mode where the press cycles continuously, initiated by an operator, and maintained by the press control system, without further operator interaction.

3.15.2 continuous on demand mode: An operating mode where the press control system provides intermittent periods of continuous cycling automatically actuated by demand signals from other machinery or equipment used in association with the press in the production process.

3.15.3 continuous mode - operator-maintained: An operating mode where the slide cycles continuously as long as the operator(s) maintains actuation of the operator(s) control.

3.16 control reliability: The capability of the press control system, the safeguarding, other control components and related interfacing to achieve a safe state in the event of a failure within their safety related functions.

E3.10 The brake may be a constant-drag type (typical on a full-revolution clutch press), or it may be a type disengaged while the clutch is engaged (most typical with a part-revolution clutch press). It may be a separate unit, or it may be a unit incorporated in combination with the clutch.

E3.12 Single break and double break refer to either one intrusion and withdrawal from the PSD sensing field, or two intrusions and withdrawals after which a cycle is initiated. See also, *presence-sensing device initiation*.

E3.13 See also, *full revolution clutch; part revolution clutch*.

E3.14 The use of the word "concurrent" means the machine motion will be activated after each control is held in the operated position. The use of the term "concurrent" is intended to exclude any inference that a simultaneous moment of actuation must exist between the operation of the individual two-hand controls.

E3.15.2 This mode is often used in cell production systems when a machine in the cell uses parts in its operation that are produced by the press, but the machine cannot operate fast enough to use the number of parts produced if the press is run full time in the "continuous" mode.

E3.16 See also, *safety-related function*.

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3.17 control system: The sensors, manual input and mode selection elements, interlocking and decision-making circuitry, and output elements of the press-operating devices and mechanisms.

3.18 counterbalance: A means provided to balance the reciprocating weight of the slide, drive members and slide attachments.

3.19 cycle: Complete movement of the slide from the initial start position back to the same start position, which may include feeding and removal of the material or workpiece.

3.20 cycling selector: See *mode selector*.

3.21 design: To develop and plan the press and/or press production system and its components to meet the intended purpose and function.

3.22 device: A piece of equipment or a mechanism designed to serve a special purpose or perform a special function.

3.23 die(s): The tooling used in a press for shearing, punching, forming, drawing, or assembling metal or other material.

3.24 die cushion: An accessory used in some press operations to aid in the forming or release of the workpiece.

3.25 die-enclosure guard: A guard attached to the die shoe or stripper in a fixed position.

3.26 die set: A tool holder consisting of a lower shoe and an upper shoe or punch holder, held in alignment by guideposts and bushings.

E3.19 Historically, the term *stroke* has come to be used interchangeably with the term *cycle* in the industry. This standard uses the term “cycle” throughout the document.

E3.21 The supplier and the user both perform the design function. Typically, the supplier’s role is primarily with the design of the power press itself, and the user’s role is primarily concerned with the design of the press production system.

E3.23 Quite commonly, the plural “dies” is used to describe the complete die, consisting of an upper element and a lower element. Thus, the expression “dies close” has the same meaning as “die closes.”

E3.24 The pressure medium may be rubber, spring or fluid, with air (pneumatic) cushions being the most common. Some uses of die cushions are:

- blanking;
- drawing or redrawing;
- maintaining uniform pressure on a part;
- knocking out or stripping.

Although usually mounted within the press bed under the bolster, die cushions are sometimes within (or within an attachment to) the slide.

E3.25 See Annex A, Figure A.10.

E3.26 Means of maintaining parallelism and alignment of the upper and lower die shoes include the following:

- a) guideposts and bushings that are usually an integral part of the die set;
- b) guideposts and bushings, supplemented by heel blocks to contain lateral forces;
- c) the press gibbing, or other means of guiding the press slide.

See Annex A, Figure A.7.

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3.27 die setting: The process of installing or removing dies and the process of adjusting the dies, other tooling or equipment and the safeguarding.

3.28 die shoe: A plate or block upon which the die members are mounted.

3.29 die shutheight: An actual or design dimension between the mounting surfaces of a die.

3.30 die tryout: The process of functionally testing and performing final adjustments or alterations to the die assembly.

3.31 direct drive: A type of driving arrangement that does not use a clutch.

3.32 drive: A source of mechanical force and energy to impart press motion.

3.33 employee: See *personnel*.

3.34 employer: See *user*.

3.35 ensure: To establish, maintain and monitor an effective program, procedure or system to implement the requirements of this standard.

3.36 face of slide: The surface of the slide to which the punch or upper die is generally attached.

3.37 feeding: The process of placing the material or workpiece into the press or removing the material or workpiece from the press.

3.38 fixed barrier guard: A guard affixed to the frame, bolster or other surface in such a manner so as to enclose all or part of the point-of-operation or other hazard area.

E3.28 A die shoe functions primarily as a base for the complete die assembly and, if used, is bolted or clamped to the bolster plate or the face of the slide. The individual die shoes are often referred to as the lower shoe and the upper shoe or punch holder.

E3.29 Maximum die shutheight to which a die can be designed is the press shutheight minus the bolster thickness.

E3.30 Die tryout differs from die setting in that tryout will usually involve more significant alterations to the die than the routine adjustments associated with die setting. Die tryout occurs in a number of different situations, some of which are:

- a) as the final construction phase of the die;
- b) either in the die builder's (vendor's) plant and press or in the user's plant in the same press to be used for production;
- c) in the user's plant in a press other than that originally intended for production.

E3.31 This standard has been revised to recognize the recent technology of the use of servo systems to directly drive a press.

E3.38 See Figure A.11.

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3.39 fixed blanking: A term used with optical–electrical presence-sensing devices that use multiple sensing channels to describe the de-selection of one or more channels over a fixed area of the sensing field to allow stationary objects or tooling to protrude through the deselected portion of the sensing field and not create a stop condition.

E3.39 Supplemental guarding or additional safety distance may be required to compensate for object sensitivity modifications created by blanking.

3.40 floating blanking: Selection which requires two or more channels of the sensing field of an optical–electrical presence-sensing device to be blocked to produce a stop signal.

E3.40 Floating blanking results in increased minimum object sensitivity and may require additional safety distance to compensate for the increased minimum object sensitivity. Some suppliers refer to this term as *reduced resolution*.

3.41 fluid: Any liquid or gas.

3.42 foot control: A foot-operated actuating control.

E3.42 See also, **actuating control; foot pedal** and Annex A, Figure A.8.

3.43 foot pedal: A foot-operated mechanism used as an actuating control for a full–revolution clutch press.

E3.43 See also, **actuating control; foot control** and Annex A, Figure A.9.

3.44 full revolution clutch: A type of clutch that, when engaged, cannot be disengaged until the press has completed a single cycle.

E3.44 Positive-type clutches are almost always full-revolution types. A tripping device releases spring pressure to move engaging members that by nature require a full revolution before they can be disengaged, generally by a throw-out cam arrangement that is part of the clutch mechanism.

3.45 guard: A barrier that prevents entry into the point-of-operation or other hazard area.

E3.45 In this standard, the use of the term "guard" is reserved exclusively for referring to barriers or enclosures designed for safeguarding at the point-of-operation. See also, **adjustable barrier guard; die enclosure guard; fixed barrier guard**, and **interlocked barrier guard**.

3.46 guide post: A pin and bushing assembly used to maintain the alignment of the dies.

E3.46 Guideposts are usually an integral part of the die set.

3.47 hand control: A hand operated actuating control.

E3.47 See also, **actuating control**.

3.48 hazard: A potential source of harm.

3.49 hazard area: An area or space that poses an immediate or impending physical hazard.

3.50 hazardous motion: Any motion of equipment that poses a hazard.

3.51 helper: An individual who assists in the operation, maintenance or repair of the press.

3.52 hold out device: See **restraint device**.

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3.53 inch: The die-setting or maintenance mode wherein an intermittent motion is imparted to the slide by momentary engagement of the clutch/brake (for part-revolution presses) or by momentary operation of the drive motor (for direct-drive presses).

3.54 individual: A person, including personnel, who may or may not be under the direct control of the supplier or user.

3.55 integrator: Any supplier that designs, provides, manufactures or assembles a press, its associated equipment, the safeguarding, and the control system into a press production system.

3.56 interleaving: A condition wherein the spacing between the wire coils of a spring is greater than the diameter of the spring wire thereby allowing one coil spring, or a portion thereof, to thread into another coil spring, or portion thereof.

3.57 interlock: An arrangement in which the operation of one control or mechanism allows or prevents machine motion.

3.58 interlocked barrier guard: A barrier, or section of a barrier, interfaced with the press control system in such a manner as to prevent access to the point-of-operation or other hazard during normal operation cycling.

3.59 jog: Die setting or maintenance mode wherein an intermittent motion is imparted to the slide by momentary operation of the drive motor.

3.60 manual: Operation of the press that requires the operator to initiate and maintain motion of the press during the cycle, or portion of the cycle, by use of the actuating control.

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E3.53 INCH is sometimes called JOG, but JOG has a different meaning for the purposes of this standard, based on the method of imparting motion to the slide. With INCH, motion is imparted by momentary actuation of the clutch; with JOG, motion is imparted by momentary actuation of the drive motor. See also, E6.4.3.2.

E3.54 See also, *personnel*.

E3.58 The interlocked barrier guard has a hinged or movable section (or the complete barrier is movable on tracks) utilizing an interlock switch that is closed when the guard is in its closed position. The hinged or movable section is normally manually powered, although some large guards may use a pneumatic cylinder, which in turn is manually controlled with a mode selector switch, for example.

E3.59 Based on thermal capacities, JOG places much more severe conditions on the drive motor and drive components than normal operational conditions.

JOG is often used on full-revolution clutch presses where momentary operation of the clutch cannot be achieved. JOG is initiated after the clutch is engaged with the flywheel at rest.

Some servo-driven direct drive presses provide what is termed an INCH mode that follows the programmed cycle motion path for a job and a JOG mode that uses the full stroke motion path of the press. See also, *inch*.

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3.61 manufacturer: Any entity that designs, manufactures or assembles presses or press production systems.

E3.61 See also, *supplier*.

3.62 mechanism: An arrangement of components to accomplish a given function.

3.63 mode: A specific manner of operation of a press or press production system determined by the control system.

E3.63 See also, *mode selector*.

3.64 mode selector: One or more means used to establish the press operating mode.

E3.64 The mode selector generally includes positions for all operating modes available on a press (e.g., OFF, INCH, SINGLE CYCLE, or CONTINUOUS.).

3.65 modification: A change to the press or press production system involving the design or construction that alters its original purpose, function, capacity, operation or safeguarding requirements.

E3.65 Modification implies a change in design or construction of major components or control circuits. For the purposes of this standard, modification includes any effects that the change has on other portions of the press production system, including safeguarding, not directly a part of the modification.

3.66 modifier: Any supplier that changes the original purpose, function or capacity of the press or press production system by design or construction.

E3.66 See also, *modification; supplier, user*.

3.67 monitoring: The checking of system components to detect a failure of a component, subassembly or module that affects the performance of the safety-related functions.

3.68 movable barrier device: A safeguarding device arranged to enclose the point-of-operation before press motion can be initiated.

E3.68 There are two types of movable barrier devices

- a) The Type A movable barrier device encloses the point-of-operation until the press ceases motion and is at its initial starting position.
 - b) The Type B movable barrier device encloses the point-of-operation during the hazardous portion of the press cycle.
- See also, E8.6.6

3.69 moving bolster: A lower bolster that has the capability to move in and out of the press under power. See 3.9 Bolster.

E3.69 Typically, powered bolsters are used to move dies in and out of the press with quick change systems. Moving bolster is a general term used in this standard and refers to several specific pieces of equipment that serve this general function which can include but is not limited to:

- Cart(s)
- Plate(s)
- Carrier(s)

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3.70 muting: The automatic temporary bypassing of any safety-related function(s) of the control system or safeguarding device.

3.71 operator: Individual performing production work on the press or who controls the press.

3.72 operator control: An operator actuated pushbutton, switch, lever, hand wheel or other device that initiates, controls or stops motion of the press.

3.73 operator's (control) station: The complement of controls used by the operator to operate the press.

3.74 part revolution clutch: A type of clutch that can be engaged or disengaged during the press cycle.

3.75 personnel: Individuals who are employed by the user including contract employees from an agency or from other third parties.

3.76 pinch point: Area, excluding the point-of-operation that poses a hazard by exposure to moving parts of the press, its related machines or equipment or the materials or workpieces.

3.77 point-of-operation: Location in the press or tooling where material or the workpiece is positioned and work is performed.

3.78 presence-sensing device: A device that creates a sensing field, area or plane to detect the presence of an individual or object.

3.79 presence-sensing device initiation (PSDI): Operating mode of indirect manual initiation of a single cycle by a presence-sensing device when it senses that work motions of the operator related to feeding or removing parts are completed and all parts of the operator's body are withdrawn from the sensing field of the device.

E3.73 Typically, an operator's station consists of two-hand RUN controls with a STOP control or FOOT control. A TOP STOP control usually is provided for presses designed for CONTINUOUS operation. See also Annex A, Figures A.1 and A.2.

E3.74 Most part-revolution clutches are air-engaged mechanisms but there are also those that use hydraulic pressure or electrically produced force. See also E6.4.

E3.75 See also, *individual*.

E3.76 The term "pinch point," as used in this standard, refers only to hazards that can exist as a part of the press or its associated equipment. The term is not used to describe hazards caused by the tooling at the point-of-operation, since these hazards are a different problem and require different treatment.

E3.78 See also, Annex A, Figure A.3.

E3.79 See also, *break*.

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3.80 press production system: A mechanical power press that is equipped, and set up for production operations.

E3.80 Typically, the equipment includes a press, dies (tooling), feeding methods, all associated automation, and point-of-operation safeguarding. Parts removal or scrap removal methods (or equipment) are usually classified as a part of the feeding operation.

3.81 press shutheight: The distance from the bed surface to the slide face, with the slide at the bottom of cycle position and the slide adjustment up.

E3.81 This distance is commonly referred to as slide down, adjustment up position (SDAU). On some presses, the press shutheight is measured from the die mounting surface of the bolster to the slide face.

3.82 protective measures: Design, safeguarding, administrative controls, warnings, training or personal protective equipment used to eliminate hazards or reduce risks.

NOTE: Generally, B11 standards use the term "safeguarding" instead of this term, which includes personal protective equipment and administrative controls.

3.83 pull-back device: A safeguarding device with attachments for the operator's hands and wrists and connected to the slide of the press, used to prevent the operator from reaching into the point-of-operation, or to withdraw the operator's hands from the point-of-operation, during the hazardous portion of the cycle.

E3.83 A pull-back device is also called a pull-out device. See Annex A, Figure A.6.

3.84 rebuilder: Any supplier that restores the press or press production system to its original design, purpose, capacity and function.

3.85 rebuild: To restore the press or press production system to its original design, purpose, capacity or function.

E3.85 Rebuild involves the restoration or replacement of major components of the press or press production system and is not considered a maintenance or repair activity.

3.86 redundancy: The use of multiple means to perform the same function.

3.87 repair: To restore by replacing a part or putting together that which is broken.

3.88 repeat: Unintended or unexpected successive cycle of the press resulting from or in conjunction with a malfunction.

3.89 restraint device: A safeguarding device including attachments for the operator's hands and wrists that prevents the operator from reaching into the point-of-operation at all times.

E3.89 A restraint device may be likened to a non-moving pull-back device. A restraint device is also called a holdout device. See also, Annex A, Figure A.5.

3.90 risk: A combination of the probability of occurrence of harm and the severity of that harm.

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3.90.1 tolerable risk: Risk that is accepted for a given task (hazardous situation) or hazard.

E3.90.1. The expression “tolerable risk” refers to the level at which further risk reduction will not result in significant reduction in risk, or additional expenditure of resources will not result in significant advantages of increased safety.

3.91 safeguarding: The protection of personnel from hazards by the use of guards, safeguarding devices, awareness devices, safeguarding methods, or safe work procedures.

3.92 safeguarding device: Any mechanical attachment or control device, other than a barrier guard, that:

- a) prevents access to a point-of-operation hazard during the hazardous motion of the press; or
- b) prevents hazardous motion of the press during access to point-of-operation hazards.

E3.92 See also, **movable barrier device; presence-sensing safeguarding device; pull back device; restraint device; two-hand control device; two-hand trip device.** (See 8.6)

3.93 safety block: A prop that is inserted between opposing tool components or press members to prevent closing of machine members or tooling components.

3.94 safety-related function: That portion of the press control system or safeguarding device that eliminates exposure to a hazardous situation or reduces exposure to a tolerable level.

E3.94 See also, 8.8 and Annex F.

3.95 scrap: The fragments of stock removed in the manufacturing process.

3.96 scrap chute opening: An opening through which scrap material is removed from the press area.

E3.96 Scrap chute openings may be through the die, bolster, or through the floor adjacent to the bolster.

3.97 scrap chute cover: A cover over the scrap chute opening to eliminate the potential for a slip or fall hazard.

3.98 servo drive: A drive system that replaces the need for a flywheel and clutch by directly connecting a servo motor to the drive train.

3.99 servo press: A type of mechanical power press that uses a servo drive and motor combination as a source of energy to the drive train. This drive and motor can be the primary means of slide movement. A clutch brake energy transmission system is sometimes incorporated into the servo drive system to provide partial (intermittent) movement of the slide. A servo press provides the user with the ability to modify the stroke motion for process control.

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3.100 set-up: The process of adjusting the press, and the installation and adjustment of tooling and appropriate safeguarding, to ensure proper and safe operation of the press production system.

3.101 single cycle: Complete movement of the slide from the initial start position to the same start position of the slide-

3.102 single-cycle capability: An arrangement used to limit the travel of the slide to one complete cycle even if the cycle initiating means is held in the operating position.

3.103 slide: The press member that reciprocates linearly and to which the tooling is attached.

3.104 slide lock: An energy-isolating device intended to address gravity hazards associated with the slide.

3.105 stop command: An action to cause cessation of press motion either automatically or through human intervention. The stop command can be immediate or normal.

3.105.1 immediate stop command: A command that initiates an action(s) to stop motion at any point in the press cycle.

3.105.2 normal stop command: A command that initiates an action(s) to stop motion at the end of a press cycle or at other points required by the machine functions.

3.106 stroke length: Length of movement of the slide from the open to the closed position.

3.107 stop control: A control that when actuated, initiates immediate or controlled stopping action of the hazardous motion of the press.

3.108 stopping-performance monitor: A system or device to monitor the stopping performance of the press.

3.109 stripper: Mechanism or die part for removing the workpieces or material from the punch.

3.110 stroke: The movement of the slide from the open to the closed position, or from the closed to the open position (up-stroke or down-stroke).

E3.102 Single-cycle capability may be accomplished by the use of a single-cycle mechanism on full-revolution clutch presses or by an antirepeat control.

E3.103 A slide is also called a ram, plunger, or platen. On certain specialized presses such as double or triple action presses, fine blanking presses and eyelet machines, there can be more than one slide.

E3.107 Stop control can also be called an emergency stop control.

E3.109 The stripper may be stationary and attached to the lower die or may be spring or cam-actuated and attached to either the upper or lower die.

E3.110 The term "stroke" has historically been used interchangeably with the term "cycle." See also, **cycle**.

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3.111 supervised: Denotes a means or method whereby the user can exercise permissive control over the operation of the press.

3.112 supervisory control: A device or method that ensures that the press production system and its safeguarding are used and operated such that individuals are protected from hazards.

3.113 supplier: Individual, corporation, partnership or other legal entity or form of business who provides equipment or services.

NOTE - This can include manufacturer, modifier, rebuilder, integrator, or under certain conditions, the user.

3.114 synchronous (actuation): Concurrent actuation of two hand control where the time lag between the start of one input signal and the start of the other is less than or equal to 500 milliseconds.

3.115 tandem press line: Two or more stand alone presses which utilize a workpiece placement and handling system between machines to sequentially process material(s).

3.116 tooling: Punch, die, knife, etc. used in the manufacture of production parts.

3.117 TOP STOP control: Operator control used to stop the press slide in the top half of the cycle.

3.118 transfer press: A single frame or modular press that may have one or more slides, where the separate or individual workpieces are transferred from one workstation to the next by an automatic system.

3.119 trip (or tripping): Momentary actuation of the activating control to initiate the cycle.

3.120 turnover bar: A bar used to manually turn the flywheel or crankshaft.

3.121 two-hand control: Actuating control that requires concurrent use of both hands of the operator to initiate or continue the press cycle.

3.122 two-hand control device: A two-hand control located at such a distance from the point-of-operation that the slide completes the closing portion of the cycle or stops before the operator can reach into the point-of-operation.

E3.112 See also, **access control**.

E3.113 For the purpose of this standard, a supplier provides, or makes available for use, all or part of the press production system

E3.115 A tandem press line is a group of presses with manual or automatic material handling between machines. See Annex A, Figure A.19.

E3.117 Quite commonly, a TOP STOP control is used to stop CONTINUOUS cycling at the top of the cycle.

E3.118 See Annex A, Figures A.18 and A.20.

E3.120 See Annex A, Figure A.16.

E3.121 See also, **two-hand control device**.

E3.122 The distinction being drawn between a two hand control and a two hand control device is its use as a safeguarding means. The two hand control has to meet the distance and synchronous requirements to be utilized as a safeguarding device. See also, **operator control; two-hand control**.

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3.123 two-hand trip: An actuating control that requires the momentary synchronous use of both hands of the operator to trip the press.

3.124 two-hand trip device: A two-hand trip used as a safeguarding device.

E3.124 A two-hand control device and a two-hand trip device are separated here to explain the difference in safeguarding capabilities. For point-of-operation safeguarding capabilities, see clause 8. For construction requirements, see clause 6. A two-hand control device requires holding the buttons depressed during a substantial portion of the closing cycle of the slide. Premature removal of hands results in a stopping action.

A two-hand trip device requires only a momentary synchronous application to pushbuttons (or other operating mechanisms) to set the slide ultimately into motion. Instantaneous removal of the hands cannot recall the action or stop the motion. A two-hand trip device is usually applicable to full-revolution clutch equipment, and a two-hand control device is possible only with part-revolution clutch or direct drive equipment. See also, *operator control; two-hand trip control*.

3.125 user: Any entity that utilizes presses and press production systems.

3.126 workpiece: Any material or part to be placed into the press for the purpose of having work performed on it.

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4 Responsibility

4.1 Supplier

4.1.1 The supplier shall be responsible to design and construct the mechanical power press in accordance with the requirements of clauses 5, 6 and the applicable requirements of clause 8 as defined in 6.1.1 and 6.1.2 of this standard.

4.1.2 When the user, modifier or integrator designs, constructs or modifies the mechanical power press, the user, modifier or integrator is considered to be the supplier of that portion of the mechanical power press so designed, constructed or modified.

4.1.3 The supplier shall:

- a) identify the sources of hazards (see 5.1);
- b) eliminate or provide the means for controlling the identified hazards by implementing a risk assessment / risk reduction strategy (see 5.2);
- c) within the scope of their work activity, equip each mechanical power press with safeguards in association with machine moving parts (e.g., guards, protective devices or awareness barriers/devices) as determined by the risk assessment (see clause 8);
- d) provide means of isolating or dissipating stored energy associated with the mechanical power press;
- e) furnish, in writing or by diagram, the clearances needed by personnel for lubrication, adjustment, and similar routine maintenance activities;
- f) identify the need for any special handling requirements for components, assemblies, or subassemblies, and provide instructions in the suppliers information for use;
- g) provide documentation for the equipment they provide, including installation, testing, start-up, operation, safeguarding and maintenance of the mechanical power press. The system integrator, where applicable, shall ensure that the documentation provided is coordinated and relevant to the mechanical power press.

E4.1.1 Clause 8 - safeguarding is defined as a "user required" clause, however, there are elements within this clause that the supplier should apply to the design of new or rebuilt equipment, which are detailed in 6.1.1 and 6.1.2.

The supplier should refer to clause 2 for applicable standards relative to the product or service provided by that supplier. When safety standards are not provided, safeguarding techniques used on similar equipment should be applied to this type of equipment, where applicable.

E4.1.3 The supplier should consult with the user for any additional hazards that should be considered as part of the hazard control strategy (see clause 5).

f) The intent of this is to provide a lifting plan that takes into consideration safe handling practices.

- g) The documentation should contain the following:
- i. foundation requirements;
 - ii. power requirements;
 - iii. electrical, hydraulic/pneumatic schematics and diagrams;
 - iv. major component weights;
 - v. equipment layout (work envelope) including min. clearances needed for maintenance;
 - vi. hydraulic system pressure and flow

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- specifications;
- vii. preparation prior to start-up;
- viii. energy sources;
- ix. physical environment for which the mechanical power press was designed;
- x. lubrication and specification, including recommended lubricants, frequency, and locations to be lubricated;
- xi. function and location of operator controls, indicators, and displays;
- xii. periodic maintenance and inspection;
- xiii. mechanical power press or tooling alignment;
- xiv. safety precautions.

4.2 User

4.2.1 The user shall be responsible for the overall workplace safety of personnel.

The user shall review the mechanical power press design including installation, set-up, operation and maintenance requirements and any modifications as provided by the supplier to ensure their press production system is in conformance with applicable requirements of clauses 5, 7, 8, 9 and 10 of this standard.

4.2.2 The user shall ensure that:

- a) The recognized hazards for the tasks to be implemented on the press production system are identified (see 5.1);
- b) The protective measures required to eliminate or control the hazards identified in 5.1 are provided and used (see 5.2);
- c) Each mechanical press be provided with appropriate point-of-operation safeguarding (e.g., guards, protective devices, see Clause 8);
- d) A procedure for the inspection and maintenance is established so that the press production system, its guards and protective devices are used in accordance with the supplier's recommendations and are in safe operating condition and adjustment;
- e) Safe working procedures are established and followed;
- f) The operator and auxiliary personnel follow the instructions and directions set forth by the user to meet the requirements of this standard (see also, E4.3);
- g) All tooling and maintenance personnel and operators are trained to perform the functions for which they are responsible. The training shall include familiarizing the employees with the portions of this standard related to their work (see clause 9).

E4.2.1 The user should provide, or require others to provide, the necessary protective measures.

One method that may be used to identify hazards and establish a hazard control strategy is to form a team of individuals from the various disciplines involved with the design, construction, operation and maintenance of the mechanical power press.

E4.2.2 Users should follow the supplier's instructional material regarding the unpacking, handling, installation, operation and maintenance (including safeguarding) of the press production system.

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4.2.3 The user shall determine what personal protective equipment is required and shall train personnel on the use of that equipment.

4.2.4 The user shall establish and follow a lockout/tagout procedure that will limit personnel exposure from unintended press production system motion that can cause injury during repair, servicing, set-up, or adjustment of the press production system (see ANSI / ASSE Z244.1).

Only authorized personnel, trained and familiar with the potential hazards of the specific press production system shall perform service and maintenance activities.

4.3 Personnel

4.3.1 Personnel shall follow the training and safety procedures provided by the user in their operation and maintenance of the press production system, in accordance with clause 9.

4.3.2 The operator shall comply with the instructions of the user concerning safe methods of operation of the press production system.

E4.2.4 See also, 29 CFR 1910.147 and 1910.333.

E4.3.1 The Occupational Safety and Health Act of 1970 – Public Law 91-596, states in section 5(b), “Each employee shall comply with occupational safety and health standards and all rules, regulations and orders issued pursuant to this Act which are applicable to his own actions and conduct.”

E4.3.2 Examples of the press operator's or auxiliary personnel's responsibilities:

- a) Follow all safety practices and procedures given in this standard that apply to his or her actions and conduct;
- b) Notify his or her supervisor when they observe an unsafe practice or condition;
- c) Properly use all specified personal protective equipment;
- d) Install, position, or adjust safeguarding devices as instructed by the user under the provisions of this standard;
- e) Do not alter, remove, or disable any safety equipment without the approval of the user;
- f) Make a visual safety check of the press during each operating shift;
- g) Maintain an orderly work area. Particular attention should be given to the storage of tools or other items that could be dislodged and fall or roll.

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5 Hazard control

5.1 Task and hazard identification

Reasonably foreseeable tasks and associated hazards shall be identified throughout the lifecycle of the press (e.g., design, installation, set-up, operation and maintenance).

E5.1

Task identification should take into account, but not be limited to, the following task categories:

- a) packing and transportation;
- b) unloading/unpacking;
- c) systems installation;
- d) start-up/commissioning;
- e) set-up and tryout (debug);
- f) operation (all modes);
- g) tool change;
- h) planned & unplanned maintenance;
- i) major repair;
- j) recovery from control failure or jam;
- k) troubleshooting;
- l) housekeeping;
- m) decommissioning;
- n) disposal.

Tasks are specific activities that relate to the task category. Each task category may have numerous tasks associated with it. Examples specific to presses include but are not limited to:

- a) workpiece feeding;
- b) changing a die;
- c) changing a material coil (where applicable);
- d) replacing a drive belt;
- e) replacing a filter;
- f) troubleshooting a repeatability problem;
- g) unsticking scrap or parts.

For each of the above tasks, there may be numerous hazards. Examples of hazards and hazardous situations addressed within this standard (design/construction, installation, set-up, operation and maintenance) are contained in Annex B.

In addition, reasonably foreseeable hazards not directly related to tasks shall be identified.

The following are some examples of reasonably foreseeable hazards not related to tasks:

- a) failure of a high pressure hydraulic line;
- b) bearing failure or bearing seizure;
- c) failure of the structural components of the mechanical power press.

Tasks and associated hazards shall be identified and reassessed when necessary or whenever the mechanical power press is modified or its typical use is changed (see 5.2).

Each time a mechanical power press is modified or its use is changed, the tasks/hazards associated with the modification or change should be identified and reassessed. For a more detailed discussion on the identification of task/hazard combinations, refer to ANSI B11.TR3.

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5.2 Risk assessment / risk reduction

Risks associated with the task/hazard combinations identified in 5.1, including reasonably foreseeable hazards not directly related to tasks, shall be assessed and reduced to a tolerable level by incorporating one or more of the following protective measures, in hierarchical order:

- a) eliminate or control hazard(s) by design;
- b) control exposure to hazards by the use of guards or safeguarding devices;
- c) provide other safeguarding (e.g., awareness barriers, awareness signals and safeguarding methods);
- d) implement administrative controls or other protective measures (including safe work procedures, preventive maintenance, training, re-training, personal protective equipment and safety signs).

When performing risk reduction for task/hazard combinations identified in 5.1, including reasonably foreseeable hazards not directly related to tasks, the requirements of clauses 6, 7, 8, 9 and 10 shall be implemented.

Tolerable risk shall be determined by evaluating the application of the protective measures against the following factors:

- a) risk-reduction benefit;
- b) technological feasibility;
- c) economic feasibility;
- d) ergonomic impact;
- e) productivity;
- f) durability and maintainability;
- g) usability.

Risk reduction is complete when the protective measures, consistent with this standard, are applied and tolerable risk has been achieved for the identified task/hazard combinations and the mechanical power press or press production system as a whole.

E5.2

Where possible and when necessary, the user in conjunction with the supplier, should ensure that the task/hazard combinations and reasonably foreseeable hazards not directly related to tasks (and their associated protective measures) identified in this standard are appropriate for mechanical power presses or press production systems. For further information on risk assessment, see ANSI B11.TR3.

For performing risk reduction on task/hazard combinations and reasonably foreseeable hazards not directly related to tasks not resolved by applying clauses 6, 7, 8, 9 and 10, see ANSI B11.TR3.

Zero risk does not exist and cannot be attained. However, a good faith approach to risk assessment and risk reduction should reduce risk to a tolerable level. For further information on tolerable risk, see ANSI B11.TR3.

Risk-reduction benefit is determined by estimating the potential reduction in severity of harm or probability of occurrence of harm. The type of protective measure is determined by the nature of the task and associated hazard(s) for the mechanical power press under consideration. Protective measures should be selected to provide the desired degree of risk reduction.

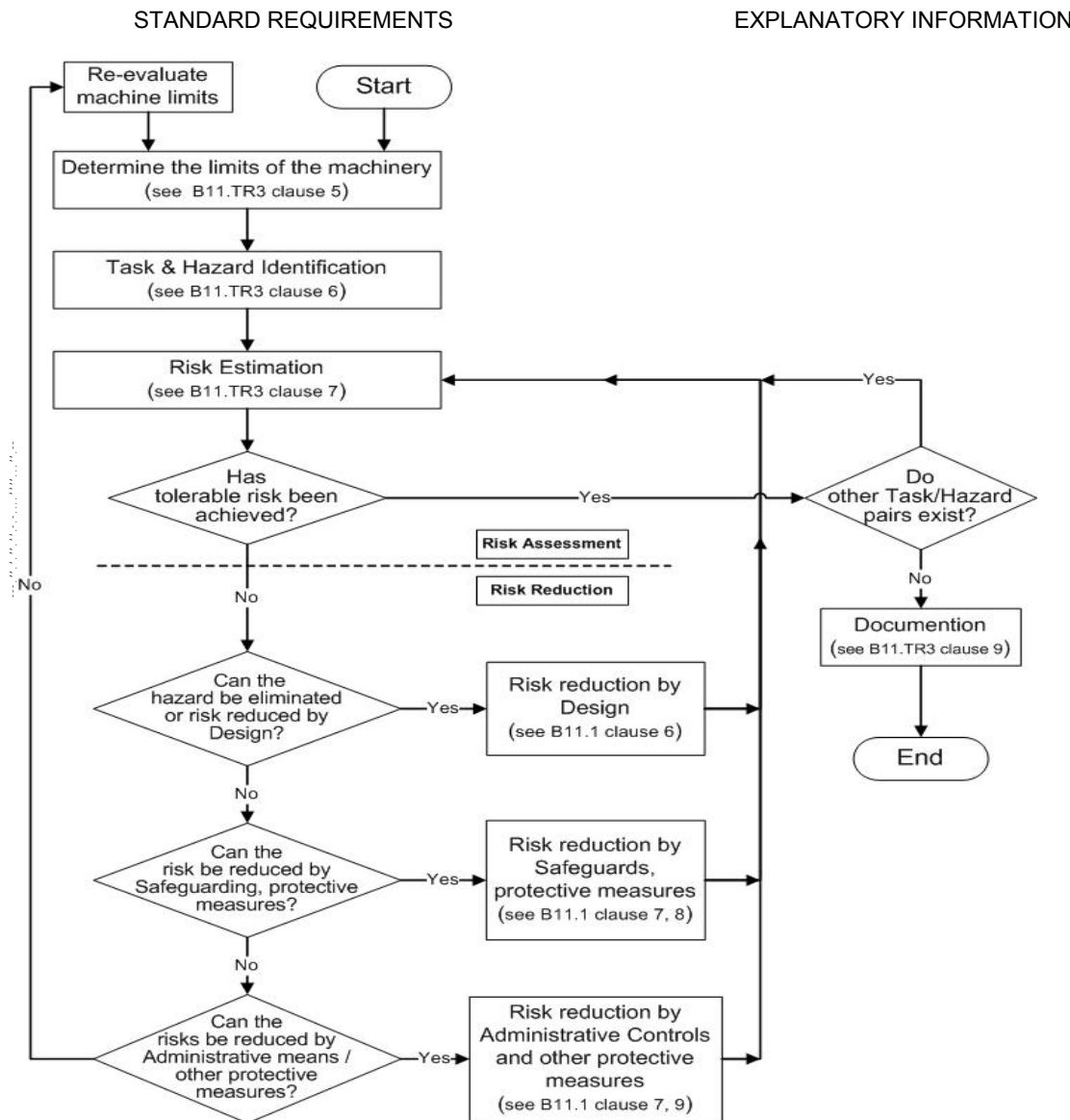
**Figure 5.1**

Figure 5.1 shows the iterative process as it relates to risk assessment/risk reduction as a hazard control strategy. It provides a visual link between this process and the requirements of clauses 6, 7, 8, 9, and 10. The requirements in these clauses stipulate the protective measures to be implemented so as to reduce the risks of various hazardous situations (task/hazard pairs) to a tolerable level. The supplier or user should be responsible for validating the stipulated protective measure(s) are appropriate, have been properly applied, meet the anticipated performance and that all hazards identified by the risk assessment have been appropriately mitigated.

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6 Design and construction

6.1 General requirements – all machines

6.1.1 Hazards associated with moving parts (other than point-of-operation hazards) *E6.1.1*

The supplier shall identify hazards associated with moving parts in accordance with 5.1, and implement a hazard control strategy in accordance with 5.2 for those hazards within the scope of their work activity.

The supplier shall also supply safeguarding for hazards identified within the scope of its work activity.

Personnel hazards other than directly at the point-of-operation may include but are not limited to:

- a) pinch points between the slide and the stationary press components or other auxiliary equipment (e.g., feeders, conveyors) and the area in between rotating components;
- b) power transmission apparatus;
- c) broken or falling components;
- d) rotating components such as the flywheel, gears, sheaves, and shafts in close proximity to personnel;
- e) in-running nip points such as meshing gears, belts and chains.

6.1.2 Hazards associated with broken or falling components *E6.1.2*

Machine components shall be designed, secured, or covered to minimize hazards caused by breakage or loosening and falling.

The hazards that can exist include but are not limited to:

- a) breakage of shafts causing falling motor sheaves, flywheel clutches, gears or other moving parts;
- b) loosening of mounting bolts causing falling of motors, protective covers, nameplates or other stationary parts;
- c) breakage of springs causing the release of hazardous energy.

6.1.3 Brakes – general requirements *E6.1.3*

1) Friction brakes provided for stopping or holding the slide movement for full revolution or part revolution clutch presses shall be self-engaging and shall require power or force from an external source for disengaging.

1) The brake may be disengaged during cycling or, on full-revolution clutch presses, it may be a constant-drag type.

Brake capacity shall be sufficient to stop the motion of the slide and shall be capable of holding the slide and its attachments at any point in its travel.

When using safeguarding devices which rely upon the stopping time to protect personnel, bringing the slide to a stop quickly allows for shorter safety distance.

2) On direct drive presses, the slide shall be stopped by the drive motor, by the friction brake, or by a combination of the drive motor and the friction brake. The friction brake shall be capable of holding the slide and its attachments at any point in the cycle with the motor de-energized.

2) On direct drive presses, the brake may be disengaged during a motor hold or “lock” condition unless other conditions require the brake to be engaged.

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If any circumstances of drive motor de-energization cause the friction brake to be the primary means of stopping the slide, the brake shall be capable of stopping the slide quickly. The brake shall always be engaged when the servomotor is de-energized on a direct drive press.

3) Where springs apply friction brakes, they shall be of the compression type operating on a rod or guided within a hole or tube, and designed to prevent interleaving of the spring coils in the event of breakage.

6.1.4 Gauges

Gauges that are attached to machine components to check machine functions, fixtures or parts set-up shall be rigidly secured to the machine or fixture (as appropriate) and located so that their use will not create a hazard to the operator or maintenance personnel.

6.1.5 Stored energy

The supplier shall provide means for the isolation, containment or controlled release of stored energy that can create a hazardous condition. See ANSI Z244.1.

6.2 Electrical requirements

The electrical requirements contained in 6.2.1 through 6.2.7 shall apply:

6.2.1 Disconnect switch

A main–power disconnect switch capable of being locked only in the OFF position shall be provided with every power press control system. See also, NFPA 79 and ANSI Z244.1.

E6.1.4

Gauges, as referred to in this subclause include instrumentation and other indicators used to indicate subsystem conditions including but not limited to:

- a) Die cushion pressure;
- b) Clutch brake pressure;
- c) Air supply pressure;
- d) Hydraulic pressures;
- e) Counterbalance pressure;
- f) Die clamp pressure;
- g) Flow control.

E6.1.5

Examples of isolation, containment, or controlled release of stored energy are:

- a) blocking;
- b) pinning;
- c) chaining;
- d) locking;
- e) controlled bleeding;
- f) check valves;
- g) discharging;
- h) dynamic braking;
- i) mechanical braking;
- j) powerdown procedures.

E6.2

See NFPA 79, 70 and 70E for additional electrical requirements.

E6.2.1

A circuit breaker can be used to meet this requirement.

The disconnect switch provides a category 0 stop (see 6.2.2.1). If properly labeled and colored, and made readily available to the operator, the disconnect switch can also qualify as an emergency stop device.

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Capability to lock the disconnect switch in the OFF position facilitates machine lockout. Emergency shutoff should be accessible and designed to prevent locking the disconnect switch in the ON position. See also, 29 CFR 1910.147 and 1910.333.

6.2.2 General requirements for stop functions, circuits and actuators

The requirements of subclauses of 6.2.2.1 through 6.2.2.4 shall apply to stop functions, stop circuits, and the operator actuators that initiate the stop function. Some stop requirements are specified. Other stops that are provided in accordance with the functional requirements and risk assessment of a specific press production system and associated auxiliary equipment shall comply with these requirements.

6.2.2.1 Stop category functional requirements

Immediate stop functions specified in other clauses of this standard shall conform to the functional requirements listed in this clause for the stop category specified.

Additional stop functions provided based on risk assessment of a specific press production system and associated equipment shall conform to the stop category indicated by the risk assessment and functional requirements of the production system.

A Category 0 stop shall initiate an uncontrolled stop by immediately removing power from the actuator(s).

A Category 1 stop shall immediately initiate a controlled stop with power available to the actuator(s) to achieve the stop, then removal of power to the actuator(s) after the stop is achieved.

A Category 2 stop shall initiate a controlled stop with power left available to the actuator(s).

Category 0 and Category 1 stops shall be operational regardless of the mode of press operation.

Category 0 stops shall take priority over (override) all other stops.

Category 0 and Category 1 stops shall operate by de-energizing the relevant circuit and shall override their related start functions.

E6.2.2

For requirements applicable to cycle stop, see 6.4.2.2.

E6.2.2.1

Stop functions may be initiated by:

- Disconnect switch(es);
- Operator controls (such as stop buttons);
- Non-protective sensor inputs;
- Protective sensor inputs from safeguarding devices or guard interlocks;
- Protective or non-protective interlocks from equipment or auxiliary equipment used in the production system.

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Category 2 stops shall override their associated start functions.

The cessation or re-set of a stop command shall not initiate motion.

Once the stop condition is removed, the use of operator controls to start or initiate motion shall be required to re-start or reinitiate motion.

EXCEPTION: Optical presence-sensing safeguarding devices used to initiate strokes in PSDI. See clause 10.

6.2.2.2 Stop circuits

1) Stop circuits shall meet the following requirements:

- a) Where indicated by functional requirements or risk assessment, stop circuits shall have provisions to connect additional operator stop controls, devices or interlocks.
- b) The components of the stop circuit shall be designed, selected, constructed and interconnected in such a manner so as to withstand the anticipated operational and environmental operating conditions.

2) Stop or emergency stop actuator control circuits provided to immediately stop the cycling of the press slide, or to prevent or stop hazardous motion related to auxiliary equipment or other machines used with the press, shall conform to the following requirements:

- a) The stop function executed for part revolution clutch press cycling shall be Category 0. The stop function executed for direct drive press cycling shall be Category 0 or Category 1;
- b) The stopping of hazardous motion of other auxiliary equipment and machines used with the press production system by such circuits shall be Category 0 or Category 1;
- c) The selection of a Category 0 or Category 1 stop shall be determined by the functional characteristics of the stopping mechanism(s) and the risk assessment of the equipment or machine;

E6.2.2.2

Local code and design selection may also require additional stop controls, devices, or interlocks.

Consideration should be given to:

- a) frequency of operation;
- b) need for periodic testing (especially where operation is infrequent);
- c) vibration, shock, temperature, dust, foreign or corrosive materials, fluids, etc.

2) Depending on system design, circuits for stop or emergency stop actuators for immediate stop of hazardous motion may stop only the cycling of the press slide or stop the press motors in addition to stopping the press slide. Where associated equipment or other machines are used with the press production system, the (emergency stop circuit) may also stop (or signal to stop) the other equipment or machines.

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- d) If the emergency stop function impairs any provision designed to release trapped individuals, alternate measures shall be provided;
- e) Where a Category 0 stop is used for the hazardous motion stop function, the circuits shall have only hardwired electro-mechanical components.

Alternative measures may include but are not limited to:

- a) predetermined procedures;
- b) supervised electrical control functions;
- c) trained personnel;
- d) design features.

See also, clause 9.

EXCEPTION: An electronic logic (hardware or software) system as well as a communication network or link that complies with 8.8 shall be permitted. Final removal of power shall be by means of electromechanical components.

- 3) Circuits for stop or emergency stop of hazardous motion shall:
 - a) Override all other functions and operations in all modes;
 - b) Remove power to the machine actuators as soon as possible without creating other hazards;
 - c) Not initiate re-start of hazardous motion when re-set;
 - d) Not be used as an alternative for proper safeguarding. See Clause 8.

- 4) Within the scope of their work activity, the supplier shall provide circuits to connect safeguarding devices and interlocks to stop hazardous motion of the press and related equipment and machines.

Circuits for interlocks shall conform to the requirements of 6.11 (and 8.8), or shall be designed and constructed to meet the level of risk reduction as determined by a risk assessment.

Direct drive controls shall incorporate a contactor that will disconnect the drive or motor.

- 5) The signal that a stop command has been initiated shall be sent to the control system's logic.

- 6) When required for production system utility, or when risk assessment indicates that it is necessary, a press production system that utilizes auxiliary equipment or other machines that have individual controls working in a coordinated manner shall incorporate a provision to signal the related control systems that a stop condition exists.

- 6) Cooperative efforts of suppliers and users are recommended, where possible, to attain the goal of acceptable risk. The success of a risk assessment is not dependent upon this relationship. See ANSI B11.20 for more information on Integrated Manufacturing Systems.

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7) When the power press is incorporated into a process or manufacturing cell which is divided into several "emergency stop zones," the cell or press control system shall be designed and constructed to facilitate easy identification as to which emergency stop device corresponds to which zone.

7) See also ANSI B11.20.

6.2.2.3 Immediate or emergency stop actuators

Stop or emergency stop actuators to initiate immediate stop of hazardous motion shall:

- a) be continuously operable and readily accessible;
- b) initiate a Category 0 or Category 1 stop function;
- c) be located at each operator control station and at other locations where such stop is required;
- d) be manually re-set to remove the stop condition;
- e) be colored RED;
- f) have a yellow background;
- g) be of the self-latching type and use normally closed contacts with positive (direct) opening operation;
- h) be of the palm or mushroom type (if the stop actuator is a pushbutton);

- i) not be flat switches or graphic representations based on software applications.

E.6.2.2.3

For the purpose of this subclause, a stop actuator is the device the operator utilizes to initiate the stop function.

Stop buttons are normally not guarded. If it is necessary to protect an emergency stop button from inadvertent operation, protective measures may be incorporated which do not impede intentional operation of the control.

The intent of this requirement is to provide a clear and unobstructed operation of the emergency stop that will not expose personnel to additional hazards. Types of devices include, but are not limited to:

- a) mushroom type pushbuttons;
- b) cables, ropes or bars;
- c) handles;
- d) in some specific applications, foot controls without protective covers.

Flat switches are typically a touch-sensitive membrane.

6.2.2.4 Motor stop actuator

The motor stop actuator shall initiate a category 0 or category 1 stop.

When the motor stop actuator is a button, it shall be of the extended operator or mushroom head type.

E6.2.2.4

Presses may have several motors in addition to the drive motor to provide motorized lubrication, shut-height adjustment, and other functions. There may be individual stop actuators for each motor, master stop or emergency stop actuator(s) that stops all motors, or a combination of stop actuators. The only stop button provision to de-energize the direct drive motor on some direct drive presses is the emergency stop button(s), which should meet the requirements of 6.2.2.3.

6.2.3 Motor-start buttons

All motor-start buttons or direct drive enable (power on) buttons shall be protected against unintended actuation.

E6.2.3

Examples of protection against unintended actuation may include, but not be limited to: recessed buttons, flush buttons, pull-on/push-off buttons, ring guards, and fabricated shields. Caution should be exercised when utilizing Human Machine Interface (HMI) technology for motor start controls.

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Buttons for up and down on slide adjust motors and other buttons whose actuation must be maintained by the operator to energize the motor should be protected against unintended actuation.

The direct drive enable (power on) buttons for the direct drive motor on servo-presses are sometimes labeled other than START, although they execute the start function. Some direct drive presses label the button RE-SET. Others have used the term SERVO-DRIVE ENGAGEMENT or SERVO POWER ON.

6.2.4 Motor–starter

All power press controls shall incorporate a type of drive motor–starter that will disconnect the drive motor from the power source in the event of control–voltage or power–source failure.

Operation of the motor start button shall be required to re-start the motor when voltage conditions are restored to normal.

E6.2.4

Line shaft drives generally do not meet the intent of this requirement.

Magnetic motor–starters or contactors with under–voltage release are devices that are commonly used to meet the requirements of this subclause.

6.2.5 Voltage

All AC control circuits and solenoid valve coils shall be powered by not more than a nominal 120–volt AC supply obtained from an isolation transformer with a grounded secondary.

E6.2.5

For more information, see NFPA 79.

Higher voltages that may be necessary for operation of machine or control mechanisms shall be isolated from any control mechanism handled by the operator.

All DC control circuits shall be powered by not more than a nominal 240–volt DC supply isolated from any higher voltages.

6.2.6 Grounds

All electrical control circuits shall be protected against false operation of the machine due to an unintended ground or improper shielding in the control circuit.

6.2.7 External and line interferences

The supplier shall design and construct the control or power system(s) so that external and line interferences do not adversely affect the safe operation of the machine and its associated equipment.

E6.2.7

Some sources of external and line interferences are:

- Electro-Magnetic Interference (EMI);
- Electro-Static Discharge (ESD);
- Radio Frequency Interference (RFI);
- shock and vibration.

For additional information, see ANSI / IEEE 518.

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6.3 Presses using full-revolution clutches

For presses using full-revolution clutches, the requirements of 6.3.1 through 6.3.5 shall apply:

6.3.1 Single-cycle capability

Presses used in single-cycle operations shall be equipped with single-cycle capability.

6.3.2 Springs

If clutch disengagement action of a press is dependent upon spring(s), the spring(s) shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of the spring coils in the event of breakage.

6.3.3 Trip mechanism

The following requirements (6.3.3.1 through 6.3.3.3) for mechanical trip mechanisms shall apply:

6.3.3.1 Single cycle mechanism

Presses that are used in single cycle shall incorporate a single cycle mechanism.

6.3.3.2 Foot pedal

When a foot pedal is furnished, it shall be designed for actuation by one foot only and meet the following requirements:

- a) The contact area of a foot pedal shall have a nonslip surface;
- b) The pedal return spring(s) if provided, shall be of the compression type, operating on a rod or guided within a hole or tube, and designed to prevent interleaving of the spring coils in the event of breakage;
- c) The pedal mechanism shall be protected to prevent accidental tripping caused by falling or moving objects, or by accidental stepping onto the pedal;
- d) If pedal counterweights are provided, the path of the travel of the weight shall be enclosed to prevent interference with its movement.

6.3.3.3 Hand-operated levers

Hand-lever actuated presses shall be equipped with a mechanism to prevent premature or accidental tripping.

E6.3 (For part-revolution clutch presses, see 6.4.)

A characteristic of full-revolution clutch presses is that once tripped, the clutch cannot be disengaged until a full revolution is completed. Consequently, if the trip mechanism is actuated and the clutch engages with the flywheel at rest, completion of a press cycle will result when the drive motor is started.

E 6.3.1

See single-cycle capability (3.97). Single-cycle capability is provided by a single-cycle mechanism or a single-cycle trip-control system. It may be desirable to have both.

E6.3.3.2

See also, Annex A, Figures A.9.

- a) A contact area greater than 516 square millimeters (8 square inches) is recommended.
- b) The objective for the inside or outside diameter clearance, or the space between coils, is to design a space insufficient to allow interleaving.

E6.3.3.3

One way to meet this requirement is to provide a spring latch on the operating lever.

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6.3.4 Trip-control system

The requirements in this subclause shall apply to electrical or pneumatic controls used to actuate full-revolution clutch presses.

6.3.4.1 Cycle stop control

Momentary operation of a CYCLE STOP control, if provided, shall cause the press slide to stop at its normal stopping position and shall disable further cycling in automatic modes until cycling is manually re-enabled by the operator. A CYCLE STOP control shall be yellow.

6.3.4.2 Mode of operation selection

1) A means of selecting operating modes shall be supplied with the trip control to select the mode of operation of the press.

The arrangement of a rotary switch, if used, shall be OFF, JOG, SINGLE CYCLE, and CONTINUOUS (and others for special applications), as the control is turned clockwise. However, if the design of the press component and its controls does not incorporate a JOG, SINGLE CYCLE, CONTINUOUS or other modes, then the mode(s) so excluded should likewise be excluded on the cycling selector. OFF shall always be provided.

Changing the mode of operation selection while the press is in motion shall initiate a stop.

2) If more than one cycling selector is provided, each shall have a "remote" position, and the design shall require that all except the controlling selector be in the "remote" position before operation can be enabled. Moving any cycling selector from its "remote" position will result in a stopping action.

3) Selection shall be by means capable of supervisory control.

4) If a Human Machine Interface graphic panel is used to select mode operation, the graphic panel shall have a means of fixing the selection so that the mode can not be changed due to failure within the Human Machine Interface hardware or software.

6.3.4.3 Operating modes**E6.3.4**

There is no intent to imply that electrical or pneumatic controls are required on full-revolution clutch presses.

E6.3.4.1

In some portions of the cycle, a CYCLE STOP command may not cause the press to stop within that same cycle. An additional cycle may occur before the press stops at its normal stopping position.

E6.3.4.2

The selection of a mode shall not by itself start or enable motion. A separate deliberate action should be required. See Annex A, Figure A.17.

3) Methods of meeting these requirements include:

- a) removable key operated switch;
- b) software password;
- c) key card.

4) Methods of meeting these requirements include:

- a) external mode change enabling switch;
- b) software password;
- c) key card;
- d) software handshaking verification.

E6.3.4.3

See Annex G, Figures G.1 and G.1.1 for flow charts showing methods of meeting the intent of this subclause.

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6.3.4.3.1 Off

The OFF mode shall prevent actuation or continued operation of the press.

E6.3.4.3.1

The selection of OFF mode does not conform to the safeguarding requirements of a lockout/tagout procedure.

6.3.4.3.2 Jog

The JOG mode, if provided, shall be designed to prevent exposure of the worker's hands within the point-of-operation.

E6.3.4.3.2

Methods of meeting this requirement include:

- a) requiring the synchronous use of both hands to JOG, or;
- b) requiring a single control protected against accidental actuation and located so that the worker cannot reach into the point-of-operation while operating the single control.

6.3.4.3.3 Single cycle

Presses used in SINGLE CYCLE mode shall incorporate an antirepeat feature.

E6.3.4.3.3

Single cycle may be provided by a single cycle mechanism or a single cycle trip–control system. It may be desirable to have both.

Characteristics of the trip–control system and clutch mechanism may be combined to achieve antirepeat. For example, while the single cycle limiting requirement may be achieved by a single cycle mechanism in the clutch, a two–hand trip should have a feature which requires release of all operating mechanisms (buttons, valves, or levers) before another cycle can be initiated.

6.3.4.3.4 Continuous

A trip–control system that provides a CONTINUOUS cycling mode shall require the selection of the CONTINUOUS mode and a prior action or decision by the operator before operation of the actuating means will initiate continuous cycling.

E6.3.4.3.4

The intent of this requirement is to establish a method of initiating cycling in the CONTINUOUS mode that is distinguishable from the initiation or enabling of cycling in other modes.

One method of meeting this requirement is to perform the following sequence:

- a) Select the CONTINUOUS mode;
- b) Momentarily depress a CONTINUOUS SET–UP (arming) button;
- c) Manually operate the actuating means within a predetermined time after the set–up (arming) button is pressed.

Another method of meeting the intent of this requirement is to use a different actuating means to initiate CONTINUOUS cycling than that used to initiate or enable cycling in other modes.

With this method:

- a) Select the continuous mode;
- b) Manually operate the actuating means that is used to initiate continuous cycling only.

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6.3.4.3.5 Operator-maintained continuous

A trip-control system that provides an OPERATOR-MAINTAINED CONTINUOUS cycling mode shall require the selection of the OPERATOR-MAINTAINED CONTINUOUS mode and a prior action or decision by the operator before operation of the actuating means will initiate cycling. If the operating means is released, the slide shall stop at the completion of the cycle in progress.

E6.3.4.3.5

The intent of this requirement is to establish a method of initiating cycling in the OPERATOR-MAINTAINED CONTINUOUS mode that is distinguishable from the initiation or enabling of cycling in other modes.

One method of meeting this requirement is to perform the following sequence:

- a) Select the OPERATOR-MAINTAINED CONTINUOUS mode;
- b) Momentarily depress an OPERATOR-MAINTAINED CONTINUOUS SET-UP (arming) button;
- c) Manually operate and hold the actuating means within a predetermined time after the set-up (arming) button is pressed to initiate and maintain continuous cycling.

Another method of meeting the intent of this requirement is to use a different actuating means to initiate operator-maintained continuous cycling than is used to initiate or enable cycling in other modes.

With this method:

- a) Select the OPERATOR-MAINTAINED CONTINUOUS mode;
- b) Manually operate the actuating means that is used to initiate operator-maintained continuous cycling only and hold to maintain continuous cycling.

6.3.4.3.6 Continuous on demand

When a trip control system provides a CONTINUOUS ON DEMAND cycling mode:

a) The enabling of continuous on demand cycling action shall require the selection of the CONTINUOUS ON DEMAND mode and a prior action or decision by the operator before operation of the manual actuating means either:

- i) manually initiates the first cycle, after which the demand signal for cycling is enabled to initiate intervals of continuous cycling as required, or;

E6.3.4.3.6

a) The intent of this requirement is to establish an enabling method for continuous on demand cycling that is distinguishable from the enabling or initiation of cycling in other modes. One method capable of meeting the intent of this standard is to perform the following sequence:

- i) Select the CONTINUOUS ON DEMAND mode;
- ii) Momentarily depress a CONTINUOUS ON DEMAND SET-UP (arming) button;
- iii) Manually operate the actuating means within a predetermined time after the set-up (arming) button is depressed to enable cycling.

Another method of meeting the intent of this requirement is to use a different manual actuating means to enable continuous on demand cycling than is used to initiate or enable cycling in other modes.

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- ii) directly enables the cycling action to be initiated by the demand signal for cycling without a manually initiated first cycle.

b) A timer shall be provided to prevent cycling in the CONTINUOUS ON DEMAND mode if the time between the demand signals for cycling exceeds a predetermined time established by the user. Cycling must be manually re-enabled by the use of the procedure described in 6.3.4.3.6(a) when the predetermined time is exceeded.

c) A STOP signal from any source shall stop any cycling action of the press and shall prevent further cycling until CONTINUOUS ON DEMAND mode is manually re-enabled by use of the procedure in 6.3.4.3.6(a).

With this method:

- i) Select the CONTINUOUS ON DEMAND mode;
- ii) Manually operate the actuating means used to initiate continuous on demand cycling only.

This configuration generally includes the press along with one or more auxiliary pieces of equipment that operate in coordination with each other.

b) The time limit should be set for the shortest practicable duration for the production requirements of the operation being performed. Adjustment means for the timer should be capable of supervision.

c) STOP signals from remote stop controls on associated machinery intended to stop the entire production process, TOP STOP controls, the press drive motor stop control, interlocked guards, etc. are signals which should stop the press and prevent cycling until continuous on demand cycling is manually re-enabled.

NOTE - Lack of the continuous on demand cycling signal for periods shorter than the predetermined time of 6.3.4.3.6(b) is not a stop signal and will not prevent further cycling from being initiated by the demand signal.

6.3.4.3.7 Automatic single cycle

When a trip-control system provides an AUTOMATIC SINGLE CYCLE mode:

a) The enabling of automatic single cycle cycling action shall require the selection of the AUTOMATIC SINGLE CYCLE mode and a prior action or decision by the operator before operation of the manual actuating means either:

- i) manually initiates the first cycle, after which the automatic single cycle signal is enabled to initiate single cycles as required, or

E6.3.4.3.7

a) The intent of this requirement is to establish an enabling method for automatic single cycle that is distinguishable from the enabling or initiation of cycling in other modes. One method capable of meeting the intent of this requirement is to perform the following sequence:

- i) Select the AUTOMATIC SINGLE CYCLE mode;
- ii) Momentarily depress an AUTOMATIC SINGLE CYCLE SET-UP (arming) button;
- iii) Manually operate the actuating means within a predetermined time after the set-up (arming) button is depressed to enable cycling.

Another method of meeting the intent of this requirement is to use a different manual actuating means to enable cycling in automatic single cycle than is used to initiate or enable cycling in other modes.

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- ii) directly enables single cycles to be initiated by the automatic single cycle signal without a manually initiated first cycle.

b) A timer shall be provided to prevent cycling in the AUTOMATIC SINGLE CYCLE mode if the time between automatic single cycle actuation signals exceeds a predetermined time established by the user. Cycling must be manually re-enabled by the use of the procedure of 6.3.4.3.7(a) when the predetermined time is exceeded.

c) A STOP signal from any source shall stop any cycling action of the press and shall prevent further cycling until AUTOMATIC SINGLE CYCLE mode is manually re-enabled by the use of the procedure of 6.3.4.3.7(a).

d) The system shall incorporate single cycle capability.

PSDI (Presence-Sensing Device Initiation) shall not be used on full revolution clutch presses.

6.3.4.4 Actuating means selection

The selection method between hand or foot means of operation shall be separate from the cycling selector and shall be designed so that the selection can be supervised. Only one means of actuating the press shall be in use at a single operator station at one time.

6.3.4.5 Actuating means

With this method:

- i) Select the AUTOMATIC SINGLE CYCLE mode;
- ii) Manually operate the actuating means used to enable cycling in AUTOMATIC SINGLE CYCLE mode only.

This configuration generally includes the press along with one or more auxiliary pieces of equipment that operate in coordination with each other.

b) The time limit should be set for the shortest practicable duration for the production requirements of the operation being performed. Adjustment means for the timer should be capable of supervision.

c) STOP signals from remote stop controls on associated machinery intended to stop the entire production process, TOP STOP controls, the press drive motor stop control, interlocked guards, etc. are signals which should stop the press and prevent cycling until automatic single cycle is manually re-enabled.

NOTE: Lack of the automatic single cycle signal for periods shorter than the predetermined time of 6.3.4.3.7(b) is not a stop signal and will not prevent further cycling from being initiated by the automatic single cycle signal. On a full revolution clutch press, only stopping at the top of the cycle is possible.

d) See also, 6.3.1.

E6.3.4.4

There is no intent to require a key-locking arrangement. While several methods of ensuring supervisory control exist, one method is to use a removable foot control held in supervised storage when not required for use, in conjunction with a dummy plug arrangement. There is no recommended order for the position of various means on the selector.

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6.3.4.5.1 Two-hand trip control

Each hand control shall be protected against unintended initiation and shall be arranged by design, construction, or separation so that the synchronous use of both hands is required to trip the press.

LIMITATIONS - For limitations in the use of two-hand trip control devices as a safeguard at the point-of-operation, see E8.6.1 d) and 8.6.2.2.

6.3.4.5.2 One-hand trip control

If one-hand trip control is provided, it shall be protected against inadvertent or unintended actuation and located so that the worker cannot reach into the point of operation while operating the single control.

If the press is equipped with two-hand trip controls, the one-hand trip control shall be a separate control.

Selection of one-hand trip control or two-hand trip control shall be capable of supervisory control.

6.3.4.5.3 Foot trip control

Foot-actuated trip controls, if provided, shall be protected to prevent actuation from falling or moving objects, or from unintended initiation of a press cycle by inadvertently stepping onto the foot trip control.

6.3.4.6 Multiple operator stations

Control systems with more than one operating station shall require the deactivation and reactivation of all operators' controls prior to re-initiation of a press cycle.

The use of the operator station shall be by a means capable of supervisory control. The trip control system shall be designed and constructed to prevent actuating the clutch if all operator stations are bypassed.

E6.3.4.5.1

This is a construction requirement applying only if the press is equipped with a two-hand trip control.

Two-hand trip control typically is accomplished by:

- a) Electrical palm-actuated switches acting as inputs to a trip control which actuates a solenoid to operate the clutch trip linkage; or
- b) Electrical palm-actuated switches acting as inputs to a trip control which actuates a pneumatic system utilizing an air cylinder to operate the clutch trip linkage; or
- c) Pneumatic palm-actuated valves operating as part of a pneumatic system to actuate an air cylinder to operate the clutch trip linkage.

Rings or shrouds are commonly used to protect palm-actuated buttons from unintentional actuation. Precautions in design or installation are needed to prevent actuation of two buttons by the use of one hand and the elbow of the same arm, and to inhibit other circumvention of the two-hand requirement.

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6.3.4.7 Trip–control system air–valve failure

Any single failure within the operating valve mechanism shall not prevent the normal disengagement of the activating means. After any single failure, the valve mechanism shall inhibit subsequent initiation until the failure has been corrected.

6.3.4.8 Press drive–motor interlock

The trip–control system shall incorporate an automatic means to prevent clutch actuation in SINGLE CYCLE, CONTINUOUS or other production mode(s) unless the press drive motor is energized.

6.3.4.9 Engaging–method failure

The trip–control system shall be automatically deactivated in the event of failure of the power or pressure supply for the clutch–engaging means.

Reactivation of the clutch shall require restoration of power or pressure and the use of the operator trip controls.

6.3.5 Turnover bar operation

Selection of bar operation shall be by means capable of supervisory control. A separate control shall be employed to activate the clutch, and the clutch shall be activated only if the drive motor is de–energized.

6.4 Presses using part–revolution clutches or direct drive systems

The following requirements shall apply to presses using part–revolution clutches or direct drive systems that can stop at any point during the cycle.

E6.3.4.7

As with any mechanism employing moving parts, eventual failure will occur. Inspection to determine mechanical condition is difficult, and the results to be obtained from such inspections may not be reliable. A tandem or dual air–valve arrangement with monitoring is commonly used to meet this provision.

E6.3.4.8

One method of meeting this requirement is the use of a control circuit interlock contact on the drive motor starter contactor to permit clutch engagement by trip control actuation in production modes only when the contactor is energized.

E6.3.5

The clutch engaging means should not be actuated until the flywheel motion has stopped.

Methods of ensuring the removal of the turnover bar from the barring hole include:

- a) Use of spring action on the end of the bar;
- b) Use of storage pockets for the bar, incorporating an interlock switch.

See also Annex A, Figure A.16.

E6.4 (For full–revolution clutch presses, see 6.3).

Air–pressure operated friction clutches are the predominant type of part–revolution clutches. Friction clutches operated by hydraulic pressure or electrically produced force are also sometimes used.

Other types of clutches include the eddy current clutch and positive clutches capable of being disengaged within the cycle.

The direct drive press does not have a clutch. Instead, it uses a motor to directly control the motion and stopping of the press slide. These direct drives match the operational characteristics of part–revolution clutches because the driving power may be interrupted during the cycle of the press.