

ANSI B11.15-2001 (R2007)

American National Standard for Machine Tools –

Safety Requirements for Pipe, Tube, and Shape Bending Machines

Secretariat and Accredited Standards Developer:

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McLean, VA 22102

Approved: DECEMBER 21, 2001
Reaffirmed: June 8, 2007

by the American National Standards Institute

American National Standard

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Published by
AMT – The Association For Manufacturing Technology
7901 Westpark Drive, McLean, VA 22102–4269, USA

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Printed in the United States of America

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Foreword

(This Foreword is not part of the requirements of American National Standard B11.15-2001)

The primary objective of this standard is to eliminate or control the risk of injuries to personnel associated with pipe tube and shape bending machines by establishing requirements for the machine's construction, operation and maintenance and for the production systems in which pipe, tube and shape bending machines are used. To accomplish this objective, responsibilities have been assigned to the supplier (manufacturer, rebuilder, reconstructor, and user) as well as to personnel in the working environment.

Point-of-operation safeguarding is the single most important factor in the elimination of point-of-operation injuries. A production system consists of the pipe, tube or shape bender as one component, feeding methods (including part or scrap removal) as a second component, and the third component, point-of-operation safeguarding. The vital third component, point-of-operation safeguarding, can be evaluated for effectiveness only after the first two components and operator involvement is known.

The safeguarding of production systems in pipe, tube and shape bending operations is complicated by the wide variety of operations and operating conditions, the variations in size, speed, and type of pipe, tube and shape bending machine used; the size, thickness, and kind of pieces to be worked; the required accuracy of the finished work; the skill of operators; the length of run; and the method of tube or shape feeding and 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 devices) have been covered in this standard.

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

Pipe, tube and shape bending machines, 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.

Inquiries with respect to the application or the substantive requirements of this standard, and suggestions for its improvement, are welcomed and should be sent to the AMT - The Association For Manufacturing Technology, 7901 Westpark Drive, McLean, Virginia 22102-4206, Attention: Safety Department.

This standard was processed and submitted for ANSI approval by the B11 Accredited Standards Committee on Safety Standards for Machine Tools. 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:

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Unified Abrasives Manufacturers' Association, Bonded Division	Charles S. Conant	
U.S. Department of the Navy (NAVSEA)	William C. Thacker	William Clark

At the time this standard was approved, the ANSI B11 ASC **B11.15 Subcommittee** had the following members who participated in the development of this revision:

Robert Grice, Chairman	Creation Windows
Thomas Glissman, Secretary	Pines Manufacturing
Robert Eggleston	Drion Safety Service, Inc. (Previously with G.E. Aircraft Engines)
Joseph Kelly	(Previously with Allegheny Teledyne Industries; past Chairman of the B11.15 Subcommittee)

Explanation of the format of the standard

This ANSI B11.15 – 2001 standard is divided into parts formerly referred to as sections or chapters and now referred to as clauses in line with the current ANSI style manual. Major divisions of clauses are referred to as subclauses and, when referenced by other text in the standard, are denoted by the subclause number (e.g., see 5.1).

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 felt would clarify the standard. This column should not be construed as being a part of the requirements of this American National Standard.

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 compliance with the 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.

By convention, the B11 standards do not use the term “and/or” but instead, the term “OR” is used as an inclusive disjunction, meaning *one or the other or both*.

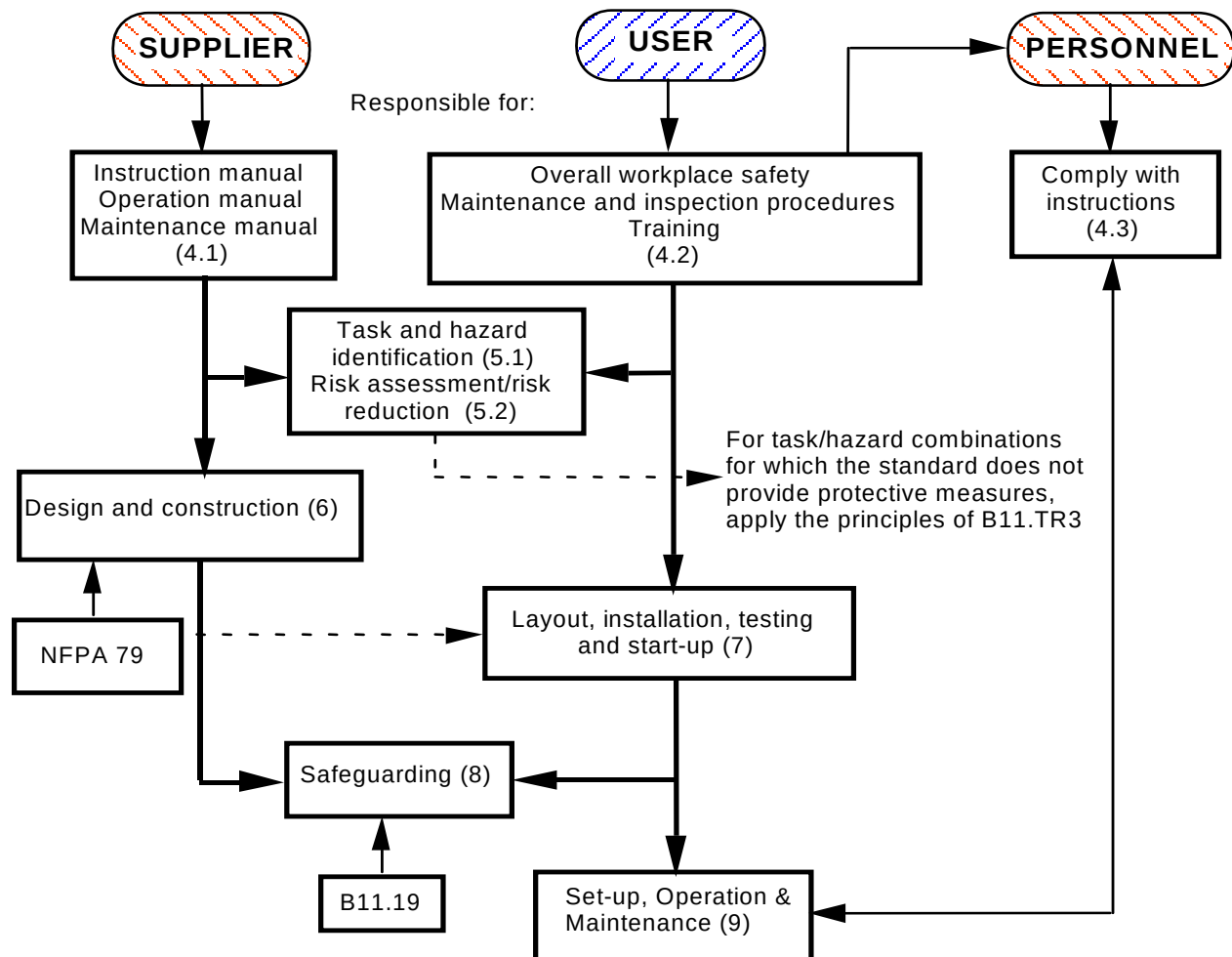
Suggestions for improvement of this standard will be welcome. They should be sent to AMT-The Association For Manufacturing Technology, 7901 Westpark Drive, McLean, VA 22102 - Attention: B11 Secretariat.

Introduction

The primary purpose of every machine tool is to process parts. This is accomplished by the machine imparting process energy onto the workpiece. Inadvertent interference with, or accidental misdirection of the released energy during production, maintenance, commissioning and de-commissioning may result in injury.

The purpose of the ANSI B11 series of machine tool safety standards is to devise and propose ways to minimize risks of the potential hazards. This can be accomplished either by an appropriate machine design or by restricting personnel or other individuals' access to hazard areas, and by devising work procedures to minimize personnel exposure to hazardous situations. This is the essence of the ANSI B11 series of safety standards.

The responsibility for the alleviation of these risks is divided between the equipment supplier, its user and its operating personnel, as follows (numbers in parentheses refer to the clause numbers in these standards which address that responsibility):



American National Standard for Machine Tools – Safety Requirements for Pipe, Tube, and Shape Bending Machines –

1 Scope

The requirements of this standard apply to any power-driven machine designed for bending pipe, tube, and shapes by means of bending dies, clamp dies, pressure dies, mandrels, wiper dies, vertical bending punches, radius dies, wing dies, and associated tooling.

NOTE - In the context of this standard, machine refers to pipe, tube, and shape bending machines.

1.1 Applications

The requirements of this standard apply to:

- Vertical hydraulic benders;
- Horizontal hydraulic benders;
- Horizontal mechanical benders;
- Horizontal or vertical combination hydraulic and mechanical benders and combination pneumatic and mechanical benders;
- Compression benders;
- Draw benders;
- Pipe benders;
- Stretch benders;
- Tube benders.

1.2 Exclusions

The requirements of this standard do not apply to:

- Bench presses;
- Hydro forming;
- Forging presses;
- Four-slide machines;
- Hydraulic presses;
- Mechanical presses;
- Power press brakes;
- Roll benders;
- Roll formers;
- Assembly machines.

1.3 Descriptions

E1

For examples of bending applications, see Figure 1.

E1.3

Examples of bending machines are shown in Figures 2 through 5 in Annex A.

Standard Requirements

Explanatory Information

1.3.1 Rotary draw bender

Draw bending is the most common method used on rotary-type bending machines, which can be powered by hydraulic, pneumatic, electric, mechanical, or numerically controlled means. The essential tooling for draw bending consists of the rotating bending form, clamping die, and pressure die.

In this method, the workpiece is secured to the bending form by the clamping die. As the bending die rotates, it draws the workpiece against the pressure die and, if necessary to prevent wall collapse, over an internal mandrel. The pressure die may remain fixed or it may move with the workpiece to eliminate sliding contact.

Draw bending is the most versatile and flexible bending method. It is used to make single bends up to 180° using standard tools, and to make multiple or compound bends using special tools (e.g., a mandrel) when making a progressive series of bends in the same tube.

1.3.2 Compression bender

Compression bending on a rotary bending machine uses a group of tools similar to those used in draw bending, except that the bending form is stationary and the clamp die is replaced by a movable-wiping shoe.

1.1.3 Compression bender requirements

The workpiece is clamped to the stationary form and the wiping shoe rotates around the form, wrapping the material against the bending form. This method is not practical for producing bends requiring a mandrel when there is more than one bend in a workpiece.

E1.3.1

Manual mode, see 6.3.1.

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 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated.

29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout)*

29 CFR 1910.333, *Selection and Use of Electrical Work Practices*

E2 Informative References

The following informative references provide additional guidance to the user of this standard:

For more information, go to www.osha.gov

For more information, go to www.osha.gov

Standard Requirements

Explanatory Information

ANSI B11.19-1990, for Machine Tools- *Safeguarding When Referenced by the Other B11 Machine Tool Safety Standards-Performance Criteria for the Design, Construction, Care and Operation.*

ANSI B11.TR3 – 2000 *Risk Assessment and Risk Reduction – A Guide to Estimate, Evaluate and Reduce Risks Associated with Machine Tools*

ANSI / ASME B15.1-1996, American National Safety Standard for Mechanical Power Transmission Apparatus.

ANSI B11.TR1 – 1994 *Ergonomic Guidelines for the Design and Installation of Machine Tools*

ANSI / ASME Boiler & Pressure Vessel Code, 2001, Division 1, Section VIII.

ANSI / NFPA-70-2002, *National Electrical Code.*

ANSI / NFPA-70E-1995, *Electrical Safety Requirements for Employee Workplaces.*

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

3 Definitions

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

3.1 automatic mode: Any operating mode that produces continuous cycling.

3.2 awareness barrier: An awareness device that warns individuals by means of physical contact.

3.3 awareness device: Any attachment that warns individuals of an approaching or present hazard.

3.4 awareness signal: An awareness device that warns individuals by means of audible sound or visible light.

3.5 bending: The application of stress concentrated at specific points to permanently turn, press or force from a straight, level or flat condition to a curved or angular configuration.

3.6 bending die(s): The tooling used in a bender for forming, or drawing.

3.7 bending form die: With a rotary bender, the tooling that determines the shape, contour or configuration of the material being bent.

3.8 bending punch die: With a vertical bender, the tooling attached to the slide to establish a specific material contour.

E3.6

See Figure 7 in Annex A.

E3.7

See Figure 7 in Annex A.

E3.8

See Figure 1 in Annex A.

Standard Requirements

Explanatory Information

3.9 category 0 Stop: The stopping of machine motion by removal of power to the machine actuators, all brakes or mechanical stopping devices being activated (i.e., an uncontrolled stop).

3.10 category 1 Stop: The stopping of machine motion by reducing the command signal to zero (0) but retaining power to the machine actuators during the stopping process (i.e., a controlled stop).

3.11 category 2 Stop: A controlled stop with power left available to the machine actuators.

3.12 clamp die: With a rotary bender, the tooling that retains the material against the bending form die.

3.13 compression bending: With a bending machine, the operation in which the material is bent by being wrapped around a bending form while being retained in compression by one or more wiping dies.

3.14 control reliability: The capability of the machine 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. See 3.65.

3.15 cycle: A complete movement of the bender, from the initial start position back to the same start position, that may include feeding and removal of the material or workpiece.

3.16 cycle stop: The stopping of a machine, initiated by the control system, at the completion of a cycle.

3.17 design: To develop and plan the machine to meet the intended purpose and function.

3.18 device: A component, attachment or mechanism designed to serve a specific purpose or perform a specific function.

3.19 dies: The tooling used in the bender.

3.20 draw bending: The operation in which the material is clamped or restrained against a bending form which rotates, drawing the material around the bend die, supported by a pressure die and, if needed, over a mandrel.

3.21 emergency stop: The immediate or controlled stopping of all hazardous machine motion. See also *category 0*, *category 1*, and *category 2* stops.

3.22 emergency stop control: An operator control, usually a push-button with a large red protruding mushroom head, that when actuated, initiates an

E3.12

See Figure 7 in Annex A.

E3.13

See Figure 1 in Annex A.

E3.21 The category used should be determined by the design of the control.

Standard Requirements

Explanatory Information

emergency stop.

3.23 feeding: The process of placing the material or workpiece into the machine, or removing the material or workpiece from the machine.

3.24 foot control: A foot-operated mechanism or device used as an actuation control.

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

3.26 hand tools: Any hand-held object designed for placing material to be processed within, or for removing processed parts from, the point of operation.

3.27 hazard: A condition or set of circumstances that can cause physical harm to exposed individuals.

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

3.29 hazardous motion: Motion of the machine or other equipment, or release of energy that poses a hazard.

3.30 immediate stop command: A command that initiates an action(s) to stop a hazardous motion (or situation) at any point in the machine cycle.

3.31 individual: A particular human being.

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

3.33 jog: To impart intermittent motion to the machine by momentary manual actuation.

3.34 jog mode: An operating mode wherein incremental motion is imparted to the machine by momentary manual operation of the drive motor by a single individual.

3.35 lockout procedure: The formal process for isolating an energy source, including stored energy, and the placement of a personal lock on the energy-isolating device by the individual involved.

3.36 maintenance: To keep in an existing state (as of repair).

3.37 mandrel: Tooling or a machine component used to

E3.26 Commonly used hand tools are loading plugs. For an example of a loading plug, see Figure 16 in Annex A.

E3.31 For the purposes of this standard, a distinction between *individual* and *personnel* is drawn. Individual includes personnel but encompasses persons who are not under direct or indirect control of the supplier or user (e.g., visitors, vendors, etc.). See also, *personnel*.

E3.37

Standard Requirements

Explanatory Information

provide internal support.

See Figure 6 in Annex A.

3.38 manual mode: Any operating mode of the machine that requires the operator to initiate and maintain motion of the machine during the cycle, or a portion of the cycle, by use of the actuating control.

3.39 manufacturer: Any supplier that designs, manufactures or assembles machines or systems.

3.40 modification: A change to the machine or production system that alters its original purpose, function, capacity, operation or safeguarding requirements.

NOTE - For the purpose of this standard, modifications include any effect that the change(s) has on other portions of the bender or production system, including safeguarding, not directly a part of the modifications.

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

3.42 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.

3.43 normal operation: The operating condition where the machine or production system performs the intended production functions.

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

3.45 operator: Any individual who performs production work and who controls the machine.

3.46 operator control: Any operator-actuated push-button, switch, lever, pedal, hand wheel or other device that initiates, cycles, controls or stops machine motion.

3.47 personnel: Individuals who are employed by the user.

3.48 pinch point: An area, excluding the point-of-operation or trapping space, that poses a hazard of exposure to moving parts of the bender, its related machines or equipment or the material or workpieces.

E3.47 Personnel includes subcontractors, consultants, or other contract workers under the indirect control of the supplier or user.

E3.48 The term "pinch point," as used in this standard, refers only to hazards that can exist as a part of the pipe, tube or shape bending machine. 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.

Standard Requirements

Explanatory Information

3.49 point-of-operation: The location in the bender where material or a workpiece is positioned and work is performed.

3.50 presence-sensing device: A device designed, constructed and arranged to create a sensing field, area or plane that will detect the presence of the operator's or other's hand or other body part and send a signal to the machine control system.

3.51 pressure die: With a bending machine, the tooling used in conjunction with the rotating bending form die to retain compression of the material during the bending operation.

3.52 programmable electronic system (PES): An electronic system that performs logical, decision-making or arithmetic functions by executing instructions in a specific manner. The system usually includes input and output elements (ports) and is usually re-programmable.

3.53 punch: The male part of the die.

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

3.55 reconstructor: See *rebuilder*.

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

3.57 risk: A combination of the probability of injury occurring and the probable degree of severity.

3.58 run: The operating mode that produces single cycle or continuous operation of the bender.

3.59 safe work procedure: Any formal written documentation of safe practices required to eliminate or control exposure of personnel to hazardous machine motion during operation, service or maintenance tasks.

3.60 safeguard (verb): To make safe.

3.61 safeguarding: Methods of protection of individuals from hazards using guards, safeguarding devices or methods, or safe work procedures.

3.62 safeguarding device: Any mechanical attachment or control device, other than a barrier guard, that prevents inadvertent access to a point-of-operation hazard during the hazardous motion of the bender, or prevents hazardous motion of the bender during access to the point-of-operation hazards.

E3.50 Examples include optical sensors (programmable or fixed), safety mats, and trip wires.

E3.51 See Figure 7 in Annex A.

E3.53 See Figure 1 in Annex A.

E3.61 See Figures 12, 13, and 14 in Annex A.

Standard Requirements

Explanatory Information

3.63 safeguarding method: Any physical arrangement of the production system to ensure that the operator cannot reach the point-of-operation hazard during the hazardous portion of the bending cycle.

3.64 safety mat: A type of presence-sensing device that senses an individual stepping or standing on its surface.

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

3.66 set-up: The process of adjusting the bender and the installation and adjustment of the workholding devices or tooling and appropriate safeguarding to ensure proper and safe operation of the bender.

3.67 set-up operator: An individual who is responsible for preparing the bender prior to production operations.

3.68 stop: Immediate or controlled cessation of bender motion.

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

3.70 stop control: An operator control used to initiate a bender stop.

3.71 stretch bending: With a bending machine, the forming where the entire workpiece is stretched longitudinally and wrapped about a form.

3.72 supplier: An individual, corporation, partnership or other legal entity or form of business that provides, or makes available for use, all or part of the press brake or press brake production system.

NOTE – When the user provides any of the above services, the user is considered to be the supplier within the scope of that work activity.

3.73 tag-out procedure: The formal process for isolating an energy source, including stored energy, and the placement of a designated personal tag on the energy isolating device, by the individual involved.

3.74 task: Any specific activity that is done on or around the machine during its lifecycle.

3.75 tolerable risk: Risk which is accepted for a given task and hazard combination.

3.64 See Figure 14 in Annex A.

E3.71 See Figure 8 in Annex A.

E3.72 Besides the manufacturer, the supplier can include the manufacturer's agent, representative, or distributor, reseller, installer, modifier, rebuilder or integrator who provides equipment or services associated with the machine.

Standard Requirements**Explanatory Information**

3.76 tooling: Elements for guiding or imparting a desired configuration to the material.

E3.76 See Figure 7 in Annex A.

3.77 two-hand control: An actuating control that requires the concurrent use of both hands of the operator to initiate or continue the machine operation in the selected mode.

3.78 two-hand control device: An actuating control, used as a safeguarding device that requires the concurrent use of both hands of the operator to initiate machine motion through the hazardous portion of the machine cycle.

3.79 warning: A means used to call attention to a hazard or unsafe work practice.

3.80 wing die: With an upright compression bender, the tooling mounted to the lower portion of the machine.

E3.80 See Figure 1 in Annex A.

3.81 wiper die: With a rotary bender, the tooling used to wrap and to fill the void behind the bending form die.

E3.81 See Figure 9 in Annex A.

3.82 wiper shoe: With a rotary bender, the tooling used to wrap material around the bending form while forming a compression bend.

E3.82 See Figure 1 in Annex A.

3.83 work area: The employer shall provide clearance between machines so that movement of one operator will not interfere with the work of another. Ample room for cleaning machines, handling material, workpieces and scrap shall also be provided. All surrounding floors shall be kept in good condition and free from obstructions, grease, oil, and water.

3.84 workpiece: Any material or part to be placed into the bender, for having work performed upon it.

4 Responsibility

4.1 Supplier's responsibility

For purposes of this standard, the supplier can be the manufacturer, integrator, modifier, rebuilder or installer of the pipe, tube or shape bending machine, or its associated equipment.

4.1.1 Scope of work activity

Within the scope of the work activity, the supplier shall be responsible to ensure that the design, construction, modification, installation and safeguarding are in

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accordance with clauses 5, 6, 7 & 8.

4.1.2 Task and hazard identification

The supplier shall be responsible for identifying sources of hazards within the scope of their work activity in accordance with 5.1 and Annex B.

4.1.3 Risk assessment / risk reduction

The supplier shall be responsible for assessing and reducing the risks identified in 4.1.2, in accordance with clause 5.

4.1.4 Documentation (information for use)

The supplier shall be responsible for providing documentation to the user that establishes guidelines for the installation, operation and maintenance of the pipe, tube or shape bending machine and its associated equipment.

4.1.5 Modification / reconstruction

It shall be the responsibility of any supplier modifying or reconstructing the machine or its associated equipment to furnish documentation for the modifications or reconstruction, or to establish new or changed guidelines for the operation, installation, and maintenance of the machine modified or reconstructed.

4.1.6 Maintenance manual

The supplier shall provide a maintenance manual for all new machines. The machine manufacturer shall furnish, in writing or by diagram, the layout needed by personnel for lubrication, adjustment, coolant reservoir cleaning and similar routine maintenance activities. Modifiers or reconstructors of machines shall provide a maintenance manual for the machine so modified or reconstructed.

E4.1.4

The machine documentation should contain the following:

- 1) a clear description of the machine and its installation including:
 - foundation requirements for the machine anchorage;
 - power consumption requirements;
 - equipment layout;
 - work area safeguarding methods;
 - preparation prior to start-up;
 - energy sources;
 - installation and anchoring requirements of safeguarding devices.
- 2) the system performance specifications;
- 3) physical environment requirements (e.g., vibration & noise levels);
- 4) information on the programming, operation and frequency of inspection and maintenance;
- 5) frequency and method of functional testing;
- 6) guidance on the repair and maintenance of the system and its safeguards.

E4.1.5

Any change of components / operation that is different than that which was supplied by the original manufacturer requires documentation.

E4.1.6

Due to the wide variety of machines covered in this standard, specific machines may require additional information; however, the maintenance manual should include the following minimum information:

- Function and location of all controls;
- Lubrication specification, including recommended lubricants, frequency of lubrication, and locations to be lubricated;
- Electrical, hydraulic, lubrication, and pneumatic diagrams;
- Periodic maintenance instructions;

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4.2 User's responsibility

The user shall be responsible for the overall workplace safety of personnel. The user shall review the machine and its associated equipment including installation and set-up and any modifications as provided by the supplier(s) to ensure their compliance with clauses 6, 7, 8 and 9 of this standard.

4.2.1 Task and hazard identification

The user shall ensure that:

- a) The recognized hazards for the tasks to be implemented on the machine are identified (see 5.1);
- b) The safeguarding required to eliminate or control the identified hazards is provided, used, and maintained in accordance with clause 8 of this standard (see 5.2);
- c) A procedure for the inspection and maintenance of the machine is established to ensure that its parts, point(s) of operation, safeguarding, and other protective devices are in safe operating condition and adjustment;
- d) The supervision team leader/work leaders to assure that correct and safe operating procedures are being followed;
- e) It is in conformance with ANSI / NFPA 70E.

4.2.2 Risk assessment / risk reduction

The user shall be responsible for assessing and reducing the risks identified in 4.2.1, in accordance with 5.2.

- Safety instructions for maintenance personnel;
- Energy control/isolation points.

The operations manual should include the following information:

- Function and location of all controls;
- Function of limit switches and solenoids;
- Sequence of operations;
- Bending machine functions and operations.

E4.2

The user should provide, or require others to provide the necessary safeguarding.

One method that may be used to identify hazards and establish a risk reduction strategy is to form a team of individuals from the various disciplines involved with the design, construction, operation and maintenance of the machine.

E4.2.1

Users should consult the supplier's instructional material regarding the unpacking, handling, installation, operation and maintenance including safeguarding of the machine.

Standard Requirements**Explanatory Information****4.2.3 Installation and start-up**

The user shall be responsible for ensuring that installation and startup of the machine and its production system is in accordance with clause 7.

The user shall ensure that all set-up and maintenance personnel and operators are trained to perform the functions for which they are responsible. The training shall include familiarizing the personnel with the portions of this standard related to their work.

The following shall be required and shall be expanded as it applies to a particular condition:

- a) the functions and location of all controls;
- b) a safe method for installing, removing, and adjusting tooling;
- c) the location of all emergency stop buttons, devices and cables;
- d) the location and method for installation and adjustment of all safety devices and guards;
- e) the use of safe operating techniques.

4.2.4 Safeguarding

The user shall be responsible for ensuring that safeguarding is provided, installed, maintained, and used in accordance with clause 8, for all individuals involved in the production process.

The user shall determine what guards, devices or protective equipment are required, and shall train the individual and enforce the use of the equipment guards or devices.

The user shall provide or require others to provide the necessary safeguarding.

The user shall ensure the use of at least one of the following methods of point-of-operation safeguarding that affords protection for the operator, consistent with the requirements of the operation:

- 1) A point-of-operation guard;
- 2) A safeguard device;
- 3) A point-of-operation awareness barrier shall only be used where the point-of operation guard or safeguard device is not an emergency stop device.

E4.2.3

Examples of the machine operator's, helper's, or set-up individual's responsibilities:

- a) Follow all safety practices and procedures given in this standard that apply to their actions and conduct.
- b) Notify their supervisor, team leader / work leader when they observe an unsafe practice or condition.
- c) Properly use all personal protective equipment as specified by their user.
- d) Install, position, or adjust safety 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 each set-up during each shift. Severe operating conditions should require more frequent checking.
- g) Do not wear clothing or jewelry that will present a hazard to their personal safety.
- h) Maintain an orderly work area. Particular attention should be given to the storage of tools or parts that could be dislodged and fall or roll.
- i) Never slow or stop the bending component or workpiece by hand gripping of the workholding device or the workpiece.

E4.2.4

The user should document and implement methods of operation that will protect the operator to the fullest extent where feasible by:

- a) Design;
- b) Point-of-operation guarding;
- c) Safeguard device;
- d) Point-of-operation awareness barrier device;
- e) Hand tools;
- f) Personal protective equipment.