# BSR/ O1.1 (202X)

**Safety Requirements for Woodworking Machinery**

**Secretariat**

**Wood Industry Association®**

**(WIA)®**

**Approved on [Enter date]**

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# Forward

*(This forward is not part of American National Standard O1.1-202X.)*

## Historical Perspective

The recorded history of the ANSI O1.1 standard begins in 1924 with the United States Department of Labor, Bureau of Labor Statistics (BLS). Published as BLS Bulletin Number 378 in December 1924, it was clearly intended for use in the woodworking industry. The original document, titled *Safety Code for Woodworking Plants*, began with this introduction:

> **This woodworking safety code is primarily intended to cover the hazards of the "point of operation" in woodworking machinery from the crude lumber to the finished product.**

It further offered this as the scope of the standard:

> **This code is intended as a guide for the safe operation and maintenance of woodworking machinery, including cooperage and making of veneer. It deals primarily with "point of operation" hazards on woodworking machinery.**

The cover page of the standard indicates it was sponsored by the International Association of Industrial Accident Boards and Commissions, and the National Bureau of Casualty and Surety Underwriters. It was further approved as a "Tentative American Standard" by the American Engineering Standards Committee (AESC) on October 16, 1924. The AESC later became the American Standards Association (ASA) and today is known as the American National Standards Institute (ANSI).

A revision of the 1924 standard was sponsored by the International Association of Industrial Accident Boards and Commissions and The National Bureau of Casualty and Surety Underwriters. That revision was approved by the ASA and issued in 1930 as Bureau of Labor Statistics Bulletin No. 519.

The first standard revision bearing the O1.1 designation was approved by the ASA in 1944. The standard title was changed to *American National Safety Code for Woodworking Machinery.*

The Standards Committee was reorganized in 1952, and the scope of the standard was changed to exclude the manufacture of structural plywood. A comprehensive revision of the section on cooperage machinery was completed and a new section dealing with radial-type saws was included. The resulting standard was issued in 1954 and reaffirmed in 1961.

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In 1969 the Standards Committee was again called and revised the 1954 (R1961) standard. The 1971 revision was retitled *American National Standard Safety Requirements for Woodworking Machinery*. Several issues related to guarding were corrected and clarified. The revision also incorporated as a section of the standard an important head note in Section 6.1 of earlier versions of this standard.

The standard was again revised and issued in 1975. In 1979 an amendment was made to the 1975 edition. Subsequent updates were published in 1992, 2002, 2004, 2009 and 2013.

Prior to the 2004 edition, the committee adopted a resolution regarding the US Occupational Safety and Health Administration (OSHA). The resolution remains in agreement with this edition and is therefore reproduced here:

> *Resolved: As the standards developed by this committee are relevant to the health and safety of workers in the wood working industry, and as this committee is charged with developing such standards and recognized for its expertise in wood working industry safety and machinery, it is the intent and expectation of this committee that newly published versions of standards developed by this committee be adopted by the US Department of Labor as regulations under the United States Occupational Safety and Health Act.*

The 2004 edition marked the beginning of a new process for the standard. Hereafter, new standards for specific machine types will be developed within the scope of the O1.1 standard. Thus the O1.1 standard will be developed and applied as an "umbrela" under which subsequent standards are developed. In 2013, the standard was republished with editorial changes. The 2013 edition was reaffirmed in 2023.

This revision of the O1.1 standard carries on the umbrella standard process by reorganizing the O1.1 general machine safety requirements sections to include the requirements generally applicable to woodworking machines. The entire standard has been reviewed and updated as needed. The format of the standard has been reorganized. Newly organized sections include:

3. References

4. Hazard Identification and Control

5. Standards for Design. (Subsection 5.1 includes updates to the "General Requirements" clauses of the previous edition. Subsection 5.2 includes updates to the "Machine Specific Requirements" of the previous edition. A machine specific section continues to be included in this edition to maintain coverage continuity for those specific machine types that do not yet have their own separate machine specific standard.)

6. Responsibilities. (This section includes updates to the "Care and Maintenance Requirements" and "Requirements For The Use Of Woodworking Machinery" of the previous edition.Appendix A -- An appendix of machine illustration examples has been added.

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Prior to the publication of this current edition of O1.1, the Accredited Standards Committee O1 (ASC O1) adopted a resolution regarding standards governing the safety of woodworking machinery that are developed outside the dominion of ANSI. The resolution remains in agreement with this edition and is therefore reproduced here:

> *Resolved: As part of the ASC O1 responsibility for developing standards applicable within the region of influence of the American National Standards Institute (ANSI), the ASC O1 endeavors to maintain reasonable awareness of standard developments occurring outside that ANSI dominion. The ASC O1 resolves to remain vigilant for opportunities of alignment with such standards whenever possible and in so far as it furthers the safety of woodworking machinery applications.*

**Changes Found in This Version:**

Both substantive and editorial changes have been made in this edition.

Suggestions for improvement of this standard are welcome.
They should be sent to the Wood Industry Association,
2331 Rock Spring Road, Forest Hill, MD 21050
allison@woodindustry.org.

**Effective Date**

The following information on effective dates is informative guidance only, and not a normative part of this standard. The Accredited Standards Committee O1 (ASC O1) 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 ASC O1 Standard Development Committee recommends that suppliers complete and implement design changes for new machinery and machinery systems within 30 months of the approval of this standard.

The ASC O1 recommends that users evaluate whether existing machinery and machinery systems can implement the requirements of this new edition 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 applicable requirements of this standard or the machine-specific safety standard

of the ANSI O1 safety standards to implement risk reduction measures (protective measures) for appropriate risk reduction.

The following list represents membership at the time the committee was balloted on the final text of this edition. Since that time, changes in membership may have occurred:

| Full Name | Interest Category | Sponsoring Organization |
|---|---|---|
| Jack Hyde, *Chairman* | | System Safety Society |
| Richard Otterbein, *Vice-Chairman* | | Affiliated Engineering Laboratories, Inc. |
| Al Weaver | | American Society of Safety Professionals |
| Amanda Johnson | | SawStop LLC |
| Brad Graves | | Accu-Router, Inc. |
| Bruce Rosenthal | | U.S. TAG to ISO/TC 39/SC 4 |
| Bryon Snapp | | Oregon OSHA |
| Chuck Arnold | | Kitchen Cabinet Manufacturers Association |
| David Felinski | | B11 Standards, Inc. |
| Drew Hornick | | Power Tool Institute |
| Eric Ruzicka | | UL Solutions |
| James Orr | | James L. Taylor Mfg./Cameron Automation |
| Jason Hunter | | |
| Mark Nobles | | Grizzly Industrial |
| Ted Sberna | | White Horse Safety |
| Warren Weber | | Standards Consultant (WIA) |
| Tom Onsrud | | C. R. Onsrud Inc. |
| **Alternates** | | |
| George Pfreundschuh *(Alt.)* | | Affiliated Engineering Laboratories, Inc. |
| Andy Phan *(Alt.)* | | SawStop LLC |
| Dave Miller *(Alt)* | | White Horse Safety |
| **Staff** | | |
| Allison Forsythe | | Wood Industry Association |

Others contributing to the publication of this standard, but not active on the ASC O1 Committee at this time of this standard's publication are:

| Full Name | Sponsoring Organization |
|---|---|
| Michael L. Gililland | Wood Machinery Manufacturers of America |
| Bill Perdue | American Home Furnishings Alliance |
| Mark Craig | Wood Machinery Industry Association |
| Dave Hansen | Safety Speed Cut Manufacturing |
| James Harris | National Institute for Occupational Safety & Health |
| Richard Current | National Institute for Occupational Safety & Health |
| Carl Webb | Kitchen Cabinet Manufacturers Association |
| Bill Pritchard | Kitchen Cabinet Manufacturers Association |

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| John Stimitz | Underwriters Laboratories |
| Stephen Gass | SawStop LLC |
| Eric Ward | SawStop LLC |
| Bob Newton | SawStop LLC |
| Bauer, Mary | Occupational Safety and Health Administration |
| Craig Schemenauer | Weather Shield Windows and Doors |
| Ashley Goodin | Architectural Woodwork Institute |
| Jim Laster | Newman Machine Company, Inc. |
| Jody Allen | Wood Machinery Industry Association |
| Peter Domeny | Subject Matter Expert |
| Todd Ransom | Grizzly Industrial |
| Amanda Conger | Cabinet Makers Association |
| Ryszard Szymani | Member at Large |
| Bob Woods | Masonite Corporation |
| Steve Ziegeweid | Ashley Furniture |
| Madison Burt | Wood Machinery Industry Association |
| Donte Shannon | Wood Machinery Industry Association |
| Pricilla Magee | General Interest |
| Riley Peterson | Safety Speed Mfg. Co., Inc. |
| Olivia Mueting-MacDonald | Wood Machinery Industry Association |
| **Alternates** | |
| Greg Gramp (Alt.) | Kitchen Cabinet Manufacturers Association |
| Neal Growney (Alt.) | American Society of Safety Engineers |
| Al Pierga (Alt.) | Power Tool Institute |
| Richard Titus (Alt.) | Kitchen Cabinet Manufacturers Association |
| Richard Schafebook (Alt.) | Power Tool Institute |
| John Copeland (Alt.) | |
| **Staff** | |
| Nikki Augsburger | Wood Industry Association |

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# Table of Contents



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| STANDARD REQUIREMENTS | EXPLANATORY INFORMATION<br>(*These notes are not a mandatory part of this standard)* |
|---|---|
| **1 Scope, Purpose, and Application** | |
| **1.1 Scope**<br>This standard covers the safety requirements for the design, installation, care and use of wood-working machinery and accessory equipment, used in industrial and commercial applications, having a total connected power of 5 hp (3.7kw) or greater, or having 3-phase wiring. | *E 1.1 Scope*<br>*Design of products outside of the scope of this standard and not specifically excluded in paragraph 1.1.1 are referred to as ANSI/UL 62841 series of standards or other standards covered by individual requirements.*<br>*Governmental, educational, and similar institutions as well as business establishments are considered commercial applications in this standard* |
| **1.1.1 Machine Types Excluded**<br>Power tools intended to be handheld in use, assembly machines, finish application equipment, primary panel product manufacturing machinery, cooperage machinery, sawmills, and machinery covered by other American National Standards are excluded from this standard. | *E 1.1.1 Machine Types Excluded*<br>*Primary panel product manufacturing machines are referred to as panel mills or board mills. Panel products as identified in this standard are plywood, particle board, medium density fiberboard, chipboard, straw board, oriented strand board, pressed board, and similar products made from wood, wood chips or wood fiber.* |
| **1.1.2 Purpose**<br>The purpose of this standard is to establish the safety requirements for the design, installation, care and use of woodworking machinery and accessory equipment covered by this standard. | |
| **1.2 Additional Requirements**<br>In addition to the requirements of this standard, standards for specific woodworking machines exist. New standards are issued periodically. The user of this standard shall review the ANSI catalog to determine if additional machine specific standards are applicable to their woodworking operations. Where conflicts in the requirements exist, the machine specific standard shall apply. | *E1.2 Additional Requirements*<br>*This standard should be applied to all woodworking machines within its scope. Where machine-specific standards exist within this ANSI O1 series they are intended to be used in conjunction with this standard.*<br>*Machine specific standards can be found at https://webstore.ansi.org/. Using the letter "O", search for O1.1 under document number.* |

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| **2 Terminology** | |
| **2.1 Definitions** | |
| **2.1.1 Abrasion**<br>Source of possible injury as a result of wearing, grinding, or rubbing by friction. | |
| **2.1.2 Administrative Controls**<br>Measures used to reduce risks by informing individuals of significant risks, communicating procedures, and training, or through the use of tools and/or personal protective equipment (PPE). | *E2.1.2 Administrative Controls*<br>*Administrative controls include, but are not limited to:*<br>*•awareness means (barriers, signals, signs, and markings);*<br>*•administrative safeguarding methods;*<br>*•procedures and training (information for use, safe work procedures, inspection, training, and control of hazardous energy);*<br>*•tools (workholding equipment and hand tools);*<br>*•personal protective equipment (PPE).*<br>*See also ANSI B11.0 for additional information on the hierarchy of controls.* |
| **2.1.3 Access Door**<br>A door cover which closes access to a hazard area not used in the processing of workpieces or an area used in machine setup. | |
| **2.1.4 Accessory**<br>Item(s), in addition to the machine components provided, that are mounted to or used with a woodworking machine to allow the safe performance of specific additional operations or maintenance procedure(s). | *E2.1.4 Accessory*<br>*Some accessory items are jigs, fixtures, feeding devices, special guards, dust hoods, grinding attachments, push sticks, and similar items.* |
| **2.1.5 Anti-Kickback Device/Finger/Dog**<br>A device that allows the movement of the workpiece in the feeding but reduces the likelihood of the rapid movement of the workpiece in the direction opposite the feed. | |
| **2.1.6 Arbor**<br>A rotating shaft used for mounting and transmitting torque to a cutting tool(s). | *E2.1.6 Arbor*<br>*A rotating shaft which can also be described as a spindle* |

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| **2.1.7 Automatic Mode**<br>The condition of a machine that, once activated, will complete a function or series of functions without operator intervention. The function or series of functions will continue until interrupted or completed. | |
| **2.1.8 Rip Saw Automatic Loading Mode**<br>In the automatic loading mode, material is brought to the infeed side of the machine by a material handling system that aligns the workpiece and introduces it into the feed system of the saw. The sole operator manipulates the material handling system and saw controls and the operator does not physically feed the workpiece into the machine. | *E2.1.8 Rip Saw Automatic Loading Mode*<br>*Automatic Loading Mode is generally used for Straight Line Rip Saws functioning in tandem for sequentially processing both sides of the workpiece. In this mode, there is no workpiece feed operator or off bearer. See ANSI B11.20 for additional safety requirements and guidance regarding Straight Line Rip Saws used in such Integrated Manufacturing Systems.* |
| **2.1.9 Auxiliary Fence/Filler Piece**<br>A stationary spacer device used on the table or fence of a circular saw to help avoid the interference between a hood guard and the fence. | |
| **2.1.10 Awareness Barrier**<br>An object that by physical contact warns the operator of a nearby hazard. | *E2.1.10 Awareness Barrier*<br>*Awareness barriers do not necessarily prevent or restrict access. Rather, they serve to make the operator aware of the hazard zone without restricting access to the zone.* |
| **2.1.11 Barrier**<br>A physical obstruction that provides a means of preventing the intrusion of an operator or others into a hazard or hazard area. | |
| **2.1.12 Bevel Cut**<br>A cut made at an angle to the face of a workpiece. | |
| **2.1.13 Crosscutting**<br>A sawing operation through the thickness of the workpiece made across the grain in natural wood or across the shorter dimension on a rectangular workpiece of reconstituted wood or plastics. | |
| **2.1.14 Crosscutting Fence**<br>A fence with a workpiece guiding surface perpendicular to the cutting device or set to a miter an- | |

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| gle with respect to the cutting device and designed to move parallel to the plane of the cutting device during the cutting process or to position the workpiece for a table saw with a sliding table function. | |
| **2.1.15 Crush**<br>See "pinch, nip and crush" | |
| **2.1.16 Cutting**<br>Severing with a single sharp edge. | *E2.1.16 Cutting*<br>*See also shearing.* |
| **2.1.17 Dado**<br>A straight sided non-through slot, perpendicular to the face of the workpiece, having a width greater than the thickness of a single saw blade. | |
| **2.1.18 Education**<br>The process of imparting knowledge or skill through systematic instruction without hands-on training, through lecture, discussion, interactive computer learning, video tape, written material or similar media. | *E2.1.18 Education*<br>*See also Training. As used in this standard, the term education does not necessarily include formal classroom instruction or hands-on training.*<br>*See B11.0 for guidance on systematic instruction.* |
| **2.1.19 Ejection**<br>The unexpected movement of the workpiece, parts of it or part of the machine from the machine during processing. | *E2.1.19 Ejection*<br>*See also, kickback, overfeed, and thrown object.* |
| **2.1.20 Employee**<br>A person who supplies services to an employer generally for a monetary reward. | *E2.1.20 Employee*<br>*For the purposes of this standard an employee is also one who provides volunteer services, a government employee, or a student in an educational institution.* |
| **2.1.21 Employer**<br>A legal entity who engages the services of others recognized as employees for an agreed upon remuneration. | *E2.1.21 Employer*<br>*For the purposes of this standard an employer is also a governmental agency (or agencies), school district(s) or similar organization(s). This definition also includes volunteer organizations.* |
| **2.1.22 Engineering Controls**<br>Guards or devices and associated safety-related parts of the control system (SRP/CS) used to reduce risk. (See *Safeguard*) | *E2.1.22 Engineering Controls*<br><br>*Guards may include, but are not limited to:*<br>•*fixed guards;*<br>•*movable guards;*<br>•*adjustable guards;* |

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| | *•nip guards;*<br>*•power transmission guards;*<br>*•shields.*<br><br>*Devices may include, but are not limited to:*<br>*•5.1.7.4 devices;*<br>*•movable barrier devices;*<br>*•presence-sensing devices;*<br>*•actuating controls;*<br>*•enabling devices;*<br>*•emergency stop devices.*<br><br>*SRP/CS include parts of machinery control systems that provide safety functions which can consist of hardware and software and can either be separate from machine control or an integral part of it.*<br>*See also, ANSI B11.0 and ANSI B11.26.* |
| **2.1.23 Enclosure Guard**<br>A physical barrier preventing exposure to a machine hazard. | |
| **2.1.24 Entanglement/Entrapment**<br>Captured, caught, snared, pinned, snagged or otherwise held by part of a machine and/or by a workpiece. | |
| **2.1.25 Featherboard/Comb**<br>A work-guiding and hold down device consisting of stock with a series of spring-like fingers along one edge, set and positioned at an angle to the workpiece. | *E2.1.25 Featherboard/Comb*<br>*The purpose of the device is to guide and hold down a workpiece and in so doing, help acceptably control the risk of kickback. Putting the fingers at an angle to the workpiece provides the means of having a spring-like and anti-kickback type action.* |
| **2.1.26 Feeding**<br>The controlled movement of a workpiece or cutting tool to process a workpiece during a woodworking operation. | |
| **2.1.27 Fence (Guide)**<br>A device used to locate and guide a workpiece relative to the cutting tool. | *E2.1.27 Fence (Guide)*<br>*This use of the term "fence" is also known as a rip fence.* |

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| **2.1.28 Fence (Barrier)**<br><br>See *Barrier* | |
| **2.1.29 Fixture/Jig**<br>A device that locates, holds, and/or clamps one or more workpieces in a desired position so that the operation can be performed. | *E2.1.29 Fixture/Jig*<br>*Devices of this type include a jig, rotating table, and similar work holding devices.* |
| **2.1.30 Freehand**<br>Freehand operation is the condition where an operator hand-feeds a workpiece or tool to complete an operation without the use of a guide or locating device and where the path of the workpiece or tool is entirely dependent on the skill of the operator. | *E2.1.30 Freehand*<br>*The locating or guiding devices referred to are templates, fence, miter gauges, fixtures and similar devices.* |
| **2.1.31 Guard**<br>A physical barrier preventing exposure to a machine hazard. | |
| **2.1.32 Hazard Zone**<br>Any space in or around the machine in which a person is exposed to an unreasonable risk of harm from machine related hazard(s). | |
| **2.1.33 Hold-To-Run Device**<br>A switch, lever, button, or other device, enabled by the “jog mode,” which must be manually and continuously activated to cause the machine to function. When released, the function stops. | |
| **2.1.34 Impact**<br>Struck by or against an object with sufficient energy to cause injury. | |
| **2.1.35 Installer**<br>A legal entity responsible for the installation of machines for use in woodworking operation. | |
| **2.1.36 Instruction**<br>See definitions for education and for training. | |

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| **2.1.37 Interlocking Device**<br>A control system device that is intended to preclude an action from being initiated in an unintended manner or stop an action in a safe fashion, or both, when the device is actuated. | *E2.1.37 Interlocking Device*<br>*Where interlocked barrier guard(s) are used to protect from motion hazards, access is typically prevented before cessation of the hazardous motion and startup of motion is prevented while access is allowed.* |
| **2.1.38 Jig/Fixture**<br>A moveable device to locate, hold, and guide one or more workpieces in the desired position so operations can be performed and, if hand fed, provide hand holds that keep the operators hands a safe distance from the cutting tool. | *E2.1.38 Jig/Fixture*<br>*Jigs can be referred to as templates or forms and can be used to guide and/or limit the relative positions of the workpiece(s) and tool(s).* |
| **2.1.39 Jog Mode**<br>That mode of operation in which a hold-to-run device controls machine operation. | *E2.1.39 Jog Mode*<br>*The term "inch mode" has also been used in this context, but the term is archaic and can be confusing. It is therefore no longer a recommended term.* |
| **2.1.40 Kerf**<br>The slot made by a saw blade as it saws through a workpiece. | |
| **2.1.41 Kickback**<br>A particular form of ejection describing the unexpected movement of the workpiece, or parts of the workpiece, opposite to the direction of feed during processing. | *E2.1.41 Kickback*<br>*When the workpiece is being fed against the rotation of the tool or cutter, the tool or cutter can grab the workpiece and throw it in the direction opposite the feed.* |
| **2.1.42 Kickback Zone**<br>A 3-dimensional hazard zone volume into which materials would be ejected if not stopped by the anti-kickback device(s). | *E2.1.42 Kickback Zone*<br>*Kickback zones should be free of operators, passerby's, traffic or workstations or similar exposure risks.* |
| **2.1.43 Maintenance**<br>Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or un-jamming of machines or equipment and making adjustments or tool changes. | |

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| **2.1.44 Maintenance Mode**<br>A machine's operational state which is intentionally set for the purpose of performing maintenance and or machine set-up. | |
| **2.1.45 Manual, Instruction**<br>A permanent or semi-permanent booklet of instructions provided by the manufacturer on the construction, installation, care and use of a woodworking machine or accessory. | |
| **2.1.46 Manual Mode**<br>An operating condition where each segment of the operation requires an action on the part of the operator to initiate or maintain it, or both. | |
| **2.1.47 Manufacturer**<br>A legal entity responsible for the design, manufacture, quality and sale of a woodworking machine or accessory. | *E2.1.47 Manufacturer*<br>*The word includes any or all of the following operations: – designing, fabricating, casting, machining, inspecting, testing, painting, crating and shipping.* |
| **2.1.48 Miter Gauge**<br>A type of crosscutting fence designed to be guided by slot(s) in the workpiece support table. | |
| **2.1.49 Modifier**<br>A legal entity modifying a previously manufactured woodworking machine or accessory in a way that changes the original purpose, function or capacity of the machine or machinery system by design or construction. | |
| **2.1.50 Nip**<br>See "pinch, nip and crush" | |
| **2.1.51 Normal Operator Position/Station**<br>Where the operator is expected to be positioned when operating the machine. | |
| **2.1.52 Numerical Control, Or Numeric Control**<br>A control system using numerical data that allows for the preprogramming of all or part of a machine cycle. | *E2.1.52 Numerical Control, Or Numeric Control*<br>*Numerical control, or numeric control: The data can be entered into the control system by punched tape, magnetic tape, bubble memory or computer.* |

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| **2.1.53 Operator**<br>An individual who performs production work and who controls the machine. | |
| **2.1.54 Overfeed**<br>A particular form of ejection describing the unexpected movement of the workpiece, or parts of the workpiece, in the same direction as the feed during processing. | *E2.1.54 Overfeed*<br>*When the workpiece is being fed in the same direction as the rotation of the tool or cutter, and the cutting action overpowers the feed device, the workpiece can be rapidly accelerated through the machine and ejected.* |
| **2.1.55 Pinch, Nip and Crush**<br>A category of injury, distinguished by magnitude, as a result of a body part being squeezed between two objects. | |
| **2.1.56 Point-Of-Operation**<br>The location on the workpiece where a woodworking operation is being performed. | *E2.1.56 Point-Of-Operation:*<br>*Area where chips or sawdust are being produced in processing a workpiece.* |
| **2.1.57 Point-Of-Operation Area**<br>The point-of-operation area is that hazard zone surrounding the point-of-operation where a hazard(s) exists that can cause personal injury. | *E2.1.57 Point-Of-Operation Area*<br>*Examples of hazards in this zone are the rotating cutter or workpiece, rotating, moving or both, and the splinters or sawdust being thrown from the machine, generated at the point-of-operation.* |
| **2.1.58 Pressure Rollers**<br>Rollers that apply pressure to the material to enhance contact with the feed mechanism. | |
| **2.1.59 Projectile**<br>An object ejected by the machine and continuing in motion by its own inertia. | |
| **2.1.59.1 Hazardous Projectile**<br>Any object ejected by the machine and continuing in motion by its own inertia and of sufficient mass and velocity to be reasonably capable of causing injury. | |
| **2.1.60 Push Block**<br>A non-metallic device with one or more handles and a flat bottom surface either with a heel or friction material on it, used as a hold-down and feed device to provide a safe distance between the hand(s) and the cutting tool. | |

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| **2.1.61 Push Stick**<br>A non-metallic stick shaped device designed to provide a safe distance between the hand(s) and the cutting tool. It has, as part of its design, a notched end with a heel and toe to hold down and feed the workpiece past the cutting tool. | |
| **2.1.62 Rabbet**<br>An operation making a two-side notch in the side or face of a workpiece. | |
| **2.1.63 Rebuilder**<br>A legal entity rebuilding a previously manufactured woodworking machine or accessory. | |
| **2.1.64 Resawing, Table Saw [ASTM]**<br>a combination of two cuts performed with an ordinary saw blade in the same plane but on opposite edges of a workpiece that results in reducing the thickness of or splitting the workpiece. | E*2.1.64 Resawing, Table Saw*<br>*There are operations on band saws called resawing, but this operation is not intended as part of this definition since, unlike the operation on a table saw, it does not extend the capacity of the machine* |
| **2.1.65 Retraining**<br>See *Training* | |
| **2.1.66 Ripping**<br>A sawing operation made through the thickness of the workpiece with the grain of natural wood, along the long dimensions of a rectangular workpiece, and usually parallel to that edge on reconstituted wood products or plastics. Two or more pieces are the result of the operation. | *E2.1.66 Ripping*<br>*Usually, a fence or similar guide is used for this operation, but some operations are done without a fence such as on a straight-line rip saw where the workpiece and off fall is controlled by the power feeding means.* |
| **2.1.67 Risk Reduction Measure(s)**<br>An action or means used to eliminate hazards and/or reduce risks. | *E2.1.67 Risk Reduction Measures*<br>*Risk reduction measures follow the hazard control hierarchy and can include, but are not limited to:*<br>• *inherently safe by design;*<br>• *engineering controls, including:*<br>  ○ *guards;*<br>  ○ *devices;*<br>• *administrative controls, including:*<br>  ○ *awareness means;*<br>  ○ *information for use (training and procedures);*<br>  ○ *personal protective equipment (PPE).* |

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| **2.1.68 Safe/Safety**<br>Freedom from unacceptable risk. | |
| **2.1.69 Safeguard**<br>A safety measure used to protect people from a present or impending hazard. | |
| **2.1.69.1 Safeguarding**<br>See risk reduction measure. | *E2.1.69.1 Safeguarding*<br>*This is a historical term and has been replaced by the term risk reduction measure in this standard.* |
| **2.1.69.2 Safeguarding Device**<br>See engineering controls – device. | |
| **2.1.70 Saw Chamber**<br>Enclosure immediately adjacent to the circular saw blade. It provides a safety guard to cover the arbor and saw blades during operation. It is also used to contain and to direct sawdust for dust collection. | *E2.1.70 Saw Chamber*<br>*Saw chambers are also known as saw pits.* |
| **2.1.71 Sawsmith**<br>A person skilled in the art of repairing, maintaining and/or sharpening saw blades. | |
| **2.1.72 Scoring**<br>A pre-cut slotting/grooving operation occurring immediately ahead of a ripping or cross-cutting operation to minimize chipping or splintering by a through cutting circular saw blade. | |
| **2.1.73 Semi-Automatic Mode**<br>An operating mode in which an operator initiates an intended cycle of events during which operations are performed on a workpiece(s) at the completion of which all machine elements return to their starting position. | |
| **2.1.74 Rip Saw Semi-Automatic Mode**<br>Manual mode operation with a material handling system that conveys the workpiece to where it needs to go next. | *E2.1.74 Rip Saw Semi-Automatic Mode*<br>*In semi-automatic mode a gang or straight-line rip saw is fitted with an automatic material handling conveyor system that receives the material being fed out of the machine without the need for an off bearer. In this alternative, the operator is responsible for all of the machine loading and unloading functions.* |

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| **2.1.75 Setup**<br>Any work performed to prepare a machine or equipment to perform its normal operation. | *E2.1.75 Setup*<br>*Minor tool changes and adjustments, and other minor servicing activities, which take place during normal operations, are not maintenance if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection.* |
| **2.1.76 Shearing**<br>A cutting action caused by relative motion of two or more parts. | *E2.1.76 Shearing*<br>*A shear point is generally considered to be where cutting occurs by movement of a mechanical part past a stationary part. A shear hazard is that area of the shear point where injury can occur. See also cutting.* |
| **2.1.77 Spreader/Splitter/Riving Knife**<br>A flat metal device slightly narrower than the saw kerf designed to prevent the saw blade kerf in the workpiece from closing on the sides of the blade during a sawing operation. | *E2.1.77 Spreader/Splitter/Riving Knife*<br>*The term splitter is synonymous with spreader, and a "riving" knife is a spreader that remains in a fixed relationship to the blade regardless of its height above the table.* |
| **2.1.78 Stock**<br>Wood, reconstituted wood or plastic material on which woodworking type operations are to be performed. | |
| **2.1.79 Supervise**<br>to reasonably verify that workplace conditions and practices comply with the safety requirements of this standard, and education and training are understood and followed. | *E2.1.79 Supervise*<br>*To design, construct, or to establish, maintain, or monitor a reasonably effective program, procedure, or system to implement the safeguarding, system and training requirements of this standard.* |
| **2.1.80 System Designer/Builder**<br>A legal entity responsible for the design, construction, and/or installation of a system of machines, transfer devices, etc., for use in a woodworking operation. | *E2.1.80 System Designer/Builder*<br>*A turnkey contractor is one example of a system designer/builder.* |
| **2.1.81 Template**<br>A device having a shape or form used with a pin, cam follower or surface to reproduce the form of a workpiece in a woodworking operation. | |

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| **2.1.82 Thrown Workpiece**<br>A particular form of ejection resulting from contact with a circular or cylindrical tool where the workpiece can be thrown in any direction perpendicular to the axis of rotation of the tool. | *E2.1.82 Thrown Workpiece*<br>*A rotating tool such as found on a router or drill press can throw the workpiece in any direction, radially.* |
| **2.1.83 Total Connected Power**<br>The sum of all loads connected through a single power supply. | |
| **2.1.84 Training**<br>The process of making proficient through instruction and supervised hands-on practice in the operation of equipment that is expected to be used and in the performance of assigned duties. | *E2.1.84 Training*<br>*See ANSI B11.0 for supplier and user training requirements and guidance for developing training protocols.* |
| **2.1.85 Trapping space**<br>The diminishing space in any machine set-up where, through powered movement of a component(s) or workpiece(s), it is possible for a body part(s) to be trapped between the tool(s), or its mounting, and the material/workpiece(s) being processed, or the associated jig/fixture/accessory equipment. | |
| **2.1.86 Warning**<br>Notice of possible harm to personnel, bystanders, or both. | |
| **2.1.90 Woodworking Machinery**<br>Means or systems that shape wood and/or wood-like material. | |
| **2.1.91 Workpiece**<br>Stock having woodworking operations being performed on it to produce a finished form. It is considered a workpiece from the time it is loaded in a woodworking machine until it exits or is removed from the machine. | |
| **2.2 Descriptions of Woodworking Machines**<br>The purpose of a machine description is to categorize and identify certain generic type machines that fall within specific categories. | *E2.2 Descriptions of Woodworking Machines*<br>*Appropriate construction and risk reduction measure requirements for each type are given in clauses 4 and 5.* |

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| **2.2.1 Band Saw**<br>A machine using as its primary cutting tool a continuous thin band of steel with cutting teeth on at least one edge and two or more wheels supporting the band, one of which drives the band. The machine has guides to control the location of the band and a work support means, fixed or capable of being tilted. | *E2.2.1*<br>*See A2.2.1 for illustration* |
| **2.2.2 Circular Saw**<br>A machine designed to use a work support means and a thin disc, commonly known as a circular saw blade, as its primary cutting tool. | *E2.2.2 Circular Saw*<br>*Some machines in this class can use other arbor mounted tools such as dado and molding heads, abrasive cut off wheels, and similar tools for specific operations.* |
| **2.2.3 Cut-Off Saw**<br>A machine designed to use a work support means and using a rotating circular saw blade moving along a single plane to crosscut the workpiece to the desired length. Machines of this type are not designed to ripcut stock. | *E2.2.3 Cut-Off Saw*<br>*Examples of manually fed cut-off saws are manually operated pull, chop, miter and swing arm saws. Examples of power fed cut-off saws are jump, chop, straight line cut-off and similar saws where power feed is by electrical, hydraulic or pneumatic means.* |
| **2.2.3.1 Overhead Swing Cut-Off Saw**<br>A machine with a work support means using a powered arbor and circular saw blade that pivots about a point located above the saw arbor. | *E2.2.3.1*<br>*See A2.2.3.1 for illustration* |
| **2.2.3.2 Straight Line Cut-Off Saw**<br>A machine with a work support means and powered arbor that uses a multiple link mechanism or other means to simulate a straight-line motion of a saw arbor. | |
| **2.2.3.3 Inverted Swing Cut-Off Saw**<br>An inverted swing cut-off saw has a work support means and utilizes a powered arbor on an arm that pivots about a point located below the saw arbor. At rest the saw blade is positioned behind the workpiece | *E2.2.3.3 Inverted Swing Cut-Off Saw*<br>*Inverted swing cut-off saws are distinguished from jump saws by the arm pivot location and the blade at rest position.* |
| **2.2.4 Jump Saw**<br>A machine that utilizes a work support means, a powered arbor on an arm that pivots about a point located behind the saw arbor at approximately the same height and a work hold down means. At rest position, the saw blade is below | *E2.2.4 Jump Saw*<br>*ANSI O1.1-1, "Safety Requirements for Fixed Angle Jump Saws" applies in addition to this standard.*<br><br>*See A2.2.4 for illustration* |

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| the workpiece. | |
| **2.2.5 Miter Saw**<br>A machine that utilizes a rotating circular saw blade, a workpiece support, and a fence to crosscut a workpiece. One or two blades can be present; each mounted to a powered arbor which moves into the workpiece to produce the cut. The crosscut angle can be adjustable. | *E2.2.5 Miter Saw*<br>*For fixed angle undercutting miter saws, ANSI O1.1-1, "Safety Requirements for Fixed Angle Jump Saws ." applies in addition to this standard* |
| **2.2.6 Panel Saw**<br>A machine designed to cut panel or sheet products with one or more circular saw blades. | *E2.2.6 Panel Saw*<br>*These machines are commonly called over-table or under-table, over and under beam, horizontal and vertical panel saws. They can be further classified as having hand or power feed and manual or power clamping.*<br>*In some saws, the arbor and saw blade are mounted in a carriage that traverses over or under a stationary workpiece clamped on a work support means. In other saws a moving bed feeds the panel through the sawing process.*<br>*Saws known as dimension saws or sliding table saws are sometimes referred to as panel saws. For purposes of this standard, these saws are addressed in the table saw requirements.*<br><br>*See A2.2.6 for illustration* |
| **2.2.7 Radial Arm Saw**<br>A machine having a work support means a rear fence, overhead arm and a saw carriage. It can be used to do at least crosscutting and mitering with an unlocked saw carriage and is capable of ripping with the overhead arm locked at 90 degrees to the rear fence and the carriage rotated and locked 90 degrees to the arm. | *E2.2.7 Radial Arm Saw*<br>*On saws of this type the carriage can be either manually or power fed.*<br><br>*See A2.2.7 for illustration* |
| **2.2.8 Rip Saw, Power Fed**<br>A machine designed to use a singular or multiple circular saw blade(s) to ripcut a workpiece. It has a powered means for feeding the workpiece into the blade(s) and has a stationary or moving work support means.<br><br>**EXCEPTION:** Table saws with power feeders mounted on them are not considered power rip saws in this standard. | *E2.2.8 Rip Saw, Power Fed*<br>*Saws of this type are known as gang saws, straight line rip saws, or other similar names.*<br><br>*See A2.2.8 for illustration* |

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| **2.2.8.1 Straight-Line Rip Saw**<br>A machine designed to be used with a single saw blade on a single spindle/arbor which is fixed in position during cutting, where the workpiece is fed to the blade by an integrated power feed. The saw blade spindle may be capable of vertical adjustment. The saw blade spindle may be arranged so that it is mounted above or below the workpiece support. | *E2.2.8.1 Straight-Line Rip Saw*<br>*The saw blade is mounted on an arbor with means to vertically adjust the arbor or workpiece relative to one another. The arbor may be supported either below or above the workpiece support/feed system. Power feed systems are typically rollers and chain conveyor or a chain bed. Straight-line rip saws are not intended to be used with cross cutting blades or for cross cutting of grained wood. They are primarily intended for rip cutting, along the grain of solid wood, with an appropriate blade.*<br>*Straight-line rip saws with special wide throat (arm) designs can be used with a combination cross/rip blade for processing plywood, Oriented Strand Board (OSB) and other face side insensitive engineered sheathing, primarily found in crating or shipping departments.*<br><br>*See A2.2.8.1 for illustration* |
| **2.2.9 Table Saw**<br>A machine designed to use a circular saw blade mounted on an arbor below the work support means. The work support means can be stationary or moving or a combination of both. A guiding means is used for all operations when manually feeding the stock. The arbor or its support means can be fixed or be capable of being tilted at an angle to the work support means of less than 90 degrees to each other. | *E2.2.9 Table Saw*<br>*BSR O1.1-7 (202X), "Safety Requirements for Table Saws" applies in addition to this standard. (Pending approval as an American National Standard).*<br><br>*Saws of this type are known as buzz, variety, rip, crosscut, table, tilting table, tilting arbor, sliding table, dimension and similar names. On some saws of this type the arbor may be raised or lowered. Saws of this type can have an arbor or a table which can be adjusted at an angle for beveling and compound miter cuts. Some machines of this type may use dado or molding cutters and other arbor mounted tooling. Table saws may be manually fed or power fed using universal feeders or, where so designed, with sliding tables.*<br><br>*See A2.2.9 for illustration* |
| **2.2.10 Wide Axis Cutting Tool Machine**<br>A machine designed to use rotating cutting tool(s) with peripheral cutting edges and having an axial tool body width greater than the thickness of a single circular saw blade and intended for surfacing or shaping the workpiece, instead of primarily cutting or separating. | *E2.2.10 Wide Axis Cutting Tool Machine*<br>*Examples of wide axis tools include cutterheads for a planer, jointer, shaper, router, engraver, dovetailer, profiler, tenoner, molder, sticker, matcher and similar names. Machines of this type use cutterheads with inserted knives, solid or inserted cutting tools, and similar wide axis cutting* |

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| **EXCEPTION:** This classification excludes circular saws, dado stacks, drilling and boring machines and lathes using cylindrical cutters. | *tools intended for surfacing or shaping the workpiece, instead of cutting or separating* |
| **2.2.11 Dovetailer**<br>A machine that has its cutter(s) in a horizontal plane operates in a semi-automatic mode and is designed to use rotating or reciprocating tooling mounted in one or more fixed or moving spindles to produce the form of a self-locking joint known as a dovetail on a clamped stationary or moving workpiece. | *E2.2.11 Dovetailer*<br>*Machines of this type are used to produce dovetails, mortises, tenons, and other types of joint cuts.* |
| **2.2.12 Jointer**<br>A manually fed machine of this type has a wide axis cutterhead with more than one knife or cutting edge. It has an adjustable infeed work support means or an adjustable cutterhead or knives. A fence or other workpiece guide is provided. | *E2.2.12 Jointer*<br>*A machine of this type with a horizontal wide axis cutterhead is usually equipped with a fence that can be adjusted at angles other than 90 degrees to the table in order to produce bevel cuts. The primary purpose of a jointer is to produce either a flat surface or a flat surface at a desired angle to another flat surface. This type of machine can also be called a jointer/planer, or a jointer/edger. Jointer cutterheads may be "cylindrical" or "non-cylindrical."*<br><br>*"Cylindrical" cutterheads, also known as "blocks," have an essentially round cross section with means for attaching knife blades that extend across the full axial width of the cutterhead.*<br><br>*"Non-cylindrical" cutterhead designs have rows of inserts that are typically square carbide inserts. The width of each insert is less than the axial cutterhead width and the inserts are typically arranged in either a helical pattern or spiral pattern around the cutting tool's axis.*<br><br>*The cutting edge of helical cutterhead knives is mounted at an angle relative to the cutterhead axis. The cutting edge of spiral cutterhead knives is mounted parallel to the cutterhead axis.*<br><br>*See A2.2.12 for illustration* |

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| **2.2.13 Molder/Multi-Head Planer**<br>A machine that uses one or more arbor mounted cylindrical rotating cutting tool and a power feeding means which once engaging a workpiece carries it linearly through the balance of the intended operations without further action on the part of the operator. Operations can be performed on all surfaces of a workpiece. Workpieces can be hopper or manually or robotically loaded and are fed ribbon-style into the machine. | *E2.2.13 Molder/Multi-Head Planer*<br>*Typical uses would be in making molding and other straight line, contoured or dimensional workpieces. Single spindle machines are sometimes referred to as horizontal spindle shapers.*<br><br>*See A2.2.13 for illustration* |
| **2.2.14 Profiler/Engraver/Carver**<br>A machine that has one or more spindles with rotating wide axis tools used to form decorative or functional contours on a stationary or moving workpiece. A template and stylus are used to control the contour of the workpiece in three dimensions. | *E2.2.14 Profiler/Engraver/Carver*<br>*Many machines use 3-dimensional templates and are semi-automatic such that once the cycle is started, it continues until the workpiece is complete. Typical parts are Queen Anne chair legs and gun stocks.* |
| **2.2.15 Planer**<br>A machine that has at least one wide axis cutterhead with one or more inserted knife or cutting edge. It has at least a cutterhead mounted above, and/or below a work-supporting means and uses either an adjustable work support or cutterhead to size the stock. The workpiece is usually power-fed. | *E2.2.15 Planer*<br>*A machine of this type is also known as a surfacer or thickness planer and is used to produce parallel surfaces on stock.*<br><br>*See A2.2.15 for illustration* |
| **2.2.16 Router**<br>A machine with one or more vertical or horizontal spindles with a wide axis cutting tool(s) used to machine decorative or functional contours on a stationary or moving workpiece. Workpiece support is provided and the cutting action is controlled by a guide, template, numerical control, or similar means. The contour machine can be two or three dimensional. The spindle(s) can be mounted above or below the work support means but is more commonly above the workpiece. | *E2.2.16 Router*<br>*Machines of this type can be fed manually as on a pin (over-arm) router or semi-automatically as on a template router or a computer numerically controlled (CNC) router.*<br><br>*For CNC Routers, ANSI O1.1-3,*<br>*"Safety Requirements for CNC Machining Centers for the Woodworking Industry" applies in addition to this standard.*<br>*See A2.2.16 for illustration* |
| **2.2.17 Shaper**<br>A machine that uses one or more fixed or tiltable vertical spindle(s), rotating wide axis cutter(s) and a horizontal table. The spindle(s) passes up through the plane of the table, and its drive motor is located beneath the table. The machine may have any of the following features: | *E2.2.17 Shaper*<br>*A machine of this type may be single or multiple spindle manual type, straight line, or rotating table swing arm. Some manual shapers have spindles that can be at an adjusted angle to the tabletop. Some also use sliding tables for straight line shaping.* |

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| a) the ability for the spindle to be raised and lowered through the table<br>b) the ability to tilt the spindle | *See A2.2.17 for illustration*<br><br>*BSR/ANSI O1.1-4, "Safety Requirements for Shapers" applies in addition to this standard.* |
| **2.2.18 Tenoner/Trim Saw**<br>A machine designed to use two or more wide axis cutters and/or circular saws, or both, to size and/or configure one or both ends of a workpiece. The workpiece is supported on a table or conveying means. A means for clamping the workpiece is provided. | *E2.2.18 Tenoner/Trim Saw*<br>*A machine may be single or double-ended. Its basic function is to prepare the tenon(s) for a tenon/mortise joint. It is also commonly used for sizing stock to length.*<br><br>*See A2.2.18 for illustration* |
| **2.2.19 Drilling/Boring Machine**<br>A single or multiple spindle machine that uses a rotating cylindrical tool(s) such as a drill(s), a counterboring tool(s), and similar tool(s) to produce a hole(s), blind hole(s), counterbore(s) countersink(s) and similar cavities in workpieces. Work support means is provided to feed the tool into the workpiece or the workpiece into the tool. | *E2.2.19 Drilling/Boring Machine*<br>*Machines of this type can be called a drill press, a multiple spindle drill, a boring machine, a counterborer/sinker and similar names.* |
| **2.2.20 Mortiser**<br>A machine designed to produce a square or rectangular cavity by use of a moving, forming or reciprocating tool(s). Means are provided to clamp and support the stock, and either move the stock into the tool(s) or the tool(s) into the stock. | *E2.2.20 Mortiser*<br>*A machine of this type is also known as a chain, hollow chisel or reciprocating mortiser.*<br><br>*See A2.2.20 for illustration* |
| **2.2.21 Lathe, Wood**<br>A machine designed to be used to generate a cylindrical surface on a workpiece. | |
| **2.2.21.1 Manual Lathe**<br>A machine designed to be used to generate a cylindrical surface on a workpiece with a cutting tool that is moved along the axis of the workpiece. Cutting can be done either free hand using a tool rest or by using a template and a tracing attachment. The machine is normally equipped with a work driving means and a work supporting tailstock. | *E2.2.21.1 Manual Lathe*<br>*A machine of this type is also known as a wood turning lathe. Hand tools used are called gouges, chisels, skew chisels and parting tools.*<br><br>*See A2.2.21.1 for illustration* |

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| **2.2.21.2 Copying/Tracer Lathe**<br>A machine similar to a manual lathe designed to use a template to determine the shape of the rotating workpiece. A means is provided to keep a template stylus against the template during the cutting action and a means to feed the tool along a path to generate the desired shape and diameter. A copying/tracer lathe can operate in a semi-automatic or automatic mode. | *E2.2.21.2*<br>*See A2.2.21.2 for illustration* |
| **2.2.21.3 Back Knife Lathe**<br>A machine similar to a manual lathe designed to use a shaped knife-like tool, in a guillotine fashion, to move downward past the rotating workpiece shaping it into the desired contour. The machine operates in semi-automatic or automatic mode. | |
| **2.2.21.4 Swing-Head Lathe**<br>A machine designed to use a fixed, rotating cylindrical cutting tool and a pivoting work-supporting, rotating and feeding means that brings the workpiece into contact with the cutting tool. The feeding means can be manual or powered and the mode of operation manual, semi-automatic or automatic. | *E2.2.21.4 Swing-Head Lathe*<br>*Machines of this type are also called rotating cutterhead lathes.*<br><br>*See A2.2.21.4 for illustration* |
| **2.2.22 Sanders**<br>Sanders are a class of machine that remove material by contact of a workpiece with an abrasive material. Sanding machines use abrasives in a variety of forms and motions. | *E2.2.22 Sanders*<br>*Sander machine names include belt, drum, disc, profile, form, brush, automatic, cylindrical, stroke, contact wheel, wide belt, flap, oscillating belt, polisher, edge, flutter and spool sander and abrasive planer.* |
| **2.2.22.1 Belt Sander**<br>A machine that uses an abrasive belt as the cutting tool. | |
| **2.2.22.2 Manual Belt Sander**<br>A machine that uses an abrasive belt as the cutting tool and uses two or more drums to drive and track the belt. A supporting means and a means of tensioning and tracking the belt is provided. Manual pressure on the workpiece or fixture is used to cause the sanding action. | *E2.2.22.2 Manual Belt Sander*<br>*A machine of this type is known as a belt, stroke, oscillating sander. A pad or platen is generally used to apply or support the sanding action.*<br><br>*See A2.2.22.2 for illustration* |

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| **2.2.22.3 Power Feed Belt Sander**<br>A machine that uses an abrasive belt(s) as the cutting tool. A powered moving belt table is used to carry the workpiece past the abrasive belt. A spring-loaded hold down(s) is used to help to reduce risk of kickback and to keep stock on the moving belt table. The moving belt is backed by a vertically adjusted platen that is positioned to size the workpiece. | *E2.2.22.3 Power Feed Belt Sander*<br>*These machines are generally called wide belt sanders.*<br><br>*See A2.2.22.3 for illustration* |
| **2.2.22.4 Disc sander**<br>A machine that uses a circular abrasive disc mounted on a circular rotating backing plate and has a work support means. Manual pressure through the workpiece or workpiece holding fixture against the abrasive disc causes the sanding action. | *E2.2.22.4 Disc sander*<br><br>*See A2.2.22.4 for illustration* |
| **2.2.22.5 Profile sander**<br>A machine that uses either a shaped abrasive wheel or block and an abrasive belt to produce a contour on the surface of the workpiece. | |
| **2.2.22.6 Drum Sander**<br>A machine that uses an oscillating or stationary drum(s) covered with abrasive material as its cutting tool. | |
| **2.2.22.7 Oscillating Drum Sander**<br>A machine that uses vertically mounted interchangeable abrasive surfaced drums of various diameters to allow for inside sanding of picture frames, “U” form and similar parts. A work supporting means is provided which can be tilted with respect to the drum. The drum is automatically oscillated vertically. | *E2.2.22.7 Oscillating Drum Sander*<br>*Machines of this type are also known as oscillating spindle sanders. At the time of publication, there were no identified machines of this type that fell within the machine scope of this standard.*<br><br>*See A2.2.22.7 for illustration* |
| **2.2.22.8 Horizontal Drum Sander**<br>A machine that uses an oscillating or stationary drum(s) covered with abrasive material as its cutting tool. A powered belt or feed rolls are used to carry the workpiece past the drum(s). Spring loaded holddown rolls are used to help reduce risk of kickback and to keep the stock in contact with the moving conveyor belt or feedrolls. A moving conveyor belt, when used, is supported by a vertically adjustable platen or table which is | *E2.2.22.8*<br><br>*See A2.2.22.8 for illustration* |

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| positioned to size the workpiece. | |
| **2.2.23 Gluing, Laminating, And Laminate Indexing Machines**<br>Machines designed to facilitate the joining of wood pieces by applying adhesive. | |
| **2.2.23.1 Surface Gluing Machines**<br>A machine that applies glue to one or both sides of panels. | *E2.2.23.1 Surface Gluing Machines*<br>*The glue can be contained in a reservoir between rolls, run in a pan of coating material or coating material can use a flow system over the roll with a blade to meter the material. The larger panels are pulled through the machine by the rolls. For smaller machines coating product on one side only, the pieces may be laid by hand on a single powered roll.*<br><br>*See A2.2.23.1 for illustration* |
| **2.2.23.2 Edge Gluing Machines**<br>A machine that applies glue to the edge of panels or narrow material. | *E2.2.23.2 Edge Gluing Machines*<br>*The rolls may be mounted with the shafts at 90° from each other and using beveled rolls to meter the material that one roll picks up by running in a pan of coating material. The product is supported by a conveyor or table system, and the product is run through the machine by hand or by a feed system.* |
| **2.2.24 Pressing Machines**<br>A machine that uses pressure to combine two or more materials that have adhesive covered surfaces. | *E2.2.24 Pressing Machines*<br>*The machine may apply pressure with pneumatic, hydraulic, or mechanical means.* |
| **2.2.24.1 Vertical Clamping Platen Presses**<br>A machine with flat platens top and bottom designed to press and hold materials together during the bonding cycle. | *E2.2.24.1*<br>*See A2.2.24.1 for illustration* |
| **2.2.24.2 High Pressure Roll Type Press**<br>A machine using high pressure rolls to combine materials as they are pulled through the machine. | *E2.2.24.2 High Pressure Roll Type Press*<br>*Sometimes called laminating machines, can have heated rolls and may apply pressure with pneumatic, hydraulic, or mechanical means. The equipment sometimes includes a mounting for large rolls of laminating material to be pulled through the machine as it is laminated to a substrate.* |

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| | *See A2.2.24.2 for illustration* |
| **2.2.25 Laminate Indexing Machine**<br>A machine that positions (indexes) glued flat substrate(s) and/or laminate(s) into a single multi-layer panel for further processing. | *E2.2.25 Laminate Indexing Machines*<br>*Sometimes, called a laminate indexing station or laminator, usually works in conjunction with a scissors lift, glue spreader and combining press.*<br><br>*See A2.2.25 for illustration* |
| **3. References** | |
| **3.1 Normative References**<br>The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard.<br><br>The normative references cited by a standard in turn include other normative standards. The applicable party subject to this standard shall be responsible to determine and obtain the normative references that apply to the particular situation under consideration.<br><br>ASME/ANSI B20.1-2024, *Safety Standard for Conveyors and Related Equipment*<br><br>ANSI/ASSE Z244.1-2024, *Control of Hazardous Energy – Lockout/Tagout and Alternative Methods*<br><br>ANSI Z535.2-2023, *Environmental and Facility for Safety Signs*<br><br>ANSI Z535.3-2022, *Criteria for Safety Symbols*<br><br>ANSI Z535.4-2023, *Product Safety Signs and Labels*<br><br>ANSI Z535.5-2022, *Accident Prevention Tags (for Temporary Hazards)*<br><br>ANSI Z535.6-2023, *Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials* | *E3.1 Normative References*<br>*Not all normative references will necessarily apply to a specific application. The reader is responsible to determine and obtain the normative references that apply to the particular situation under consideration.*<br>*For example, ANSI O1.1 lists an entire series of normative references which should all be applicable; each of those normative references may contain additional normative references that a manufacturer or user may not need.*<br><br>*At the time of publication, the editions indicated were valid. All standards are subject to revision. Users are encouraged to review the most current editions.* |

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| ANSI B11.0-2020, *Safety of Machinery.*<br><br>ANSI B11.19-2019, *Performance Requirements for Risk Reduction Measures: Safeguarding and other Means of Reducing Risk.*<br><br>ANSI/NFPA 79-2024, *Electrical standard for industrial machinery*<br><br>NFPA 664-2020: *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.*<br><br>ANSI/RIA R15.06-2006, *Industrial robots and robot systems – Safety standard*<br><br>ANSI/UL 969-2025, *Standard for Marking and Labeling Systems.*<br><br>ACGIH [2024]. *Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. By American Conference of Governmental Industrial Hygienists.* | |
| **3.2 Other References**<br>Machine components not addressed by this standard shall comply with any applicable nationally recognized standards. | |
| **3.3 Informative References**<br>ANSI B11.20, *Safety Requirements for Integrated Manufacturing Systems*<br><br>ANSI B11.TR 1, *Ergonomic Guidelines for the Design, Installation and Use of Machine Tools.*<br><br>ANSI B11.TR5-2006 (R2017) - *ANSI Technical Report for Machines -Noise Level Measurement Guidelines - A Guide For Measuring, Evaluating, Documenting And Reporting Noise Levels Emitted By Machinery.*<br><br>ANSI/ASA S2.72 PART 1: 2002(R2018), *American National Standard Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Part 1: General requirements.* | |

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| ANSI/ASSE Z490.1-2016, *Criteria for Accepted Practices in Safety, Health and Environmental Training.*<br><br>ANSI/ASSP Z490.2-2019, *Accepted Practices for E-Learning in Safety, Health and Environmental Training*<br><br>*Accident Prevention Manual for Business and Industry - Administration & Programs*, 14th Ed, National Safety Council, 2015.<br><br>*IES Lighting Handbook*, published by the Illuminating Engineering Society (IES), http://www.ies.org/.<br><br>NIOSH [1994]. *Applications manual for the revised NIOSH lifting equation*. By Waters TR, Ph.D., Putz–Anderson V, Ph.D., Garg A, Ph.D. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-110 (Revised 9/2021).<br><br>UL 1439-2015*, Standard for Safety Tests for Sharpness of Edges on Equipment* | |
| **4 Hazard Identification and Control** | |
| **4.1 Hazard Identification**<br>Entities with designated design and supervision responsibilities (See Clause 6) shall within the scope of their responsibilities identify the reasonably foreseeable tasks and associated hazards for the applicable phases of the lifecycle of the machine in accordance with ANSI B11.0. | |
| **4.2 Electromagnetic Compatibility Hazards** | |
| **4.2.1 Electromagnetic Interference and Compatibility Requirements**<br><br>Industrial electrical/electronic equipment, apparatus, or systems shall comply with the applicable | *E4.2.1 Electromagnetic Interference and Compatibility Requirements*<br>*Electrical disturbances caused by or associated with the use of industrial machines should be addressed and if necessary mitigated to comply with* |

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| electromagnetic interference and compatibility requirements of 47CFR, Parts 2, 15 and/or 18 | *the relevant Federal Communications Commission requirements.*<br><br>*Further consideration should be given to:*<br><br>*- Reduce the level of electromagnetic energy to reduce risk of disturbances of other equipment or systems, interference with communication systems, or injury to personnel.*<br><br>*- Reduce the likelihood of hazardous malfunctions of the equipment or control circuitry caused by being subject to external electromagnetic interference or disturbances.* |
| **4.2.2 Electrical System Hazards** | *E4.2.2 Electrical System Hazards*<br>*Electrical hazards associated with the design and use of industrial machines should be addressed as part of an overall risk assessment of the complete system and application. This assessment should take into consideration an acceptable level of risk associated with the personnel and the equipment. Such safety hazards will include, but not limited to, the following:*<br><br>*- Electrical shock or fire hazards resulting from faults or failures within the electrical/electronic equipment.*<br><br>*- Hazards associated with the malfunctioning of the equipment control circuits.*<br><br>*- Malfunctions of the equipment due to external power disruptions or disturbances as well as faults or failures in the power circuitry.* |
| **4.2.3 Shock, Short Circuits, And Overloading**<br><br>Electrical/electronic equipment, apparatus, or systems operating from a nominal voltage of 600 volts or less shall meet the requirements of ANSI/NFPA 79, Electrical Standard for Industrial Machinery. | *E4.2.3 Shock, Short Circuits, And Overloading*<br>*In particular ANSI/NFPA 79 addresses:*<br>*- Prevention of electric shock*<br>*- Protection against short circuits*<br>*- Protection against overloading.*<br><br>*A component of the equipment, apparatus, or system should comply with the applicable requirements for that component and be used in accordance with its established rating for the intended conditions of use.* |

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| | *Electrical systems should be protected against moisture, oil, dust, and other contaminants as warranted by the intended use and location.* |
| **4.2.4 Hazards Resulting from Restart After Power Loss or Failure**<br>Where a machine is shipped with a motor(s) starter(s) and there is risk of injury to personnel from a hazard if the motor(s) restarts after power loss or failure, means shall be provided to reduce risk of restart or reduce the risk of injury. (See Clause 6.8 for Employer responsibility). | *E4.2.4 Hazards Resulting from Restart After Power Loss or Failure*<br><br>*Some machines are shipped without controls or motors, or both, and the manufacturer cannot know what will be installed on the machine. The maintenance manual should provide the installer of the controls, or motors, or both, the control schematic and motor type that would meet the requirements of the standard and the hazard, if any. (Refer to ANSI/NFPA 79.)* |
| **4.3 Pressurized Systems Hazards**<br>Components, subsystems, systems, and installation of pressurized systems shall comply with applicable nationally recognized standards. | |
| **4.4 Puncture, Cutting, And Shear Hazards** | |
| **4.4.1** All sharp edges, points or shear hazards accessible during normal operation and/or maintenance and not necessary for the function of the machine shall be eliminated. | |
| **4.4.2** Where practical, sharp edges, points or shear hazards necessary for the function of the machine shall be safeguarded from contact with persons in the vicinity of the machine during normal operation of the machine. | *E.4.4.2 UL 1439, Standard for Safety Tests for Sharpness of Edges on Equipment describes a standard test method that can be used to judge sharp edges on machines, and 16 CFR 1500.49.* |
| **4.5 Power Transmission and Motion Hazards**<br>The manufacturer shall provide protection against the risk of moving part hazards. Where hazards cannot be eliminated, they shall be safeguarded. Where they cannot be safeguarded the manufacturer shall warn against the hazards. | *E4.5 Power Transmission and Motion Hazards*<br>*Some of the recognized hazards are:*<br><br>*a) Rotating components such as flywheels, gears, drive belts, sheaves and shafts;*<br><br>*b) In-running pinch points such as meshing gears, belt and sheave combinations, and meshing chains and sprockets;* |

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| | *c) Pinch points between moving and stationary components (see also Clause 4.14);*<br>*d) Motion of counterbalancing means during normal operation or in the event of failure.*<br><br>*Examples of moving part hazards that cannot be eliminated by design are the rotating face plate on a manual wood lathe, the rapidly moving table and saddle of a CNC router.* |
| **4.5.1** Components that are stationary during normal operation and are in proximity to moving parts shall be restricted against being dislodged. | |
| **4.5.2** Components or subsystems which may be subject to movement shall be restricted such that movement will not result in increased risk. | |
| **4.5.3** Liquid shall be contained such that movement of the container, as a normal function of the operation and/or maintenance of the machine, will not result in:<br>a. tipping or unexpected movement of the machine or its components,<br>b. spillage of any of the contents. | |
| **4.5.3.1** If liquid exists within a system which, during normal operation, can produce or be subjected to hydraulic shock, means shall be used to reduce the shock to a level not injurious to personnel or the machine. | |
| **4.5.4** Springs and shock absorbers shall be designed, installed and maintained such that they do not “bottom-out” or over-extend during normal operation of the machine. | |
| **4.5.5** Structural members shall be designed to withstand impact and dynamic loads expected during normal operation of the machine. | *E4.5.5 Components which might be damaged or might cause damage by impact during operation may be provided with bumpers, shock absorbers, springs, or other devices to lessen the effects of such impacts.* |

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| **4.5.6** Surfaces of the machine upon which personnel are expected to stand during normal operation and/or maintenance shall be slip-resistant. | |
| **4.5.7** Hinged covers or access panels that must be raised to open shall have a means of securing them in their open positions against accidental closures that could cause injury. | |
| **4.5.8** Moving assemblies shall have mechanical limit stops to prevent movement past intended travel where such movement would create a hazard. | |
| **4.6 Powered Cranks, Levers, or Control Hand Wheels**<br>Powered Cranks or Control hand wheels shall be evaluated in accordance with ANSI B11.0 for their potential to cause injury to the user. The manufacturer or rebuilder shall provide protection against the danger of moving part hazards. If risk assessment reasonably indicates these parts create a danger to the user, then the parts shall be safeguarded or disengaged during powered operation when possible. | |
| **4.7 Hazards Associated with Ladders/Stairs, Work Platforms, and Walkways**<br>If ladders/stairs, work platforms or walkways are provided as part of the machine, the manufacturer shall comply with the applicable standard. | *E4.7 Hazards Associated with Ladders/Stairs, Work Platforms, and Walkways*<br><br>*Smooth surfaces are necessary for part of fixture mounting. Ladders/stairs, work platforms, and walkways, where possible, should meet the requirements of ANSI 1264.1 and ANSI A14.3.* |
| **4.8 Hazards from Wood Dust**<br>The manufacturer shall provide for the collection of dust and/or chips from the machine so as to enable the machine to be connected to a dust collection system. (See Clause 5.1.17.2 Dust Collection for the employer's responsibility). | *E4.8 Hazards from Wood Dust*<br><br>*A warning may be necessary to inform the employer where in normal use, the amount of wood dust generated can exceed the limits set by the enforcing authority.* |
| **4.9 Anti-Motion Mechanism or Counterbalance System**<br>Where the free-fall rate of vertically moving components can result in injury, motion controlling | *E4.9 Anti-Motion Mechanism or Counterbalance System*<br><br>*Falling rates of vertical components, such as slides and other overhead components at* |

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| means, such as one of the following, shall be provided. | *speeds above the normal rapid traverse rates on the failure of the supporting or driving means, may create a hazard. Retardation of the unintended motion need only be used where the weight of the object is such that an injury would result.* |
| **4.9.1 Counterweight**<br>A counterweight shall be designed, located or guarded so that it will not create a risk of injury. | |
| **4.9.2 Spring Counterbalance**<br>Spring counterbalance, when used, shall not create a hazard on spring failure and shall incorporate a safe means for disassembly. A warning shall be given if improper disassembly can create a hazard. | *E4.9.2 Spring Counterbalance*<br>*Instructions necessary for safe disassembly and reassembly should be included in the maintenance manual.* |
| **4.9.3 Hydraulic or Pneumatic Counterbalance System**<br>Hydraulic or pneumatic counterbalance shall include a self-energizing locking or retarding mechanism when the falling rates of vertical components constitute a hazard. | *E4.9.3 Hydraulic or Pneumatic Counterbalance System*<br><br>*Mechanisms such as orifices, check valves or spring-loaded stops may be used to fulfill this requirement.* |
| **4.9.4 Brake and Locking Devices**<br>When a brake or locking device is used for an anti-motion device involving hazard(s), it shall be of the self-energizing or self-locking type. | *E4.9.4 Brake and Locking Device*<br><br>*A device such as a spring engaged or permanent magnet brake may be used to fulfill this requirement.* |
| **4.9.5 Counterweight and Support Chain or Cable**<br>Guarding shall be provided to reduce risk of the hazard of a falling mass or whipping support chain or cable (causing injury to personnel) in the event of a failure of any component in the system. | |
| **4.10 Noise and Vibration Hazards** | |
| **4.10.1 Noise**<br>See Clause 6.8.3.3.1 Employer Noise level survey and noise exposure sampling/monitoring. | *E4.10.1 Noise*<br>*Guidance for measurement of acoustical noise levels can also be found in ANSI B11.tr5.* |
| **4.11 Vibration Hazards** | |

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| **4.11.1 Fasteners Subject to Vibration**<br>Fasteners which are subject to loosening due to vibration or other influences shall be secured with appropriate locking methods. | |
| **4.11.2 Operator Exposure to Vibration**<br>Where system controls do not acceptably control operator exposure to hazardous levels of whole body or segmental/<br>hand-transmitted vibration as established by the ACGIH (American Conference of Governmental Hygienists), the employer shall provide means to acceptably control the risk.<br><br>Where operators can be exposed to hazardous levels of whole body or segmental/<br>hand-transmitted vibration as established by the ACGIH (American Conference of Governmental Hygienists) and the ISO (International Standardization Organization), the employer shall provide means to reduce exposure to the vibration below hazardous levels. | *E4.11.2 Operator Exposure to Vibration*<br>*See informative reference ANSI/ASA S2.72 PART 1: 2002(R2018), American National Standard Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Part 1: General requirements*<br><br>*Whole body and segmental/hand-transmitted vibration Whole body vibration (WBV) is the vibration transmitted through the seat or feet of a worker while operating machinery or standing on vibration platforms. Health concerns from WBV include in part:*<br>● *low-back pain and back disorders*<br>● *neck-shoulder disorders*<br>● *digestive and circulatory disorders*<br>● *Cochleo-vestibular and reproductive effects*<br><br>*Segmental/hand-transmitted vibration is the vibration workers experience when using handheld tools. Physical damage includes in part:*<br>● *vascular (damage to the blood vessels, i.e. Vibration White Finger Disease)*<br><br>● *Neuropathic (damage to the nerves/nervous system)*<br><br>● *Carpal tunnel syndrome* |
| **4.12 Chemical Reactions** | |
| **4.12.1** Materials, liquids or other chemicals may not be used if the material, liquid or other chemical will react with air or moisture in the air in such a way as to cause the release of flammable, explosive or toxic substances. | |
| **4.12.2** Materials, liquids or other chemicals which cause injury to human skin or eyes upon contact shall be contained so as to reduce risk of such contact during normal use and maintenance of the machine. | |

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| **4.12.2.1** Warnings of the presence of such materials, liquids or other chemicals shall be given on the machine in the proximity of any location where contact is possible. | |
| **4.12.2.2** Instructions regarding the presence, control and safe handling of such materials, liquids or other chemicals shall be given in the instruction manual accompanying the machine. | |
| **4.12.3** Where materials, liquids or other chemicals present during normal use or maintenance of the machine could combine with other materials, liquids or other chemicals expected to be present could cause injury, appropriate warnings shall be placed on the machine. | |
| **4.12.4** Where materials, liquids or other chemicals present during normal use or maintenance of the machine could cause allergic reactions, appropriate instructions shall be given in the user manual accompanying the machine. | |
| **4.12.5** Where liquids are in use during normal operation and/or maintenance of the machine, information shall be provided in the operator manual that, in the event of ingestion of the liquid, a practical antidote is identified or that there is no antidote indicated. | |
| **4.12.6** Where material(s) are used whose molecules will break down in the presence of heat or ultraviolet radiation to produce dangerous products, appropriate warnings shall be given on the machine and in the operator manual. | |
| **4.12.7** Liquids or gases used in the normal operation or maintenance of the machine shall be held in containers which will not react with the liquids or gases. | |
| **4.13 Machine Stability Hazards** | |

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| **4.13.1 Machines Designed for a Fixed Location**<br>Machines designed for a fixed location shall be securely anchored to prevent walking, tilting, or moving. All other machines must meet the requirements of clause 4. 13.3, *Stability tests.* | |
| **4.13.1.1** All machines shall be provided with bolt holes or other means for securing to the floor or supporting structure. | |
| **4.13.2 Casters or Wheels**<br>Casters or wheels that support a machine shall be retractable or of a locking design. | |
| **4.13.3 Stability Tests**<br>Machines not anchored or secured to the floor, wall or ceiling shall meet the following stability tests. | |
| **4.13.3.1** When lifted from any side such that the machine is tilted 7 degrees from its at rest position, the machine will return to its at rest position when the lifting force is removed. | |
| **4.13.3.2** A machine installed in accordance with the manufacturer's instructions shall not overturn when any doors, empty drawers, movable tables, or other appurtenances are placed in any position to which they are capable of being moved without the use of a hand tool. The machine need not be capable of normal operation when components are positioned for this test. | *E4.13.3.2 Manufacturers should also consider the possibility of loaded drawers being opened.* |
| **4.14 Pinch, Nip, and Crush Hazards**<br>Pinch, nip and/or crush hazards shall be eliminated or reduced to an acceptable risk level, if they are accessible during normal operation and/or maintenance. | *E4.14 Pinch, Nip, and Crush Hazards*<br>*Pinch points exist where two or more objects, any of which is in motion, meet or come near one another. This can occur as a result of rotation or linear motion. Nip is another term for Pinch.*<br><br>*Crushing is similar to pinching, except at a greater magnitude. Crushing generally involves damage to bone or other structure whereas pinch may not.*<br><br>*Other terms of art are nip point, pinch point, etc.* |

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| | *See ANSI B11.0 for guidance on achieving acceptable risk* |
| **4.15 Hazards from Workpiece Ejection**<br>Means shall be provided to reduce the risk of workpieces being forcefully ejected from machines. These means shall address the possibility of wrong way feed. | *E4.15 Hazards from Workpiece Ejection*<br><br>*Positive means for preventing wrong way feed should be used where practical. Some machines such as manual-fed spindle shapers do not lend themselves to such devices, in which case warnings and instructions should be used.* |
| **4.15.1 Kickback**<br>Kickback hazards shall be addressed in accordance with the machine specific requirements of this standard. See Section 5. | *E4.15.1 Kickback*<br>*Resistance of a rotating abrasive or cutting tool contacting the workpiece applies force tangential to the direction of rotation of the tool. When this force is in the direction opposite the feed direction of the workpiece and it is unchecked or uncontrolled, a potential of kickback exists. The potential for kickback occurs when a cutting tool binds in the workpiece and can be caused by a variety or combination of factors, including, but not limited to, poorly maintained cutters or blades, improperly aligned guide fences, irregularities in workpieces, excessive feed rates, wrong way feed, and/or operator inattention.*<br><br>*The hazard created may be either the thrown workpiece or the exposed work processing means such as a saw, cutter, or abrasive head or belt.* |
| **4.15.2 Overfeed**<br>Overfeed hazards shall be addressed in accordance with the workpiece ejection requirements of this standard. See Sections 4 & 5. | *E4.15.2 Overfeed*<br>*Resistance of a rotating abrasive or cutting tool contacting the workpiece applies force tangential to the direction of rotation of the tool. When this force is in the same direction as the feed direction of the workpiece and it is unchecked or uncontrolled, a potential of overfeed exists. The potential for overfeed occurs when a cutting tool binds in the workpiece and can be caused by a variety or combination of factors, including, but not limited to, poorly maintained cutters or blades, improperly aligned guide fences, irregularities in workpieces, excessive feed rates, wrong way feed, and/or operator inattention.* |

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| | *The hazard created may be either the thrown workpiece or the exposed work processing means such as a saw, cutter, or abrasive head or belt.* |
| **4.15.3 Thrown Workpiece and Materials.**<br><br>Where an operation presents a risk of an operator or a bystander being struck by thrown workpiece parts, and the hazard is not protected by existing engineering controls, risk reduction measures compliant with B11.19 shall be provided by the employer to reasonably reduce the risk. | *E4.15.3 Thrown Workpiece and Materials*<br><br>*Thrown workpiece parts can consist of the workpiece, offal pieces, broken pieces, etc. Barriers or other suitable risk reduction measures should be used to reduce the risk of harmful contact to an acceptable level.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk* |
| **4.16 Projectiles**<br>Means shall be provided to reduce the risk of projectiles being forcefully ejected from machines. | *E4.16 Projectiles*<br><br>*Projectiles generally involve the ejection of parts, either machinery and or processed materials/workpieces. Rapidly moving or rotating parts, and everything in their vicinity, are capable of becoming projectiles. For example, clamps or guards in the vicinity of a rotating cutter can become projectiles if they contact the cutter.* |
| **4.16.1** Components having sufficient motion to throw projectiles capable of injury shall be protected by engineering controls to reduce risks of injury from projectiles to an acceptable level. | *E4.16.1 See ANSI B11.0 for guidance on achieving acceptable risk* |
| **4.16.2** Where ejected materials cannot be contained, means, such as guarding or personal protective equipment for the at-risk body parts, shall be provided by the employer to reduce risks of injury from projectiles to an acceptable level. | *E4.16.2 See ANSI B11.0 for guidance on achieving acceptable risk* |
| **4.17 Impact Hazards**<br>Where movement of machines, workpieces, or other components present a risk of impact injuries, risk reduction measures shall be used to reduce the risk of injury to acceptable levels. | *E4.17 Impact Hazards*<br>*Examples of machines or conditions which can result in impact are Robotic arms, CNC machine centers, projectiles, kick back, material movement or conveyance.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |

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| **4.18 Entanglement and Entrapment Hazards** | *E4.18 Entanglement and entrapment hazards*<br>*Loose clothing, jewelry, long hair, gloves, fingers, hands, etc. can become entangled in rotating or moving parts.*<br><br>*Entanglement/entrapment hazards may exist while operating, but may also exist when loading, unloading, adjusting, measuring, cleaning, or similar operations.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **4.18.1 Entanglement**<br>Where entanglement hazards exist, risk reduction measures shall be used to reduce the risk of injury to acceptable levels. | |
| **4.18.2 Entrapment**<br>On machines operating in automatic or semi-automatic mode, an engineering control is required when any part of the operator's body is at risk of entering the trapping space hazard zone. Awareness barriers are only acceptable where there is no other appropriate alternative. | |
| **4.19 Abrasion Hazards**<br>Where abrasion hazards exist, moving machine surfaces shall be designed or protected by engineering controls to reduce the risk of abrasion injury to acceptable levels. | *E4.19 Abrasion Hazards*<br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **4.20 Miscellaneous Hazards**<br>Provisions, systems and/or accessories provided for the purpose of lifting materials shall comply with the appropriate currently published and nationally recognized standards. | *E4.20 Provisions, systems and/or accessories provided for the purpose of lifting materials*<br><br>*There are numerous ANSI standards for hoists, for example.* |
| **4.21 Radiation Hazards** | |
| **4.21.1 Ionizing Radiation**<br>Where woodworking and accessory equipment emits ionizing radiation, employee exposure controls shall comply with the applicable provisions of the federal Nuclear Regulatory Commission, codified in 10 CFR 20. | *E4.21.1 Ionizing Radiation*<br><br>*Ionizing radiation injury can be caused by x-rays, gamma rays, alpha particles, beta particles, neu-* |

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| | *trons, and other nuclear particles. Local authorities may have additional applicable regulations that should be considered.* |
| **4.21.2 Non-Ionizing Radiation**<br>Where woodworking and accessory equipment emit non-ionizing radiation, employee exposure limits shall comply with the applicable provisions of the current edition of the American Conference of Governmental Industrial Hygienists "Threshold Limit Values for Chemical Substances and Physical Agents." | *E4.21.2 Non-Ionizing Radiation*<br><br>*Non-ionizing radiations include radio frequencies, infrared frequencies, ultraviolet lamps, electric arc welding, plasma torches, high-intensity lights in photocopying machines, sources of "black light", lasers, heating elements, high temperature furnaces, molten metal, fires and explosions, and microwave ovens.* |
| **5. Standards for Design** | |
| **5.1 General Requirements**<br>Requirements of this section shall apply to all woodworking machinery within the scope of this standard. Where a conflict exists between these general requirements and any ANSI O1 machine specific requirements, the machine specific requirements shall take precedence. | *E5.1 The general requirements of section 4 apply to all machines. Where contradictions exist, the requirements of a machine specific standard shall control. Machines not addressed in this section are governed by the general requirements of sections 4, Hazard Identification and Control and 5.1 1 General Requirements* |
| **5.1.1 Machine Manual**<br>A machine manual shall be provided for each machine. | *E5.1.1 Machine manual*<br><br>*This manual would normally contain instructions for the assembly, installation, adjustments, care and use of the machine and its accessories, and a listing of the component parts with electrical, hydraulic, pneumatic and lubrication diagrams, if required, for use by maintenance or service personnel. The information may be contained in one or more manuals which may take the form of paper, electronic media, video, etc.* |
| **5.1.1.1 Responsibility** | |

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| It shall be the responsibility of the manufacturer to provide a manual(s) containing information on the construction, installation, care and use of the machine. This shall include illustrated parts lists, a general maintenance schedule, as well as electrical, hydraulic, and pneumatic diagrams, where such systems are included in the machine.<br>See also:<br><br>*6.3.1 Machine Modifier Revisions to Machine Manual*<br><br>*6.4.2 Rebuilder Revisions to Machine Manual*<br><br>*6.5.1 System manual responsibilities* | |
| **5.1.1.2 Standards**<br>The machine manual shall inform the reader of the existence of this standard and how to obtain a copy of this standard. | *E5.1.1.2 Standards*<br><br>*This standard is available in electronic format from the American National Standards Institute, 25 West 43rd Street, New York, NY 10036 (www.ansi.org).* |
| **5.1.1.3 Lockout/Tagout**<br>Instructions shall be included for proper shut down of the machine in preparation for lockout/tagout as required by ANSI Z244.1, *Control of Hazardous Energy – Lockout/Tagout and Alternative Methods* and Federal or State regulations or statutes. | *E5.1.1.3 Lockout/Tagout*<br><br>*Lockout/tagout requirements should consider all the potential and kinetic energy forms utilized by the machine, such as electrical, hydraulic, pneumatic, thermal, ionizing and non-ionizing radiation, chemical, spring and/or gravitational.* |
| **5.1.1.4 Hazard Zone Identification**<br>The manufacturer shall identify each hazard zone in or around the machine associated with the intended use and provide in the instruction's definitions of each identified hazard zone. | |
| **5.1.1.5 Identifying Warning and/or Label Location(s)**<br>The manual shall describe or depict the original placement of all warnings and labels. | |
| **5.1.1.6 Fasteners** | |

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| Where a fastener is critical to the safe operation of the machine, its grade and installation torque shall be provided. | |
| **5.1.1.7 Weight**<br>The weight(s) of the machine, major components and/or assemblies shall be provided by the manufacturer. | *E5.1.1.7 Weight*<br><br>*Use of inadequately rated lifting equipment or using improper lifting can cause serious injury. Guidance on lifting can be found in NIOSH lifting guides:*<br><br>*NIOSH [1994]. Applications manual for the revised NIOSH lifting equation. By Waters TR, Ph.D., Putz–Anderson V, Ph.D., Garg A, Ph.D. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-110 (Revised 9/2021), https://www.cdc.gov/niosh/docs/94-110/* |
| **5.1.1.8 Instruction Manual Warning Label**<br>In addition to the safety instructions required in Clause 5, the manufacturer shall affix to the machine a conspicuous permanent marking and/or a digital display communication that a manual(s) has been furnished that specifies information to be understood and followed to avoid injury.<br><br>The form of information shall comply with the requirements of the applicable ANSI Z535 standard(s). | |
| **5.1.2 Accessory Instructions – General**<br>The accessory manufacturer shall provide appropriate instructions with the accessory on its construction, care, installation, and use. | |
| **5.1.3 Accessory Instructions – Specific** | |
| **5.1.3.1 Lockout/Tagout**<br>For accessories in which hazardous energy exists, instructions shall be included for preparation for lockout/tagout as required by ANSI Z244.1, *Control of Hazardous Energy – Lockout/Tagout and Alternative Methods.* | |

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| **5.1.4 Controls** | |
| **5.1.4.1 Operator Controls**<br><br>Operator controls shall be located such that they are within the normal reach of a machine operator from the operating position(s) and not require that the operator(s) reach over, under or past unguarded moving parts, workpieces or cutters that can cause injury. | |
| **5.1.4.2 Operator Starting Position**<br><br>It shall not be possible to initiate the cutting action from any position other than the normal operator position(s). | |
| **5.1.4.3 Unintended Actuation**<br><br>Controls shall be designed to reduce to an acceptable level the risk of the possibility of unintended actuation by the normal movement of the machine operator or work. EXCEPTION: This requirement does not apply to emergency stop controls. | *E5.1.4.3 Unintended Actuation*<br><br>*Ease of access and multiple operating capability means are of primary importance on emergency stop controls. (See ANSI/NFPA 79.)*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.1.4.4 Identification**<br><br>The function of controls shall be clearly identified when their function is not self-evident. | *E5.1.4.4 Identification*<br><br>*See ANSI/NFPA 79.* |
| **5.1.4.5 Jog Control(s)**<br><br>The jog control(s) shall be hold-to-run. | |
| **5.1.5 Mechanical Controls** | |
| **5.1.5.1 Hand Wheels, Direction of Rotation**<br><br>A handwheel turned in a clockwise rotation should produce, for the controlled component, a linear movement to the right, away or upward. If rotary motion is produced by the handwheel, clockwise rotation should cause clockwise movement of the controlled component. Counterclockwise rotation of the handwheel should produce motion opposite that of clockwise rotation. | *E5.1.5.1 Hand Wheels, Direction of Rotation*<br><br>*This is the preferred action. However, there are exceptions where this is not possible, such as a handwheel at both ends of the same shaft.* |

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| **5.1.5.2 Levers, Direction of Motion**<br><br>A control lever should move in the same direction as the controlled component when both motions are parallel. | *E5.1.5.2 Levers, Direction of Motion*<br><br>*This is the preferred action. However, there are exceptions where this is not possible.* |
| **5.1.6 Multiple Control Stations** | |
| **5.1.6.1 Setup Control Station**<br><br>When a separate setup control station(s) is provided in addition to the normal operator's control station, selection of the setup station(s) shall render the operator's station inoperative, except for emergency stop. Switching from one control station to another shall not create a hazard. | *E5.1.6.1 Setup Control Station*<br><br>*A setup control station(s) is normally not capable of cycling the machine. It is basically a jog/ inch control station used to set up a part of a multi-station machine. Keyed on-off controls are generally used to lock out all other stations when a particular station is being used.* |
| **5.1.6.2 Multiple Operators**<br><br>When more than one operator is required to operate the machine from different control stations, each station shall be provided with a cycle start button and all cycle start buttons must be depressed concurrently in order to initiate the cycle. | |
| **5.1.6.3 Multiple Operating Stations, One Operator**<br><br>When one operator can operate the machine from more than one station, all cycle start buttons other than the one being used shall be made inoperative. | |
| **5.1.6.4 Multiple Part Loading**<br><br>Where parts are manually loaded and where the operator is exposed to a hazard due to cutter or machine component movement, the transfer of a part(s) from one position to another shall only occur when initiated by the operator. | |
| **5.1.7 Emergency Stop Control** | |
| **5.1.7.1 Application**<br><br>All machines shall incorporate one or more NFPA 79 compliant emergency stopping means, which | *E5.1.7.1 Application*<br><br>*Emergency stopping means include pull cables, mushroom buttons, pressure mats, presence* |

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| upon momentary operation, shall safely stop all machine motions. These emergency stopping means shall be located at all operator control stations and, if inherent hazards are present at other operating positions, an emergency stopping means shall be provided at each position. EXCEPTION: On a manual machine with a single motor and motor controller, the motor stopping means is considered the emergency stop. | *sensing devices and similar devices. Set up positions are not considered operator control positions. Examples of other locations could include off-loading position, etc.* |
| **5.1.7.2 Power-Operated Clamping**<br><br>When power operated clamping is used, it shall be so designed so as not to release due to a failure or actuation of the emergency stopping means. Release shall be accomplished by either the completion of the cycle or an intentional action by the operator. | *E5.1.7.2 Power-Operated Clamping*<br><br>*This may be accomplished by the use of toggles, wedges, cam lock arrangements, accumulator tanks with check valves, or by other means.* |
| **5.1.7.3 Control Function**<br><br>A control device shall not be used to initiate any motion unrelated to its designation. | *E5.1.7.3 Control Function*<br><br>*When an unanticipated motion occurs it can cause an operator reaction which results in an injury.* |
| **5.1.7.4 Interlocking of Electro-Optical, RF, and Area Scanning Presence Sensing Engineering Control Devices**<br><br>When used, a presence-sensing device shall be interlocked into the control circuit to initiate a category 1 stop (see ANSI / NFPA 79) for those hazardous situations covered by the device, or prevent operation of the hazardous function(s) covered by the device if a hand or other part of the body is detected in the sensing field. It shall not in itself create any hazard. The removal of the object from the sensing field shall not cause the hazardous functions covered by the device to resume (i.e., manual initiation shall be required). | *5.1.7.4 Remote Control*<br><br>*Where a machine is capable of being controlled remotely, Clause 5.1.18.1 Requirements for risk reduction measures and any governmental regulations that take precedence shall apply.* |

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| **5.1.7.5 Foot Operated Control Device**<br><br>A foot operated control device shall be provided with risk reduction measures to reduce to an acceptable level the risk of unintended operation when such actuation can result in a hazard to personnel. | *E5.1.7.5 Foot Operated Control Device*<br><br>*Unintended actuation may occur from falling stock or accidental stepping on the device. Two examples of risk reduction measures are:*<br><br>*a) to guard the top of the device so that the foot must be placed under the guard to actuate the device; or,*<br><br>*b) to lock out or remove the device when not in use.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.1.8 Hydraulics and Pneumatics** | |
| **5.1.8.1 General**<br><br>Machinery design shall reduce the risk of hazards to an acceptable level from the following:<br><br>• Overpressure;<br>• Pressure surges or under pressure;<br>• High pressure injection;<br>• Stored energy;<br>• Sudden hazardous movement of a hose resulting from leakage<br>• and/or component failures.<br><br>Hydraulic systems shall conform to the applicable sections of ISO 4413. Pneumatic systems shall conform to the applicable sections of ISO 4414. All system components shall be selected to be used in accordance with the manufacturer's specifications and instructions, including maximum working pressure.<br><br>All elements of the machinery, especially pipes and hoses, shall be protected against abrasion, contamination, ultraviolet radiation and mechanical or other damage. | *E5.1.8.1 General*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |

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| **5.1.8.2 Pressure Regulation**<br><br>Regulators shall be used for air controlling equipment and pneumatic actuators requiring less than line pressure or variable pressure settings. | |
| **5.1.8.3 Overpressure Protection**<br><br>Overpressure protection (e.g., regulator, relief valve, pressure switch, bypass) shall be provided on all hydraulic power sources. The pressure adjustment on a pressure compensated pump shall be the protective device. An additional relief valve downstream from the pump shall be provided. | |
| **5.1.8.4 Pressure Variations**<br><br>Circuits shall be designed and components applied so that anticipated pressure variations do not cause a hazard. | *E5.1.8.4 Pressure Variations*<br><br>*A high-pressure transient, as a result of valve closure, may cause failure of other components, creating a hazard from flying parts, hydraulic fluid discharge or uncontrolled motion. Components and circuit design should take this possibility into consideration.* |
| **5.1.8.5 Range of Pressure Adjustment**<br><br>No adjustable components shall be used that can be adjusted beyond the safe working range of the circuit unless means are furnished to prevent that adjustment. Pressure adjusting devices on such circuits shall be marked to indicate the allowable pressure range and should be lockable. | *E5.1.8.5 Range of Pressure Adjustment*<br><br>*Examples of adjustable components are relief valves, flow control valves, flow dividers and similar devices. The maximum safe pressure range of the circuit should be stated in the maintenance manual.* |
| **5.1.8.6 Loss of Pressure or Vacuum**<br><br>Circuits shall be designed and components selected, applied and adjusted so that loss of pressure or vacuum shall not cause a hazard. | *E5.1.8.6 Loss of Pressure or Vacuum*<br><br>*Parts coming loose from fixtures, tools flying out, or heads dropping due to loss of clamping pressure are typical hazards caused by loss of control media.* |

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| **5.1.8.7 Safety Shut-Off and Exhaust Valve**<br><br>Energy isolating device(s) shall be provided to shut off and release pressure from the various systems, including accumulators. These devices shall meet the requirements of ANSI B11.0. | |
| **5.1.8.8 Circuits with Maintained Pressure**<br><br>When pressure is maintained after power is off, a warning sign shall be used and procedures for de-pressurizing the circuit shall be described in the maintenance manual. | *E5.1.8.8 Circuits with Maintained Pressure*<br><br>*A warning stating "Danger: Pressurized System. Avoid Serious Injury. Discharge Pressure Before Servicing" or similar wording may be appropriate. Additional precautions may be necessary.* |
| **5.1.8.9 Pressure Control Fail-Safe**<br><br>Where proper safe machine operation requires that supply pressure be controlled within specific limits, an automatic means of stopping and preventing machine operation when the supply pressure falls below or goes above the specified limits shall be provided. | |
| **5.1.8.10 Accumulators**<br><br>Pressure vessels with an inside diameter larger than 6-in. (150mm) shall conform to the ASME Boiler and Pressure Vessel Code Section VIII Division 1 and be equipped with a pressure relief valve in the event of over pressurization.<br><br>Circuits employing accumulators shall automatically vent the accumulator pressure or isolate the accumulator when the machine is shut off.<br><br>Non-vented accumulators shall not actuate machine motion and shall be identified with a sign that is in accordance with ANSI Z535. Charging and discharging information for proper servicing of non-vented accumulators shall be given on or near the accumulator in a visible location and in the maintenance manual.<br><br>Gas-charged accumulators operating above 200 psig (.1406Kg/$m^2$) charging pressure shall be charged with inert gas | *E5.1.8.10 Accumulators*<br><br>*A properly identified non-vented accumulator will remind the maintenance personnel to discharge fluid before servicing. The warning given can state "Danger: Unvented Pressure Vessel. Avoid Serious Personal Injury. Discharge Fluid Before Servicing" or similar wording* |

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| **5.1.8.11 Air Filters, Lubricators and Mufflers**<br><br>The air shall be filtered and excessive moisture removed before it enters the system.<br><br>Lubrication shall be provided only for components that require it, and they can be of the single point type which applies lubrication directly to the actuator. Lubrication shall be set so as to provide sufficient lubrication but not so as to over lubricate, thereby causing excessive oil to be discharged into the atmosphere or create valve malfunction.<br><br>Mufflers used in safety systems and air dumps shall have sufficient capacity so as to not restrict the exhausting of the system and not be prone to contamination over time. Paper or bronze sintered elements shall not be used. | |
| **5.1.8.12 Accumulator Residual Pressure Management**<br><br>Circuits employing accumulators shall automatically vent the accumulator pressure or isolate the accumulator when the machine is shut off. | *E5.1.8.12 Accumulator Residual Pressure Management*<br><br>*Unexpected motion may occur from a charged accumulator, creating a hazard for maintenance personnel.* |
| **5.1.8.12.1 Non-vented Accumulator**<br><br>A non-vented accumulator shall be identified with a warning against its hazards. Charging and discharging information for proper servicing of a non-vented accumulator shall be given on or near the accumulator in a visible location, and in the maintenance manual. | *E5.1.8.12.1 Non-vented Accumulator*<br><br>*A properly identified non-vented accumulator will remind the maintenance personnel to discharge fluid before servicing. The warning given can state "Danger: Unvented Pressure Vessel. Avoid Serious Personal Injury. Discharge Fluid Before Servicing" or similar wording.* |
| **5.1.8.12.2 Circuits with Maintained Pressure**<br><br>When pressure is maintained with power off, such as in a counterbalance or accumulator circuit, a warning of this condition shall be provided. | *E5.1.8.12.2 Circuits with Maintained Pressure*<br><br>*A warning stating "Danger: Pressurized System. Avoid Serious Injury. Discharge Pressure Before Servicing" or similar wording may be appropriate. Additional precautions may also be necessary.* |

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| **5.1.8.12.3 Accumulator Charged Over 200 psig (.1406Kg/m$^2$)**<br><br>Gas-charged accumulators operating above 200 psig (.1406Kg/m$^2$) charging pressure shall be charged with inert gas. | |
| **5.1.8.13 Flexible Hose**<br><br>A flexible hose(s) shall be arranged in a manner so as not to create a draping or tripping hazard to the operator in the work area. Where failure of a flexible hose(s) can constitute a whipping hazard, the hose shall be constrained to reduce to an acceptable level the risk of that possibility. | *E5.1.8.13 Flexible Hose*<br><br>*Hose carriers, cable restraints, hose bundles, etc., offer this protection.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.1.9 Cutting Tool Retention** | |
| **5.1.9.1 Cutting Tool Retention During Rotation**<br><br>Means shall be provided to retain the cutting tool or blade. If held in place by a retention means the mechanism shall not loosen during any normal operating condition, or as a result of loss of power, stopping or braking action. | *E5.1.9.1 Cutting Tool Retention During Rotation*<br><br>*Consideration should be given to all normal operating conditions including acceleration and deceleration of the blade(s) and/or cutting tool(s).*<br><br>*Fastening means could include adequately torqued nuts, bolts or screws, locking arbor nuts, keyed flanges, pinned cutting tools, etc.* |
| **5.1.9.2 Cutting Tool Retention During Tool Changing**<br><br>The cutting tool or cutting tool adapter shall remain in place in the storage magazines or in the transfer mechanisms during all phases of the tool change cycle and shall not be released as a result of power loss. | |
| **5.1.10 Material Transfer Components** | |
| **5.1.10.1 Robot**<br><br>When a robot is used to load and unload machines, risk reduction measures shall be used to reduce to an acceptable level the risk of injury to personnel by any part of the robot. | *E5.1.10.1 Robot*<br><br>*A programmed robot may create a hazard by moving suddenly and unexpectedly or failing to take the programmed path. Limiting access is one way of providing a risk reduction measure. Access to the area can be interlocked or may require a* |

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| | *special key. Reference ANSI/RIA R15.06, and ANSI B11.20 for material handling.*<br><br>*Also see ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.1.10.2 Material Transfer Device**<br><br>A material transfer device which is an integral part of the machine that can create a risk of injury shall be protected by engineering controls. | *E5.1.10.2 Material Transfer Device*<br><br>*Limited access is the usual way of providing engineering controls. Access to the area can be interlocked or may require a special key.* |
| **5.1.10.3 Work Support/Loading Height**<br><br>Work support/loading height shall be designed to be convenient to an operator.<br><br>See Clause 6.8.3 Operation for employer's responsibility where the operator's stature can cause a risk of injury. | *E5.1.10.3 Work Support/Loading Height*<br><br>*See ANSI B11.TR 1-2016, Ergonomic Guidelines for the Design, Installation and Use of Machine Tools, and see Applications manual for the revised NIOSH lifting equation.* |
| **5.1.11 Arbor/Spindle Design** | |
| **5.1.11.1 Arbor/Spindle**<br><br>The arbor/spindle and tool shall be designed to fit without appreciable play. | |
| **5.1.11.2 Size of Arbor/Spindle**<br><br>The size and shape of the arbor/spindle for mounting cutting tools shall be designed to fit the applicable tools without appreciable play. | |
| **5.1.11.3 Direction of The Arbor/Spindle Thread**<br><br>When circular cutting tools are secured by means of a central arbor and fastener, the hand (left or right) of the thread shall be so that the arbor fastener tends to tighten as the spindle revolves under power. When direction of rotation is reversible or if an arbor/spindle brake is furnished, means shall be used to reduce the risk of the fastener spinning off. | *E5.1.11.3 Direction of The Arbor/Spindle Thread*<br><br>*This requirement helps to reduce the risk that the fastener will back off during a powered cut. However, on some machines equipped to reverse spindle rotation or equipped with a braking means, or both, a keyed washer or some means of adjusting the braking time may be necessary to prevent spin-off of the arbor fastener.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |

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| **5.1.11.3.1 Arbor Rotation Direction Marking**<br><br>The direction of arbor rotation must be clearly and durably marked on the machine, and in a place where it is visible when changing the arbor mounted tool. | |
| **5.1.11.3.2 Length of Arbor/Spindle Thread**<br><br>When circular saw blades are mounted by means of a central arbor/spindle, retaining nuts and flanges, the following two conditions shall be maintained:<br><br>a) Arbor/spindle thread shall be of sufficient length to allow full thread engagement of the retaining nut;<br><br>b) The saw blade shall be supported concentrically on the arbor/spindle. | |
| **5.1.11.4 Drive Pins**<br><br>Drive pins, when supplied, shall be of such a diameter, strength, and number to transmit without failure, from the spindle to the saw blade or cutting tool, the stall torque at the spindle of the largest motor intended to be used on the machine. | |
| **5.1.12 Operating Speed**<br><br>The operating speed(s) or range of speeds for which the machine was designed shall be provided with the machine. | *E5.1.12 Operating Speed*<br><br>*Because of the design and material, some saw blades and cutters may not be suitable for all possible spindle speeds of a machine. It is, therefore, important that an operator or setup operator know the speed at which the spindle will rotate in order to safely setup or use the machine. Common practice is to put the information on a plate on the machine or in the machine manual.* |

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| **5.1.12.1 Limiting Speed for a Rotating Cutting Tool**<br><br>A rotating cutting tool or circular saw blade designed to be used on a woodworking machine shall be marked, where possible, by its manufacturer with its maximum safe rotational speed. When the cutting tool or circular saw blade is too small to mark legibly, the maximum safe speed shall be marked on its packaging. | |
| **5.1.12.2 Excessive Speed of Cutter Rotation**<br><br>The employer shall supervise the selection and application of tooling to ensure rotating tools are not operated at speeds higher than their rated speed (RPM). | |
| **5.1.13 Design and Material of Saw Blade Flanges**<br><br>Flanges shall be of such diameter as to satisfactorily transmit the driving torque from the spindle to the circular saw blade or cutting tool. Where the bearing surface of the flanges is not sufficient to transmit the driving torque, drive pins or other means shall be used. Flanges may be made of steel, cast iron, or other material of equal or greater strength and rigidity. | |
| **5.1.13.1 Opposing Flanges**<br><br>Opposing flanges, between which a circular saw blade or cutting tool is mounted, shall be designed so that the opposing bearing surfaces on the flanges do not cause a bending problem resulting in a hazardous condition. | *E5.1.13.1 Opposing Flanges*<br><br>*Normally this requirement is satisfied by having equal diameter and equal bearing surfaces by the use of relieved flanges.* |
| **5.1.14 Tool/Workpiece Coasting Hazard**<br><br>Where normal use can result in injury to personnel from accidental contact with a rotating or moving tool, or workpiece that coasts to a stop after its driving means is de-energized, risk reduction measures shall be provided to reduce to an acceptable level the risk of that injury. The means used shall not create an additional hazard(s). | *E5.1.14 Tool/Workpiece Coasting Hazard*<br><br>*Means to satisfy this requirement include guards, braking devices and short coasting time equal to or less than 10 seconds.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |

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| **5.1.14.1 Tool/workpiece coasting hazard during power loss**<br><br>Engineering controls for safeguarding a coasting hazard shall be so designed that those engineering controls will remain functional upon loss of power. | |
| **5.1.15 Access door/cover**<br><br>A door cover which closes access to a hazard area not used in the processing of workpieces or in machine setup shall be attached in a manner which requires a tool(s) to open. Where access to a hazard area into which an operator must place body parts in the processing of workpieces or in the setup of a machine, the door cover shall be provided with risk reduction measures to reduce to an acceptable level the risk of an injury. | *E5.1.15 Access door/cover*<br><br>*A door/cover used for setup or maintenance should only be used by experienced personnel and may require that the machine be operational with the door/cover open. Where the machine does not have to be operational, the machine shall be disconnected and locked out from its power source.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.1.16 Warnings, safety signs, labels and instructions** | |
| **5.1.16.1 Permanent markings** | *E5.1.16.1 Permanent markings*<br><br>*Permanent in the context of labeling requirements refers to markings intended to last the life of the product when properly maintained to keep labels legible.* |
| **5.1.16.2 Label durability**<br><br>Permanent marking labels shall be so designed and placed to comply with ANSI/UL 969 for their intended application and expected lifetime. | |
| **5.1.16.3 Tool Information**<br><br>A tool shall be legibly marked where it will be readily visible after the tool has been installed, with the following:<br><br>a) Manufacturer's name, trade name or trademark.<br><br>b) The date or date period of manufacture. | |

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| c) A distinctive catalog number or the equivalent. | |
| **5.1.16.4 Permanent Marking Replacement labels**<br><br>For permanent marking labels containing safety information, the manufacturer shall make available replacement labels. | |
| **5.1.16.5 Safety Signs**<br><br>The design of safety signs shall comply with ANSI Z535.2, "Environmental and Facility Safety Signs." | *E5.1.16.5 Safety Signs*<br><br>*Safety signs are normally used to identify hazards within an environment. They are not generally used for specific, on-product hazards.* |
| **5.1.16.6 Safety symbols**<br><br>The design of safety symbols shall comply with ANSI Z535.3, "Criteria for Safety Symbols." | |
| **5.1.16.7 On-product warnings**<br><br>The design of on-product warnings and instruction labels shall comply with ANSI Z535.4, "Product Safety Signs and Labels." | |
| **5.1.16.8 Temporary hazards**<br><br>The design of temporary hazard tags shall comply with ANSI Z535.5, "Accident Prevention Tags (for Temporary Hazards)." | *E5.1.16.8 Temporary hazards*<br><br>*Temporary hazards are those which only exist for a limited period of time. For example, certain hazards may exist only during installation of a machine, after which the hazard no longer exists, and the warning is no longer appropriate.* |
| **5.1.16.9 Safety instructions**<br><br>The format of safety instructions shall comply with ANSI Z535.6, "Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials." | *E5.1.16.9 Safety instructions*<br><br>*Collateral materials can vary significantly in terms of their purpose, content, format, and/or length.*<br><br>*For example, they may come in the form of a bound manual, a single sheet of paper (folded or otherwise), a pamphlet, a booklet, or an electronic document.* |
| **5.1.17 Machine layout, installation, testing and startup** | |

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| **5.1.17.1 Floor loading**<br>The flooring supporting the machine and its associated equipment shall be capable of bearing the dynamic load. | |
| **5.1.17.2 Dust collection**<br>Dust collection shall be provided in accordance with the requirements of NFPA 664: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities. | *E5.1.17.2 Dust collection*<br>*The end user provides a dust collection system to be connected to the machine's dust extraction features such that the entire system complies with the dust limit values established by the Authority (Authorities) Having Jurisdiction.* |
| **5.1.17.3 Lockout/tagout**<br>Each machine, installation, use and maintenance shall comply with the Lockout/Tagout requirements of ANSI Z244.1, *Control of Hazardous Energy – Lockout/Tagout and Alternative Methods* and/or applicable governmental regulations. | *E5.1.17.3 Lockout/tagout*<br>*Occupational safety regulations having jurisdiction govern the user's minimum responsibilities for lockout/tagout. For Federal Occupational Safety and Health Administration regulations, see 29CFR1910.147.* |
| **5.1.18 Risk Reduction Measures** | |
| **5.1.18.1 Requirements for risk reduction measures**<br>If a hazard exists, risks shall be evaluated in accordance with ANSI B11.0. Where that evaluation identifies a danger, risk reduction measures shall be applied in accordance with ANSI B11.19. Where conflicts between ANSI O1 and ANSI B11 standards exist, the ANSI O1 requirements will take precedence. | *E5.1.18.1 Requirements for risk reduction measure*<br><br>*Hazards should be eliminated by design, where practical. If the hazard cannot be eliminated, the risk reduction measure requirements of this standard should be applied.*<br><br>*For the purposes of this standard, physical barriers are the first risk reduction measures to be applied. Other risk reduction measures are then described for use, followed by warnings and instructions.*<br><br>*Proper risk reduction is a function of many things, including nature of the hazard, location of the hazard, and machine application.*<br><br>*Engineering control devices, such as a guard, guarding device, or awareness barrier is required when a rotating/moving cutter(s) is exposed on a machine in the automatic or semi-automatic mode and any part of the operator's body is at risk of entering the hazard zone.* |

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| **5.1.18.2 Supplemental and Emerging Risk Reduction Measure Technology**<br>When applying supplemental or emerging risk reduction measures technology, the technology shall be employed only in conjunction with the risk reduction measure requirements of this standard. Risks of applying supplemental and/or emerging technologies shall be addressed as required in ANSI B11.0. | *E5.1.18.2 New Risk Reduction Measure Technology*<br><br>*The risk reduction measure requirements of this standard may be exceeded where possible. At the time of this standard's publication, a number of patent protected and other emerging risk reduction measure technologies were known to the scientific community. Users of this standard are encouraged to consider any new technology that has been reasonably established as an acceptable risk reducing means for the user's specific application. 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.*<br><br>*Examples include self-closing of unattended blade guards, flesh-sensing/Active Injury Mitigation System (AIMS) technologies, operator proximity sensors and more.* |
| **5.2 Requirements for specific machines and special devices**<br><br>The general requirements of Clause 5.1 apply to all machines. Where contradictions exist, the requirements of a machine specific standard shall be the controlling requirement. Machines not addressed in this section are governed by the general requirements of Clause 5.1. | *E5.2 Requirements for specific machines and special devices*<br><br>*Machine Specific Requirements are included in this standard for the sake of continuity with prior versions of ANSI O1.1. It is the intent of this Committee that future machine specific standards, adopted under the O1 series, will replace their respective sections of this standard.* |
| **5.2.1 Vertical band saw** | |
| **5.2.1.1 Blade guide(s)**<br>An upper and lower blade guide shall be furnished that provides adequate support for the blade. | *E5.2.1.1 Blade guide(s)*<br>*Typically blade guides have the ability for adjustment to maintain proper guidance of the saw blade as these guides wear and different width blades are used. There should also be adjustment in the thrust bearing behind the saw blade to maintain proper support of different width saw blades.* |
| **5.2.1.2 Work Support**<br>A table shall be provided to properly support the workpiece immediately adjacent to the blade. | *E5.2.1.2 Work Support*<br>*A work support may consist of a table with or without a table insert.* |

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| **5.2.1.2.1 Work support insert material**<br>The material adjacent to and/or surrounding the blade shall meet the following requirements:<br>a) be of non-sparking material;<br>b) not be of magnesium or other material likely to be ignited by sparking; and<br>c) be sufficiently soft so that contact between the table or insert and the blade will not result in rupture or splitting of the blade. | |
| **5.2.1.2.2 Table insert retention**<br>An insert shall be firmly held in place and prevented from rotating. | |
| **5.2.1.3 Upper blade guide adjustment**<br>An upper blade guide shall be vertically adjustable for the full range of the workpiece thickness capacity. The employer shall be responsible for supervising the band saw operator adjustment of the upper blade guide to be as close to the maximum height of the workpiece or fixture as practical. | |
| **5.2.1.4 Guarding of the saw blade** | *E5.2.1.4 Guarding of the saw blade* |
| **5.2.1.4.1 Blade enclosure**<br>All portions of the saw blade shall be enclosed or protected by engineering controls except the working portion between the bottom of the upper guide and the top of the table. The guard providing protection in the guidepost area above the upper guide shall guard the cutting edge of the saw blade on the front and open side of the machine. | *E5.2.1.4.1 Blade enclosure*<br>*Where a user application creates a blade exposure other than the working portion, the user is responsible for utilizing any needed additional risk reduction measures appropriate for that specific saw operation.* |
| **5.2.1.4.2 Guard adjustment**<br>The employer shall supervise the band saw operator adjustment of the upper guard to minimally clear the workpiece and expose only the amount of blade necessary to complete a given sawing operation | |
| **5.2.1.5 Guarding of the band wheels**<br>Means shall be provided to enclose the band saw wheels during operation. Access doors or covers used shall be secured in a manner so that they will remain closed during normal operation and | *E5.2.1.5 Guarding of the band wheels*<br><br>*The table of distance to hazard in ANSI B11.19 It is recognized that the band saw wheels and* |

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| in the event of a band breaking. The enclosure shall meet the requirements of ANSI B11.19, for enclosures except for the band exit area, the guidepost and the telescoping guard. These openings shall be kept to a practical minimum. | *guides must be accessible for maintenance and adjustment and cannot be permanently enclosed.* |
| **5.2.1.6 Wheel coasting hazard** | |
| **5.2.1.6.1 Coasting time limit**<br>An effective means of stopping the blade motion shall be provided to facilitate safety protocols that reduce to an acceptable level the risk of injury from the coasting hazard. Stopping time shall not exceed 10 seconds, except where a band saw's runup time exceeds 10 seconds. Where the runup time exceeds 10 seconds, the coasting time to a complete stop must not exceed the runup time. In no case shall the coasting time to a complete stop exceed 30 seconds. Blade stopping methods shall not create additional hazards. | *E5.2.1.6.1 Coasting time limit*<br>*An adequate brake or sufficient frictional drag of the drive system can satisfy the requirements of this clause.*<br><br>*When stopping a band saw, care must be taken to consider inertial forces. Stopping a band saw blade too quickly can create risks of blade and/or drive belt failure and ejection injury hazards.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.1.6.2 Operator actuated brake**<br>An operator actuated brake shall be provided that brings the band saw wheels to a stop. | *E5.2.1.6.2 Operator actuated brake*<br>*The operator must be able to stop the band saw moving parts in the event of unexpected instances such as blade breakage.* |
| **5.2.1.7 Blade housing access door interlock**<br>A blade-housing interlock shall be provided for bandsaws to meet the requirements of section 5.1.7.4**,** *Interlocking of Electro-Optical, RF, and Area Scanning, Presence, Sensing, and Engineering control devices*, so that the blade will not turn except for adjustment until the housing is closed and will not open until all blade motion has stopped. | *E5.2.1.7 Blade housing access door interlock*<br>*See also Clause 5.1.15, Access Door/Cover.*<br>*For lock out/tag-out compliance, the interlock will prevent engineering control bypass until all motion has stopped. The engineering control can then be bypassed and the machine locked out.* |
| **5.2.1.8 Saw blade tension**<br>A means shall be provided to adjust and indicate the proper tension for the range of band saw blades designed to be used. | *E5.2.1.8 Saw blade tension*<br>*Excessive tension can result in fatigue failure of the blade resulting in blade breakage. Tension setting should be in accordance with the manufacturer's instruction and controlled by the employer's instruction and supervision.* |
| **5.2.1.9 Blade tracking window**<br>A blade-tracking window shall be provided and placed so that the operator has visual contact | |

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| without opening the blade housing to determine blade motion and blade tracking. | |
| **5.2.1.10 Saw blade tracking**<br>Means shall be provided for the adjustment of the saw blade tracking with respect to the upper and lower band saw wheels. | *E5.2.1.10 Saw blade tracking*<br>*Blade tracking is generally accomplished by tilting one of the band saw wheels so that the blade will remain centered on the wheel rims as it is turning.* |
| **5.2.1.11 Saw blade width** | |
| **5.2.1.11.1** The band saw manufacturer shall specify the maximum saw blade width in the instruction manual and on the product label(s). | |
| **5.2.1.11.2 Blade width limitation**<br>A built-in means shall be provided to limit the maximum blade width that can be installed on the machine where greater blade width will create a hazard. | *E5.2.1.11.2 Blade width limitation*<br>*Clearances in access doors or covers or limited guard width(s) can be utilized to limit maximum blade width.* |
| **5.2.1.12 Instructions on minimum radius operations**<br>The blade manufacturer shall provide instructions regarding the minimum radius that can be sawed for each recommended saw blade width. | *E5.2.1.12 Instructions on minimum radius operations*<br>*It is intended that the instructions provided on, or with, the band saw are to be given to the operator by the employer.* |
| **5.2.1.13 A small or difficult-to-hold workpiece**<br>Where a hazard exists to the operator on manually fed machines in processing a small or difficult-to-hold workpiece, means shall be furnished by the employer to feed or clamp, or both, the workpiece to complete the operation safely. | *E5.2.1.13 A small or difficult-to-hold workpiece*<br>*Round, trapezoidal or unusually shaped parts are examples of difficult-to-hold workpieces. These types of workpieces have the potential to rotate, or pivot compared to a rectangular workpiece such as a board if the blade grabs the workpiece during the cut. Such rotation or pivoting movement will self-feed the workpiece, potentially moving hands toward the blade, or create potential for workpiece pivoting/rotation backward or upward toward the operator, depending on the shape and circumstances.* |
| **5.2.1.14 Feed rolls**<br>In-running nip points of powered feed rolls on a band saw shall be guarded in accordance with ANSI B11.19. | *E5.2.1.14 Feed rolls*<br>*It is common on resaw accessories on band saws to use powered feed rolls* |

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| **5.2.1.15 Rip fence** | |
| **5.2.1.15.1 Rip fence locking**<br>A rip fence, when supplied, shall have adequate means for locking it in position for all locations within its capacity. | |
| **5.2.1.15.2 Rip fence support**<br>A rip fence, where required for safe cutting operations, shall provide appropriate support to stabilize the workpiece throughout the cutting operation. | *E5.2.1.15.2 Rip fence support.*<br>*Operations such as resawing may require taller rip fence facings to provide support.* |
| **5.2.2 Circular saw** | |
| **5.2.2.1 General Circular Saw Requirements** | |
| **5.2.2.1.1 Direction of rotation**<br>The manufacturer shall indicate on the machine the direction of rotation for the saw blade. | |
| **5.2.2.1.2 Saw Blade**<br>The manufacturer shall supply the following information on the model number plate or name plate of the sawing machine.<br><br>(a) Blade characteristics appropriate for the expected range of uses of the saw.<br>(b) The speed of rotation of the spindle.<br>(c) Maximum permissible blade size. | |
| **5.2.2.1.3 Maximum blade size**<br><br>The saw chamber and/or blade guarding system shall prevent use of a blade larger than the specified maximum.<br>The circular saw machine shall be constructed so that the saw will not operate with blade diameters more than 2 % larger than what is recommended by the manufacturer. | |

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| **5.2.2.1.4 Blade condition**<br>Only blades having a bore compatible with the saw's arbor shall be used. Blades that are bent, cracked, are missing teeth, have a buildup of foreign material or are excessively dull, shall not be used. | *E5.2.2.1.4 Blade condition*<br>*Properly fitting bore reducer bushing to fit the blade to the arbor are permissible.* |
| **5.2.2.2 Gang rip saws and straight-line rip saws** | |
| **5.2.2.2.1 Hood and guard**<br>Clause 5.1.18.1 Requirements for risk reduction measures and the following requirements apply. The blade(s) shall be guarded except for the areas necessary to feed the stock and retrieve a workpiece. An upper hood shall be provided that will protect the hand(s) of the operator from flying splinters and broken saw teeth and will deflect sawdust away from the operator. Feed rolls and chains shall be protected by engineering controls. | *E5.2.2.2.1 Hood and guard*<br>*On machines with arbors below the table, it has been found useful to incorporate a dust collection pickup on the upper hood. This greatly reduces the amount of chips and sawdust in the point-of-operation area.*<br><br>*See ANSI B11.19 for guidance in determining guard design requirements.*<br><br>*Avoiding nip point contact may be done by use of a drop away lid which deflects to relieve a pinch point at the chain opening or by extending the upper hood past this point without obscuring view of the workpiece. It is recommended that the employer requires the operator to wear kickback aprons.* |
| **5.2.2.2.2 Arbor Access Door Safety**<br>Opening of the arbor access door to the saw chamber shall be prevented until all hazardous motion has ceased. The arbor shall not start rotating under power unless the access door is closed. | *E5.2.2.2.2 Arbor Access Door Safety*<br>*See Clause 5.1.14 Tool/workpiece coasting hazard.* |
| **5.2.2.2.3 Arbor lock**<br>A device shall be provided to prevent rotation of the saw arbor during installation and removal of the 'gang' of saws. | |
| **5.2.2.2.4 Feed Start**<br>The feed start control shall not be operable until the arbor is running. | |
| **5.2.2.2.5 Adjustment of power feed**<br>The employer shall supervise the proper installation, maintenance and use of power feed devices for each piece of stock to help reduce the risk of | |

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| kickback. | |
| **5.2.2.2.6 Chain feed bed**<br>The links in a chain feed bed shall be designed, where possible, so as not to present a pinch point hazard. Where this is not possible the nip points shall be protected by engineering controls. | |
| **5.2.2.2.7 Side guarding**<br>Side guarding shall be provided to prevent narrow trim edges from being thrown out of the side of the machine. | *E5.2.2.2.7 Side guarding*<br>*Guarding may be done with a barrier that adjusts itself to the thickness of wide pieces and drops to the tabletop for narrow stock or by other means.* |
| **5.2.2.2.8 Anti-kickback device**<br>An anti-kickback device(s) shall be provided to facilitate safety protocols that reduce to an acceptable level the risk of the possibility of the unexpected backward movement of the workpiece causing injury to an operator or bystander. It shall be operable for all stock thicknesses up to the full through-cutting capacity of the saw. In an operation where an anti-kickback device(s) cannot be used, the employer shall provide other equally effective means to reduce the risk of injury from unexpected backward movement of the workpiece. | *E5.2.2.2.8 Anti-kickback device*<br>*It is recognized that all anti-kickback devices have some limitations such as being less effective on hard surface materials, damaging delicate surface finishes, requiring frequent maintenance to retain effectiveness, and similar limitations. Creating a safeguarded space for the kickback zone to acceptably reduce the risk of access in a manner complying with ANSI B11.19 is a way of providing equivalent protection where anti-kickback devices are not suitable for the application.*<br><br>*See also ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.2.2.9 Kickback Zone** | |
| **5.2.2.2.9.1 Kickback Zone Warning**<br>The manufacturer shall warn that a kickback zone exists, define the approximate width and height of the kickback zone volume, and, if applicable, means for reducing the volume size. | |
| **5.2.2.2.9.2 Kickback Zone Supervision**<br>The employer shall supervise the establishment and maintenance of kickback zone safeguarded space to acceptably reduce the risk of access. | *E5.2.2.2.9.2 Kickback Zone Supervision*<br>*The length of a kickback zone is dependent on the specific operation. The employer is in the best position to determine that zone component.* |
| **5.2.2.2.10 Table**<br>A table or other equivalent support means shall be provided. | *E5.2.2.2.10 Table*<br>*For large workpieces, the table supplied with the saw may not provide sufficient support. External support means, such as conveyors, infeed rollers, are examples of equivalent support.* |

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| **5.2.2.2.10.1 Table size and strength**<br>The table or other equivalent support means shall have sufficient size and strength to stabilize the workpiece prior to the workpiece engaging the automatic feed mechanism and throughout the cutting operation. | *E5.2.2.2.10.1 Table size and strength*<br>*While necessary to support very wide material, in normal operation the stock, once fed into the feed system of the rip saw, does not touch the worktable. The primary purpose of the worktable is to provide a multi-purpose cover for the machine base and to provide a convenient return slide surface, when needed.* |
| **5.2.2.2.11 Fence (Guide)**<br>An adjustable fence shall be provided for width of rip positioning before the workpiece engages the feed mechanism to commence a cutting operation. | |
| **5.2.2.2.12 Infeed and/or Outfeed devices and Conveyors**<br>Infeed and outfeed devices, including ASME/ANSI B20.1 compliant conveyors, shall be designed to reduce the exposure of the operator to additional hazards. | *E5.2.2.2.12 Infeed and/or Outfeed devices and Conveyors*<br>*Properly designed infeed conveyors will move the operator away from the infeed hazard zone (See Figure #X) and should be included when practical with the saw.* |
| **5.2.2.2.13 Workpiece dimensions**<br>The manufacturer shall specify in the saw instructions the minimum and maximum workpiece dimensions, as applicable, that can be safely processed by the saw. | |
| **5.2.2.2.14 Crosscutting**<br>The manufacturer shall provide instruction that solid wood lumber shall not be cut across the grain. | *E5.2.2.2.14 Crosscutting*<br>*Rip saws are designed to be safely used for ripping operations only. They are not designed or intended to be used for cutting across the narrow dimensions of a workpiece.* |
| **5.2.2.2.15 Maintenance Mode**<br>At all times when the machine is in the maintenance mode, an audible and/or visible warning shall be active indicating the maintenance mode is engaged. | |
| **5.2.2.3 Cut-off saw**<br>The requirements placed on Fixed Angle Jump Saws are found in the machine specific standard ANSI O1.1-1. | *E5.2.2.3 Cut-off saw*<br>*The following types of a saw are considered cut-off saws: swing, jump, underslung, overtable, inverted swing, miter and straight-line cut-off saws. Other generic names may also designate a similar* |

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| | *function saw. Cut-off saws are not designed to be used for rip cutting.* |
| **5.2.2.3.1 General requirements** | |
| **5.2.2.3.1.1 Blade guard**<br>Each saw shall be provided with guarding designed to facilitate safety protocols that reduce to an acceptable level:<br>• the risk of injury from flying splinters and broken saw teeth, and<br>• the risk of contacting the saw blade. | *E5.2.3.1.1 Blade guard*<br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.2.3.1.2 Fence**<br>A fence shall be provided that will resist movement of the workpiece in the cutting direction of the blade. | *E5.2.2.3.1.2 Fence*<br>*This fence may also serve as a guide to position the workpiece at a specific angle with respect to the saw blade.* |
| **5.2.2.3.1.3 Operating controls**<br>A saw arranged to power feed the cutting head through the cutting stroke shall be designed to return the saw blade carriage to its at rest position if the cutting stroke is stopped by interruption of an operating control. Interruption of the cutting stroke shall not create additional hazards. This control feature shall not override an Emergency Stop control. | *E5.2.2.3.1.3 Operating controls*<br>*Cut-off saw operations commonly process random widths of material. Operators may interrupt a full cutting stroke for a less than full width piece. An automatic return helps to avoid a possible hazard of the carriage continuing to come out after feed interruption.* |
| **5.2.2.3.1.4 Travel limit**<br>The saw shall have a mechanical travel stop designed to prevent any unguarded part of the saw blade from extending beyond the front edge of the work support table. | |
| **5.2.2.3.2 Under table cut-off saw**<br>The requirements placed on under table cut-off saw are found in the machine specific standard ANSI O1.1-1. | *E5.2.2.3.2 Under table cut-off saw*<br>*Underslung, inverted swing or jump saws are typical under table type saws.* |
| **5.2.2.3.3 Over table cut-off saw** | *E5.2.2.3.3 Over table cut-off saw*<br>*Chop saws, miter saws, swing saws and overhead sliding or articulated saws are typical of over table saws.* |
| **5.2.2.3.3.1 Saw blade guarding**<br>An upper guard shall be provided to enclose the saw blade periphery not required to be exposed | *E5.2.2.3.3.1 Saw blade guarding* |

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| during the cutting operation to facilitate safety protocols that reduce to an acceptable level the risk of injury from blade contact, flying splinters, broken saw teeth and other debris. A lower guard shall be provided which, in the at rest position, shall cover the lower part of the blade sides to at least the full depth of the tooth gullet.<br><br>**EXCEPTION:** Where work-actuated lower blade guards increase the risks of an operation and other machine risk reduction measures that equally control the risk of contact with the saw blade have been applied, the employer is not required to utilize the lower blade guard. | *See ANSI B11.0 for guidance on achieving acceptable risk.*<br><br>*Where lower guards contact the workpiece additional risks may be created and require employment of other risk reduction measures.* |
| **5.2.2.3.3.2 Work holding means**<br>The employer shall supervise installation and use of workpiece securing means appropriate for the task to prevent stock movement during a cutoff cycle. When there is a risk of injury from the pinching hazard created by the workpiece securing means, the hazard shall be safeguarded in accordance with ANSI B11.19. | *E5.2.2.3.3.2 Work holding means*<br>*The employer has first-hand knowledge of the sawing task and is, therefore, obligated to determine the most suitable workpiece securing means.* |
| **5.2.2.3.3.3 Direction of rotation**<br>The direction of rotation of the saw blade shall tend to force the stock down on the work support surface and against the fence for cross cutting operations. | |
| **5.2.2.3.1.2 Swing cut-off saw carriage return**<br>On a manually operated swing cut-off saw a means shall be provided to prevent the saw carriage from moving out of its at rest position as a result of gravity or vibration. | *E5.2.2.3.1.2 Swing cut-off saw carriage return*<br>*A counterweight is often used for this purpose on a swing cut-off saw. When used, the counterweight should be guarded by a barrier extending to the floor. The guard should prevent unintended contact with the counterweight. On overhead sliding or straight-line swing cut-off saws it may be possible to adjust the machine so that the saw blade will remain at the rear rest position by adjusting the machine so that the arbor has to travel slightly uphill as it is moved through its cutting stroke.* |

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| **5.2.2.4 Panel saw** | |
| **5.2.2.4.1 Saw blade guarding**<br>Clause 5.1.18.1 Requirements for risk reduction measures applies. | |
| **5.2.2.4.2 Stock holding means**<br>Stock securing means shall be provided to prevent stock movement during the cutting cycle. When there is a risk of injury from the pinching hazard created by the work securing means, the hazard shall be protected by engineering controls in accordance with ANSI B11.19. | |
| **5.2.2.4.3 Saw and/or work feeding mechanisms**<br>Clauses 5.1.15.1 Requirements for risk reduction measures and 5.1.6.2 Material transfer apply. | |
| **5.2.2.5 Radial arm saw** | |
| **5.2.2.5.1 Saw blade hood**<br>Each saw shall be provided with a hood that completely encloses the upper portion of the blade down to a point that includes the centerline of the saw arbor to prevent arbor mounted devices from coming off. The hood shall be designed to help to protect the operator from flying debris and broken teeth and to deflect sawdust away from the operator. | |
| **5.2.2.5.1.1 Maximum blade size**<br>Clause 5.2.2.1.3 Maximum blade size, shall apply. | *E5.2.2.5.1.1 Maximum blade size*<br>*Typically, on radial arm saws, maximum blade size is limited by the blade guard design.* |
| **5.2.2.5.2 Lower blade guard**<br>The manufacturer shall provide a lower blade guard that will:<br><br>a) Cover both sides of the teeth of the blade not covered by the upper guard when the blade and lower guard are clear of the workpiece and table;<br><br>**EXCEPTION:** A one-piece combination upper and lower blade guard may have a 1-1/4-in. (31.8-mm) side slot on the motor side, extending from the motor-shaft to | *E5.2.2.5.2 Lower blade guard*<br>*When cutting a compound miter and other operations cause a guard binding problem, the guard may have to be locked out of position or be removed. On completion of the operation the guard should be reinstalled by the operator maintenance personnel.*<br><br>*The purpose of the lower guard is to reduce the likelihood of blade contact from the side or axial direction, when the saw blade is not in the cut. It is designed for the 90 degrees crosscut mode, when the saw blade is perpendicular to the table* |

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| the bottom of the guard, for motor-shaft clearance.<br><br>b) Cover the teeth of the blade to their full depth;<br><br>c) For miter and bevel angles of 45° and less, comply with (a) and (b) in a radial direction, and (d); and<br><br>d) Automatically ride over the workpiece and return to the original position upon leaving the Workpiece.<br><br>**EXCEPTION:** A mechanical means may be provided to raise and lower the lower guard during crosscutting. | *surface. It does not prevent blade contact from the radial or sawing direction.*<br><br>*When the lower guard is work actuated, the lower guard may increase the risk of injury caused by problems including:*<br><br>*a) Lower guard may hang up when setting up to perform, or when performing, bevel cuts;*<br><br>*b) Lower guard may become caught in prior kerfs in the fence or table;*<br><br>*c) Short, cut-off pieces of wood may bind between the lower guard and the saw blade and lodge inside the upper guard;*<br><br>*d) The lower guard may become bound up against the fence when attempting to perform certain in-rip cuts;*<br><br>*e) Narrow cut-off pieces may bind between the lower guard and the saw blade and be thrown towards the operator.* |
| **5.2.2.5.2.1 Lower blade guard instructions**<br>The manufacturer shall furnish instructions for the proper use of a lower blade guard and the hazards, if any, caused by its use. | *E5.2.2.5.2.1 Lower blade guard instructions*<br>*When cutting a compound miter and other operations cause a guard binding problem, the guard may have to be locked out of position or be removed. On completion of the operation the guard should be reinstalled by the operator maintenance personnel.* |
| **5.2.2.5.2.2 Lower saw blade guard use**<br>The lower guard shall be used only for sawing operations where it functions properly. Care shall be taken by the employer to see that additional hazards resulting from the use of lower guards are not created. | *E5.2.2.5.2.2 Lower saw blade guard use*<br>*On repetitive crosscuts it is common to slide stock past the front of the blade and the lower blade guard helps to prevent unintended contact with the blade from the side.* |
| **5.2.2.5.3 Direction of rotation**<br>The manufacturer shall indicate on the machine the direction of rotation for the saw blade that tends to force the stock down on the work support surface and against the fence for cross cutting operations. | *E5.2.2.5.3 Direction of rotation*<br>*The proper direction of rotation is counterclockwise when viewed from the right-hand side of the saw.* |

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| **5.2.2.5.4 Maximum blade coast time**<br>A radial-arm saw shall be designed such that a 10-in. (254-mm) or smaller blade will stop within 15 seconds and a larger blade will stop within 25 seconds. | |
| **5.2.2.5.5 Fence**<br>A saw table supplied by the manufacturer shall be equipped with a fence which is an adequate back stop when cross cutting and a stock guide when ripping. The employer shall supervise maintenance of the integrity of the fence and provide instruction and training for the use of the fence during those operations for which it was designed. | *E5.2.2.5.5 Fence*<br>*Radial arm saw fences are often made of wood and considered to be a sacrificial part that will be cut by the saw blade. The employer is in the best position to determine when a fence needs to be replaced. Separate fences may be provided for dedicated use in cross cutting or ripping operations.* |
| **5.2.2.5.6 Table**<br>It is the responsibility of the employer to supervise maintenance of the integrity of the saw table size, and support surface. Replacement tables shall meet or exceed the manufacturer's specifications. | *E5.2.2.5.6 Table*<br>*Radial arm saw tables are typically considered to be a sacrificial part that will be cut by the saw blade. The employer is in the best position to determine when a table needs to be replaced.* |
| **5.2.2.5.6.1 Minimum table size**<br>The table shall, at minimum, be large enough that the unguarded portion of the blade shall not extend beyond the table or mounting frame when the carriage is at any position on the arm. | |
| **5.2.2.5.7 Travel limit**<br>The saw shall have a mechanical travel stop designed to prevent any unguarded part of the saw blade from extending beyond the front edge of the work support table. | |
| **5.2.2.5.8 Requirements for crosscutting** | |
| **5.2.2.5.8.1 Blade tooth hook (rake) angle for crosscutting**<br>The manufacturer shall provide a warning in the instruction manual stating that only saw blades with a hook/rake angle between ± 5° shall be used for manual crosscutting operations. | |
| **5.2.2.5.8.2 Requirements for crosscutting safeguarding.**<br>Clause 6.8.3.4 Employer risk reduction measure responsibilities. applies. | *E5.2.2.5.8.2 Requirements for crosscutting safeguarding.*<br>*Some radial arm saw features required for cross-* |

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| | *cutting are not used when the saw is set up ripping operations.* |
| **5.2.2.5.8.3 Adjustable stop**<br>An adjustable means shall be furnished with the saw to limit the forward travel of the blade beyond the position necessary to complete the operation. The employer shall provide employee training and supervise the proper installation, maintenance and use of the limit for each set-up. | *E5.2.2.5.8.3 Adjustable stop*<br>*Instructions to the employee on how to use a "C" clamp on the arm can meet this requirement* |
| **5.2.2.5.8.4 Anti-roll out**<br>The employer shall provide a means to prevent the saw carriage of a manually operated saw from moving forward on the arm as a result of gravity or vibration. | *E5.2.2.5.8.4 Anti-roll out*<br>*To provide anti-roll out, the saw may be installed with its front end slightly higher than the opposite end or other methods may be used to satisfy this requirement* |
| **5.2.2.5.8.5 Saw carriage return** | E5.2.2.5.8.5 Saw carriage return |
| **5.2.2.5.8.5.1 Saw carriage return training**<br>On a manually operated saw the employer shall train the operator to return the saw carriage to its at rest position after completion of the cut and before releasing the saw carriage handle. | *E5.2.2.5.8.5.1 Saw carriage return training*<br>*On a manually operated saw it is important to train the operator to always push the saw carriage back to its rear at rest position to help reduce the risk of blade exposure in front of the fence.* |
| **5.2.2.5.8.5.1 Saw carriage return installation**<br>Radial arm saws shall be so designed and installed in such a manner so as to cause the saw carriage to return to the starting position without rebounding past the fence when released by the operator.<br><br>Return function shall be verified with the saw off by releasing the saw carriage from the end of the arm so that the saw carriage returns to the home position without any part of the blade rebounding beyond the front of the fence. | *E5.2.2.5.8.5.1 Saw carriage return installation*<br>*Return of the saw carriage can be done with a device such as a spring or counterweight or tilting the saw arm front to return the saw carriage by gravity. If a released saw carriage does not remain behind the fence, there is an increased risk of blade contact.* |
| **5.2.2.5.9 Ripping operation** | |
| **5.2.2.5.9.1 Requirements for ripping safeguarding.**<br>Clause 6.8.3.4 Employer risk reduction measure responsibilities applies. | *E5.2.2.5.9.1 Requirements for ripping safeguarding.*<br>*In this standard a ripping operation on a radial arm saw is one in which the saw carriage is locked to the arm and the plate of the saw blade* |

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| | *is positioned to be parallel with the fence or back stop.*<br><br>*Some radial arm saw features required for ripping are not used when the saw is set up crosscutting operations.* |
| **5.2.2.5.9.2 Hold down device**<br>A hold down device shall be furnished to facilitate safety protocols that reduce to an acceptable level the risk of the stock lifting off the table at the start of a ripping operation. | *E5.2.2.5.9.2 Hold down device*<br>*The edge of the upper blade guard can be rotated and locked down over the workpiece to satisfy this requirement.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.2.5.9.3 Anti-kickback device**<br>An anti-kickback device designed to contact the workpiece on both sides of the kerf on the out-feed side of the blade shall be provided. The device shall be operable for all thicknesses of material within the capacity of the saw. | *E5.2.2.5.9.3 Anti-kickback device*<br>*It is recognized that all anti-kickback devices have some limitations such as being less effective on hard surface materials, being difficult to adapt to non-through cutting operations, requiring frequent maintenance to retain effectiveness, mounting on components which must be removed to do the operation and similar limitations. Customized featherboards and fixtures are recognized substitute anti-kickback devices where those provided by the manufacturer cannot be used or are not effective for the particular use.* |
| **5.2.2.5.9.4 Spreader**<br>The manufacturer shall make a spreader available for a saw used for ripping. The spreader shall be capable of being aligned with the saw blade, positioned in the workpiece kerf, and designed to help facilitate safety protocols that reduce to an acceptable level the risk of kickback that would otherwise be caused by workpiece kerf from closing on the saw blade. | *E5.2.2.5.9.4 Spreader*<br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.2.5.9.4.1 Spreader alignment**<br>A spreader, when attached, shall move automatically with the arbor when the saw is set for bevel cuts. | |
| **5.2.2.5.9.5 Push stick**<br>Clause 5.2.8.3 *Manual work feeding device* applies. | |

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| **5.2.2.5.9.6 Special fixture**<br>A special fixture and/or feeding device to provide clearance between the fence and the lower blade guard, shall be provided by the employer and used by the operator for ripping a narrow width close to the fence. | *E5.2.2.5.9.6 Special fixture*<br>*Fence spacers are commonly used to prevent interference between the guard and the fence and are commonly referred to as an auxiliary fence or filler.* |
| **5.2.2.5.9.7 Direction of feed** | |
| **5.2.2.5.9.7.1 Direction of feed training**<br>The employer shall provide operator education and training to feed the workpiece only against the direction in which the saw blade turns | *E5.2.2.5.9.7.1 Direction of feed training*<br>*When material is fed with the direction of rotation, it can be grabbed by the blade and be propelled rapidly through the cut in an uncontrolled fashion. This uncontrolled feeding action can cause contact with the blade or throw the workpiece from the outfeed side of the saw causing injury. One way the manufacturer can satisfy the requirement is by posting a warning on the machine* |
| **5.2.2.5.9.7.2 Direction of feed marking**<br>The manufacturer shall provide a permanent marking not less than 1 1⁄2-in. (38 mm)= by 3⁄4-in. (19 mm) affixed to the rear of the guard at approximately the level of the arbor, reading as follows: ‘‘Danger: Do Not Rip or Plough From This End’’. | |
| **5.2.2.6 Table saw**<br>WIA/BSR O1.1-7, Safety Requirements for Table Saws shall apply. | |
| **5.2.3 Wide axis cutter machines** | *E5.2.3 Wide axis cutter machines* |
| **5.2.3.1 Jointer** | |
| **5.2.3.1.1 Cutterhead** | |
| **5.2.3.1.1.1 Knife projection on cylindrical cutterheads** | |
| **5.2.3.1.1.1.1 Knife projection design**<br>The Manufacturer shall design the cutterhead to be adjustable so the projection of knives beyond the body to the cylindrical cutterhead can be set not to exceed .125 in. (3.2mm). | |

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| **5.2.3.1.1.1.2 Knife projection warning for cylindrical cutterheads**<br>The Manufacturer shall warn to adjust cutterhead knives to not exceed .125 in. (3.2mm). | |
| **5.2.3.1.3. Knife retention**<br>Clause 5.2.8.7 Knife retention applies. | |
| **5.2.3.1.4 Front of fence cutterhead guarding**<br>A guard shall be supplied which remains in contact with the stock being cut and automatically covers the unused portion of the cutterhead on the front side of the fence.<br><br>The cutterhead guard shall be designed so that, with the feed tables coplanar, the guard's maximum opening above the outfeed table complies with B11.19 opening requirements. | *E5.2.3.1.4 Front of fence cutterhead guarding*<br>*On jointers equipped with rabbetting ledges, cutterhead guards may need to be removed to allow rabbetting operations.* |
| **5.2.3.1.5 Front of fence cutterhead guarding employer responsibility**<br>Clauses 6.8.3.1.3 Employer risk reduction measures responsibility and 6.7.2 Employer training responsibility apply. | *E5.2.3.1.5 Front of fence cutterhead guarding employer responsibility*<br>*Equivalent means of safety are typically proper workpiece support and feeding devices to keep the operator's hands away from the cutterhead.* |
| **5.2.3.1.6 Cutterhead guarding behind the fence**<br>Any exposed portion of the cutterhead behind the fence shall be guarded. | |
| **5.2.3.1.7 Throat area**<br>The gap between the infeed and outfeed tables at the stock support surface shall be as narrow as possible and not exceed 2.5-in (63.5mm) with the tables set for zero depth of cut tangent to the knife cutting circle. The gap between the top edge of the outfeed table and the knife cutting circle shall not exceed .125-in. (3.2mm) when the outfeed table is tangent to the knife cutting circle. | |
| **5.2.3.1.8 Table position locking**<br>Means shall be provided to prevent unintended movement of the infeed or outfeed support table. | |

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| **5.2.3.1.9 Fence position**<br>An adequate means for locking the fence in position shall be provided for location and angle to the tables. | |
| **5.2.3.1.10 Safety instructions**<br>Instructions shall be provided on the hazards caused by a kickback. These shall include information on how to reduce to an acceptable level the risk of a kickback and injury. The employer shall inform each operator of the hazards and shall provide each operator with education and training for the implementation of the instructions given by the manufacturer. | *E5.2.3.1.10 Safety instructions*<br>*A kickback can result in inadvertent hand contact with the cutterhead or a "struck by the thrown workpiece" injury. A kickback may occur as a result of:*<br><br>*a) Pushing down on the front end of the stock as it passes over the throat area (tip-in kickback);*<br><br>*b) Grain or knot pull-out cause kickback when surfacing dredging grainy or improper stock or against the grain of natural wood;*<br><br>*c) Attempting to surface or edge stock that is too short or;*<br><br>*d) Making an end grain cut without a fixture.*<br><br>*e) Failing to maintain the projection of knives beyond the body of the cylindrical cutterhead to no more than one-eighth in. (3.2mm).*<br><br>*A warning may be given on the machine, in the form of instructions in a manual or in any appropriate way to satisfy the requirement.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.3.1.11 Push block**<br>A push block, blocks, or pads when used, shall be of an appropriate design for the operation to be performed. The employer shall provide and supervise the use of a push block(s) or pad(s) where required for a safe operation. | *E5.2.3.1.11 Push block*<br>*The main purpose of a push block or pad is to provide protection in the form of increased distance from the hand to the cutterhead as well as making hand feeding easier and safer.* |
| **5.2.3.1.12 Special operations**<br>Special fixtures, jigs and other safety devices shall be provided by the employer for all special operations requiring them. The employer shall be responsible for their maintenance and use and shall allow only properly trained operators to use | *E5.2.3.1.12 Special operations*<br>*Jointers are used for many special operations such as rabbeting end grain cuts, some special cuts for chair legs, taper cutting, cuts on small workpieces, etc. These require special fixtures or special training, or both, for them to be performed safely, and the employer is responsible* |

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| them. | *to determine whether an operator has the proper fixture and is qualified to do the operation safely.* |
| **5.2.3.2 Molder (Moulder)/multiple head planer** | |
| **5.2.3.2.1 Guarding the cutterhead**<br>The cutterhead(s) and cutting tool(s) shall be protected by engineering controls to facilitate safety protocols that reduce to an acceptable level the risk of unintended contact. | *E5.2.3.2.1 Guarding the cutterhead*<br>*Risk reduction measures can take the form of individual guards or a complete enclosure. During set-up or service the area may have to be designated by the employer as a hazard area by appropriate means until guards are reinstalled.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.3.2.2 Feeding means**<br>The nip or pinch point of feed rolls and similar self-feeding devices shall be protected by engineering controls during operation to facilitate safety protocols that reduce to an acceptable level the risk of injury to operators or others. | *E5.2.3.2.2 Feeding means*<br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.3.2.3 Ripping Anti-kickback protection**<br>On machines equipped to rip cut workpieces the manufacturer shall provide an anti-kickback device and feed contact pressure system that functions over the range of manufacturer's specified stock thickness variation for the molder. | |
| **5.2.3.3 Planer, single or two surface** | *E5.2.3.3 Planer, single or two surface*<br>*A machine of this type is commonly called a planer or surfacer. This subclause does not apply to a machine called an abrasive planer. For abrasive planers see Clause 5.2.6 Sander. For combination machines using both planing heads and abrasive planing heads, both 5.2.3.3, Planer, single or two surface, and 5.2.6, Sander apply.*<br><br>*Planers are sometimes converted to perform molding operations. In that case, section 5.2.3.2, Molder(Moulder)/multiple head planer applies.* |
| **5.2.3.3.1 Guarding of the cutterhead**<br>Clause 5.1.18.1 Requirements for risk reduction | |

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| measures applies. | |
| **5.2.3.3.2 Cutterhead design**<br>Clause 5.2.3.1.1 Cutterhead design applies. | |
| **5.2.3.3.3 Feeding means**<br>Nip or pinch points on feed rolls and similar self-feeding devices shall be protected by engineering controls during operation in accordance with ANSI B11.19. | |
| **5.2.3.3.4 Anti-kickback**<br>The manufacturer shall provide and the employer shall supervise the installation, maintenance and the proper use of means for minimizing the risk of kickback. | *E5.2.3.3.4 Anti-kickback*<br>*Risk of kickback can be reduced with anti-kick-back pawls, feed systems or access limiting engineering control designs that provide equal risk reduction.* |
| **5.2.3.3.5 Multiple board surfacing**<br>For machines designed to be used for simultaneous multiple board surfacing the manufacturer shall provide and the employer shall supervise the proper use of an anti-kickback device and feed contact pressure system that functions over the range of manufacturer's specified stock thickness variation for the planer. | |
| **5.2.3.3.6 Safety instructions**<br>The manufacturer shall provide Instructions on how to reduce to an acceptable level the risk of injury from the following conditions:<br>a) Maintenance and operation requirements to prevent and/or avoid kickback when surfacing;<br>b) Pinching hazard to fingers when hand loading short workpieces;<br>c) Any opening that allows access to the cutterhead where accidental contact with the cutterhead can occur. | *E5.2.3.3.6 Safety Instructions*<br>*See ANSI B11.0 for guidance on achieving acceptable risk.*<br><br>*Maintenance and operation requirements can include keeping feed rollers sufficiently clean and providing proper workpiece support.*<br><br>*Certain openings are essential to planer function, such as those required for feeding and removal of the workpiece.* |
| **5.2.3.3.7 Depth of cut limitation**<br>The design of the machine shall include a means to limit the maximum depth of cut per pass and a means to limit the minimum thickness of stock that can be processed. | *E5.2.3.3.7 Depth of cut limitation*<br>*The usual method used to limit the maximum depth of cut per pass is a front panel or bar. A table adjustment stop is an acceptable way of limiting the minimum thickness of stock that can be* |

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| | *processed. The purpose of a limit on minimum stock thickness is to avoid possible contact between the table and cutterhead.* |
| **5.2.3.3.8 Special fixtures**<br>It shall be the responsibility of the employer to provide and maintain fixtures used for special cuts on planers and to authorize their use only by qualified operators. | *E5.2.3.3.8 Special fixtures*<br>*The employer is in the best position to evaluate what special fixtures are needed and whether the operator is qualified to perform the operation safely.* |
| **5.2.3.4 Manual Router** | *E5.2.3.4 Manual routers are also known as over-arm routers*<br>*This standard specifies safety requirements for the general class of manually controlled routing machines. These machines may have automatic capability but may not be equipped with automatic part handling, automatic feed mechanisms nor automatic tool changing systems. Safety requirements for CNC Machines where manual control is used only to set the machine for automatic production are found in ANSI O1.1-3, "Safety Requirements for CNC Machining Centers for the Woodworking Industry."* |
| **5.2.3.4.1 Cutter Risk Reduction Measures**<br>Clause 5.1.18.1 Requirements for risk reduction measures applies. | *E5.2.3.4.1 Cutter Risk Reduction Measures*<br>*Examples of risk reduction measures that can be employed are ring guards, barrier guards, use of fixtures, dust and chip exhaust hoods, etc. which help to safeguard the cutter.* |
| **5.2.3.4.2 Tool locking means**<br>No set screw or other tool locking means shall be designed to protrude beyond the outer diameter of the section in which it is located in a chuck or other tool holding means. | |
| **5.2.3.4.3 Dust and chip collection**<br>Clause 4.8 Hazards from wood dust applies. | *E5.2.3.4.3 Dust and chip collection*<br>*Dust and chip collecting devices may provide a engineering control barrier to help avoid unintended contact with the cutterhead.* |
| **5.2.3.4.4 Coasting hazard**<br>Manual routers shall be designed to stop within 10 seconds when fitted with the largest manufacturer recommended cutter. | |
| **5.2.3.4.5 Non-CNC Automated spindle router** | *E5.2.3.4.5 Non-CNC Automated spindle router* |

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| | *For purposes of this standard non-CNC automated routers are not considered manual routers. Machines of this type have an automated/non-operated step or steps in the workpiece processing. They can be equipped with other numerically controlled (NC) automation, automated template systems or other machine-controlled movement mechanisms including powered work feeding devices.* |
| **5.2.3.4.5.1 Exposed moving machine parts**<br>Clauses 5.1.15.1 Requirements for risk reduction measures and 5.1.6.2 Material transfer apply. | *E5.2.3.4.5.1 Exposed moving machine parts*<br>*Moving parts can consist of moving tables and heads. Barriers or other suitable means should be used to eliminate or, where elimination is not possible, facilitate safety protocols that reduce to an acceptable level the risk of harmful contact.* |
| **5.2.3.5 Shaper** | |
| **5.2.3.5.1** American National Standard O1.1-4 Safety Requirements for Shapers governs the machine specific requirements for Shapers. | |
| **5.2.3.6 Tenoner/trim saw** | *E5.2.3.6 Tenoner/trim saw*<br>*These machines are commonly known as single or double-end tenoners. They can perform several operations on end(s) of the work during a single pass through the machine. Double-end tenoners can be widened or narrowed to match the width of the workpiece being processed.* |
| **5.2.3.6.1 Guarding the cutting tools**<br>Clause 5.1.18.1 Requirements for risk reduction measures applies. | |
| **5.2.3.6.2 Guarding of power feed means**<br>Clauses 5.1.15.1 Requirements for risk reduction measures and 5.1.6.2 Material transfer apply. | *E5.2.3.6.2 Guarding of power feed means*<br>*Power feeding means that present a risk of injury to personnel are typically enclosed or equivalently protected by engineering controls except for that portion necessarily exposed to transport the stock.* |
| **5.2.3.6.4 Braking means**<br>Clause 5.1.14 Tool/workpiece coasting hazard applies. | |

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| **5.2.3.7 Miscellaneous cylindrical cutter machines**<br>Other machines using cylindrical cutters not currently covered by machine specific requirements shall have the cutting tool(s) and material transfer means protected by engineering controls. Clauses 5.1.15.1 Requirements for risk reduction measures and 5.1.6.2 Material transfer apply. | *E5.2.3.7 Miscellaneous cylindrical cutter machines*<br>*Machines not already specifically covered can include, but are not limited to, profilers, dovetailers, engravers and carvers.*<br><br>See ANSI B11.0 for guidance on achieving acceptable risk<br><br>*On many of these types of machines, barrier guarding is not possible. In those cases, equivalent risk reduction measures should be provided.* |
| **5.2.4 Drilling/boring/mortising machine** | *E5.2.4 Drilling/boring/mortising machine*<br><br>*For the purpose of this standard, drilling and boring are considered the same operation of making a hole in a workpiece with a rotating bit or tool.* |
| **5.2.4.1 Point-of-operation area risk reduction** measures on a manually operated machine<br>On manually operated machines, risk reduction measures for the point-of-operation, rotating cutting tool or trapping space, shall be suitable for the subject machine application. Clause 5.1.18.1 applies. | *E5.2.4.1 Point-of-operation area risk reduction measures on a manually operated machine*<br><br>*On manually operated machines, the feed of the cutting tool is initiated and controlled by the operator. ANSI B11.0 should be applied by the employer to each job for risk attenuation, risk reduction measures and use. No universal guard is known for all operations that will protect the operator and accommodate the variety of tools, workpieces, and fixtures that can be used on this type machine.* |
| **5.2.4.2 Point-of-operation area risk reduction measures for a semi-automatic or automatic Machine**<br><br>Clauses 5.1.15.1 Requirements for risk reduction measures and 5.1.6.2 Material transfer apply.<br><br>In addition, on machines operating in the semi-automatic or automatic mode the employer shall be responsible for applying proper risk reduction measures to the point-of-operation area. An awareness barrier is acceptable when a guard or guarding device cannot be used, or if used, would of itself create a hazard. | *E5.2.4.2 Point-of-operation area risk reduction measures for a semi-automatic or automatic machine*<br><br>*Because no universal guard is currently known for all operations that will protect the operator and accommodate the variety of tools, workpieces, and fixtures that can be used on this type machine the employer must assess each job for the type point of operation risk reduction measures that best contributes to achieving acceptable risk attenuation.* |

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| **5.2.4.3 Securing the Workpiece(s)**<br>The employer shall supervise the installation and use of a means for securing the workpiece is provided and utilized to reduce to an acceptable level the risk of injury from unintended rotation or movement of the workpiece or fixture. | *E5.2.4.3 Securing the Workpiece(s)*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.5 Wood lathe** | |
| **5.2.5.1 Guarding a rotating cutter**<br>Rotating cutter(s) shall be protected by engineering controls to facilitate safety protocols that reduce to an acceptable level the risk of contact with the cutter on the non-working side. | *E5.2.5.1 Guarding a rotating cutter*<br><br>*On swinghead or similar lathe, the working side of the rotating cutter must be exposed to allow the workpiece to contact and be shaped by it.* |
| **5.2.5.2 Guarding a rotating workpiece** | |
| **5.2.5.2.1 Semi-automatic or automatic lathe**<br>Clause 4.15.3, Thrown workpiece and materials, applies for protection from the risk of thrown workpieces and materials. | *E5.2.5.2.1 Semi-automatic or automatic lathe*<br><br>*Operators frequently operate more than one machine and cannot react fast enough to prevent a flawed workpiece from breaking and being thrown from the lathe.* |
| **5.2.5.2.2 Manual lathes**<br>On a manual machine the employer shall comply with the requirements of Clause 5.1.18.1, Requirements for risk reduction measures and Clause 4.18 Entanglement and entrapment hazards. | *E5.2.5.2.2 Manual lathes*<br><br>*Risk variables include the type and shape of the stock, turning speed(s), material removal means, required workpiece operator access, etc. Engineering controls should be used wherever and only where they acceptably reduce the risk of injury.* |
| **5.2.5.3 Guarding a trapping space**<br>Clause 4.18.2 Entrapment, applies. | *E5.2.5.3 Guarding a trapping space*<br><br>*On back knife lathes, guillotine action between the knife and workpiece creates a trapping zone at the rear. On swing head lathes, location may be one risk method.* |
| **5.2.5.4 Tool rest**<br>A tool rest shall be supplied on a manual lathe and shall be designed to be adjustable for changes in workpiece diameter and cutting techniques. | *E5.2.5.4 Tool rest*<br><br>*When the distance between the tool rest and workpiece is more than .25 in. (6.4mm) the risk increases that a handheld tool may tip and dig into the workpiece. This can cause workpiece* |

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| | *breakage and ejection, and loss of control of the tool.* |
| **5.2.5.5 Work support(s)**<br>An adjustable work support(s) shall be used for small diameter workpieces when breakage, due to high tool loads, can occur on automatic and semi-automatic lathes. The work support(s) shall not in itself create a hazard. | *E5.2.5.5 Work support(s)*<br><br>*Long and small diameter workpieces are common in wood turning and require work supports to avoid being broken by the action of the cutter or tool. Re-adjusting means may need to be applied, as feasible, when the supporting diameter changes during the operation.* |
| **5.2.6 Sander** | |
| **5.2.6.1 Workpiece support**<br>Clause 4.15 Hazards from workpiece ejection applies. | *E5.2.6.1 Workpiece support*<br><br>*A gap of up to .125 in. (3.2 mm) is considered acceptable.* |
| **5.2.6.2 Nip point(s)**<br>Clause 4.15 Hazards from workpiece ejection applies. | *E5.2.6.2 Nip point(s)*<br><br>*In-running nip points occur on stroke, wide belt, keyhole, drum and similar type machines using belts to carry abrasives.* |
| **5.2.6.3 Never used run of sanding medium**<br>The area of the abrasive medium not intended to ever be used to sand the workpiece shall be protected by engineering controls. | *E5.2.6.3 Never used run of sanding medium*<br>*Sanders using a rotating sanding medium typically have a "return" (never used) run portion that is not intended to be used for sanding a workpiece.* |
| **5.2.6.4 Feed rolls**<br>Clause 4.15 Hazards from workpiece ejection applies. | |
| **5.2.6.5 Pressure points**<br>Clause 4.15 Hazards from workpiece ejection applies | |
| **5.2.6.6 Transport means**<br>Clause 4.15 Hazards from workpiece ejection applies. | *E5.2.6.6 Transport means*<br>*Body bars, cables or stop tapes across the front and back of the feed table, adjustable guards on the machine housing to limit the opening above the conveyer to the thickness of the* |

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| | *stock, and engineering control devices can be utilized to safeguard the sander.* |
| **5.2.6.7 Unintended ejection**<br>Clause 4.15 Hazards from workpiece ejection applies. | *E5.2.6.7 Unintended ejection*<br>*This requirement on wide-belt abrasive sanders can be met by the use of barriers, location, anti-kickback devices and automatic unattended operation. When the sander is designed to take heavier cuts than normally used in sanding, such as on wide-belt abrasive planers, anti-kickback devices are commonly used.* |
| **5.2.6.8 Multiple board sanding anti-kickback means**<br>On machines intended for use in sanding multiple boards Clause 4.15 Hazards from workpiece ejection applies. | *E5.2.6.8 Multiple board sanding anti-kickback means*<br><br>*Sectional infeed rolls or other means may be used for this purpose.* |
| **5.2.7 Miscellaneous and combination machines** | *E5.2.7 Miscellaneous and combination machines*<br>*This clause would apply to the numerous types of special purpose and custom woodworking machines that may be found in various woodworking applications.*<br><br>*Examples of miscellaneous machines covered by the general requirements of this standard include profilers, dovetailers, engravers and carvers. On some of these types of machines, barrier guarding is not possible. Location or distance and warnings have been used as the risk reduction measures. To determine the proper risk reduction measures, each hazard should be evaluated as required by ANSI B11.0.* |
| **5.2.7.1 Miscellaneous machines**<br>Miscellaneous machines within the scope of this standard not mentioned elsewhere in this standard shall be protected by risk reduction measures as required by Section 4 General Requirements. | |
| **5.2.7.2 Combination or multiple function machine**<br>Each separate point of an operation area, shall be protected by risk reduction measures as required by Section 4 General Requirements and all applicable Section 5 Machine Specific requirements, | *E5.2.7.2 Combination or multiple function machine*<br><br>*Combination machines are single machines that combine the functions of two or more independent machine functions.* |

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| that do not conflict with the utility of the combined machine. | |
| **5.2.8 Special device(s) provided by the employer** | *E5.2.8 Special device(s) provided by the employer*<br><br>*Devices required for safe operation under this category may be used for:*<br>*a) Work holding, supporting or guiding;*<br>*b) Work loading or unloading;*<br>*c) Work feeding;*<br>*d) Anti-kickback.* |
| **5.2.8.1 Responsibility** | |
| **5.2.8.1.1** The employer shall determine when a special device(s) is required and shall provide, maintain, and supervise its use. | |
| **5.2.8.1.2** The employer shall evaluate any special device for reasonable safety in accordance with B11.0 and all applicable requirements of this standard. | |
| **5.2.8.2 Anti-kickback device**<br>An anti-kickback device, as designed and constructed, shall reasonably reduce the risk of a kickback. The employer shall supervise the proper installation, maintenance, adjustment, function and use of the device. | *E5.2.8.2 Anti-kickback device*<br>*An example of an anti-kickback device furnished by an employer, is a featherboard or a workpiece holding fixture.*<br><br>*See ANSI B11.0 for guidance on achieving acceptable risk.* |
| **5.2.8.3 Manual work feeding device**<br>A manual work feeding device, where provided, shall be designed and constructed to provide the operator with a reasonable level of safety to reduce the risk of injury when completing an intended operation. | *E5.2.8.3 Manual work feeding device*<br>*An example of a manual work feeding device is a push stick or block, a miter gauge, or a keyed work holding fixture.*<br><br>*If a feeding device could contact the cutting tool, the feeding device should be made of easily machinable material.* |
| **5.2.8.4 Work holding and/or guiding device** | |
| **5.2.8.4.1 Attachment means**<br>The attachment means of a work-holding and guiding device shall be of sufficient capacity to resist all normal cutting forces and shall not in itself create a hazard. | |

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| **5.2.8.4.2 Workpiece retention**<br>Fixtures shall be designed to prevent unintended movement of the workpiece being processed. The restraining or clamping means shall not in it-self create a hazard. | |
| **5.2.8.4.3 Power clamping**<br>When the power clamping means for a workpiece causes a pinch point hazard to personnel, that hazard shall be protected by engineering con-trols. | *E5.2.8.4.3 Power clamping*<br>*If the clamp opening is more than .25-in. (6.4mm) and the clamp location is within the reach of an operator this condition may create a hazard.* |
| **5.2.8.4.4 Weight specification and handling**<br>Any work holding or guiding device that weighs more than 50 lbs. (22.7kg) shall be clearly and permanently marked to identify its weight. The marking shall be visible when the device is in or on the machine. The employer shall provide and identify a means of safely installing, removing and transporting the device. EXCEPTION: Devices that are an integral part of a machine are exempt from this requirement. | *E5.2.8.4.4 Weight specification and handling*<br>*The installing, removing and transporting means considered are eye bolts, hooks, and handling holes.* |
| **5.2.8.4.5 Workpiece loading device**<br>An automatic and semi-automatic loading device that has a pinch point(s) or trapping space that can cause injury to an operator shall have the hazard(s) protected by engineering controls. | |
| **5.2.8.5 Work guiding means** | |
| **5.2.8.5.1 Template**<br>A template, when used as work guiding means, shall be constructed to be securely attached to the machine or fixture. | |
| **5.2.8.5.2 Fixture as a work guide**<br>A fixture, when used as a work guiding means, shall be securely attached to or guided in the ma-chine and shall be designed to support the cut-ting forces it must control during the operation. | |
| **5.2.8.6 Special tooling**<br>Special tooling, when used, shall be designed to be safe for the operation requiring its use. It shall be the employer's responsibility for maintaining the tooling in safe condition or discarding it when it becomes unsafe. | |

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| **5.2.8.7 Knife retention**<br>A cutterhead with a removable blade(s) shall be furnished with a means to securely retain the blade(s) under all normal operating conditions. The employer shall not permit resharpening procedures that compromise or eliminate the means used to retain the blade(s). | |
| **6. Responsibilities** | |
| **6.1 Manufacturer Responsibilities**<br>It shall be the responsibility of the machine manufacturer to design and construct the machine in accordance with the applicable parts of this standard. | |
| **6.2 Accessory manufacturer responsibilities**<br>It shall be the responsibility of any accessory manufacturer to design and manufacture an accessory in conformance with the applicable clauses of this standard. | |
| **6.3 Modifier responsibilities**<br>A modifier of machines covered by this standard shall be considered to be the manufacturer of those machines insofar as the modification is concerned and shall have the responsibilities of the manufacturer for such modification(s). | *E6.3 Modifier responsibilities*<br>*Integration of a machine into a system is not considered modification of the machine.* |
| **6.3.1 Machine modifier revisions to machine manual**<br>Machine modifiers shall supply instructions covering construction, installation, care and use of the area of reconstruction or modification where it differs in a material way from what the original manufacturer supplied. | *E6.3.1 Machine modifier revisions to machine manual*<br><br>*An instruction manual would normally contain information on construction, care and use of the modified area and a listing of component parts with appropriate electrical diagrams etc. The information may be contained in one or more manuals which may take the form of paper, electronic media, video, etc.* |
| **6.4 Rebuilder responsibilities**<br>For the purposes of this standard, the rebuilder acts as the manufacturer of the machine. As such, the rebuilder is responsible for performing a risk analysis, meeting and maintaining the manufac- | *E6.4 Rebuilder responsibilities*<br><br>*Rebuilding involves refurbishing, or the restoration or replacement of major components of the machine or the machinery system and is not con-* |

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| turers' requirements and complying with the requirements of the standard as it exists at the time of the rebuild.<br><br>**EXCEPTION:** Existing machines that are physically incapable of complying with standards postdating the manufacture of the machine must be provided with the risk reduction measures the machine design will support as called for by proper risk analysis.<br><br>**EXCEPTION:** This subclause excludes routine service and maintenance. | *sidered a maintenance or repair activity. Activities such as cleaning and/or routine replacement of minor worn parts required to continue existing operations is considered maintenance and not a rebuilding activity.*<br><br>*The user is encouraged to update all machines to comply with the requirements of this standard. Where such updates are not reasonably possible, equivalent risk control measures are needed to maintain acceptable risk, or the subject machine should be removed from service.* |
| **6.4.1** The rebuilder shall permanently affix markings on the machine that can be used to identify the rebuilder and the date of rebuild. | |
| **6.4.1.1** Such markings shall not obscure, modify, remove, or otherwise make illegible such identification(s) placed on the machine by the original manufacturer or any subsequent rebuilder(s). | |
| **6.4.1.2** Such markings shall be located where they are visible and accessible without disassembling or moving the machine. | |
| **6.4.1.3** Such markings shall be located on a permanent part of the machine or on a part that cannot be removed without impairing the operation of the machine. | |
| **6.4.2 Rebuilder Revisions to machine manual**<br>Rebuilders shall supply instructions covering construction, installation, care and use of the area of reconstruction or modification where it differs in a material way from what the original manufacturer supplied. | *E6.4.2 Rebuilder Revisions to machine manual*<br><br>*An instruction manual would normally contain information on construction, care and use of the modified area and a listing of component parts with appropriate electrical diagrams etc. The information may be contained in one or more manuals which may take the form of paper, electronic media, video, etc.* |
| **6.5 System designer/builder responsibilities**<br>It shall be the responsibility of the system designer/builder, as described by the scope of ANSI B11.20, to design and construct the system in accordance with the applicable clauses of this | *E6.5 System designer/builder responsibilities*<br><br>*Integration of a machine into a system is not considered modification of the machine. However,* |

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| standard. | *the system designer does assume responsibility for the safe integration of the machine.* |
| **6.5.1 System manual responsibilities**<br>The system designer/builder shall supply instructions for the construction, installation, care and use of the system and its components. This shall include electrical, hydraulic, and pneumatic diagrams, illustrated parts lists, and a general maintenance schedule, for all additions and/or changes made by the system designer/builder. | |
| **6.6 Tool/fixture/designer/builder responsibilities**<br>A designer and/or builder of tools and/or fixtures to be used in or on machines covered by this standard shall be considered to be the manufacturer for those tools and/or fixtures and shall have the responsibilities of the manufacturer for those tools and/or fixtures. | |
| **6.7 Training and maintenance responsibilities** | |
| **6.7.1 Initial training responsibility**<br>It shall be the responsibility of each manufacturer/installer/system designer/system builder/modifier/rebuilder entity to make available initial safety training for that entity's part of the machine and /or system to maintenance personnel and operators at the time of delivery and furnish training material. The manufacturer/installer/system designer/system builder/modifier/rebuilder shall provide guidelines to the purchaser in maintaining the equipment in a safe condition and in providing safety training to employees. | |
| **6.7.2 Employer training responsibility.**<br>It shall be the responsibility of the employer to educate and train employees in their respective responsibilities for installation, set-up, operation and maintenance so as to comply with the safety requirements of this standard. | *E6.7.2 Employer training responsibility.*<br><br>*Where industry accepted skill sets or standards exist, they should be used. Training should include on-the-job training at the machine. Typical publications providing guidance include ANSI/ASSP Z490.1-2016, ANSI/ASSP Z490.2-2019 and the National Safety Council Accident Prevention Manual* |

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| | *for Business & Industry - Administration and Programs. Where safety regulations have specific training requirements, those should take precedence.* |
| **6.7.3 Safety instructions**<br>Before allowing the use of a device, the employer shall provide employees with education and training on the hazards associated with the use of a device such as a template, cutting tool, or fixture. The instructions provided shall include, but not be limited to, identifying all hazards stated by the manufacturer of the device in the instructions with, or on, the device and the risk reduction measures required to mitigate the risk to an acceptable level. | |
| **6.8 Installation, setup, operation and maintenance responsibilities**<br>Clause 5.1.1 Machine manual for the manufacturer responsibility to provide instructions applies. | *E6.8 Installation, setup, operation and maintenance responsibilities*<br><br>*Each manufactured product may have unique characteristics requiring separate and unique care.* |
| **6.8.1 Installation** | |
| **6.8.1.1 Installer responsibilities**<br>The installer of a woodworking machine shall use and follow the recommendations of the manufacturer. | *E6.8.1.1 Installer responsibilities*<br>*Since proper installation can reduce the possibility of injury to an employee(s) and damage to a machine, typical areas where recommendations or requirements may be provided are:*<br>● *The securing of a machine to the floor, foundation, table or alternate mounting means;*<br>● *The placement of a machine where a kickback can throw a workpiece out of the machine into a work traffic area. (See Clause 5.2.2.2.9 Kickback Zone);*<br>● *The installation of electrical components on, or the connection of, electrical power to the machine to meet the recommendation of the manufacturer (see Clause 4.2.2 Electrical system hazards) and the requirements of the enforcing authority;* |

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| | ● *The conformance with the dust (4.8) and noise (4.10.1) requirements of the enforcing authority;*<br><br>● *Electrical grounding, local exhaust ventilation, ionizing and non-ionizing radiation shielding, fuel gas connections (if applicable).* |
| **6.8.2 Employer machine-area responsibilities**<br>The employer shall provide and maintain an adequate area around woodworking machines to allow for safe operation, care and maintenance. | *E6.8.2 Employer machine-area responsibilities*<br><br>*Sufficient clearance must be provided for access door openings, personnel, ladder or man-lift positioning, and for other necessary maintenance equipment. The manufacturer should provide information on any special/unusual access requirements (that would affect the ability to perform parts or components change-outs safely) in the pre-sales process.* |
| **6.8.3 Operation** | |
| **6.8.3.1 Employer operation responsibilities**<br>The employer shall be responsible for supervising the safe use of a woodworking machine by complying with user requirements of ANSI B11.0 and all government regulations that take precedence. | *E6.8.3.1 Employer operation responsibilities*<br><br>*The use of a machine includes the selection, installation and use of tooling, fixtures, safety devices, personal protective devices, set-ups and work handling. The tasks involved may be the responsibility of one or more supervisors but each function must be done properly to maintain an acceptably safe operation.* |
| **6.8.3.2 Employer supervision responsibilities**<br>The employer shall establish and supervise appropriate rules for the safe operation of a woodworking machine(s) consistent with the manufacturer's training and instructional requirements of this standard. | *E6.8.3.2 Employer supervision responsibilities*<br><br>*Information on safe shop rules is available from many authoritative sources. To have a safe shop, the employer should establish safe practices that apply to the skill of employees, equipment, products, and type of business involved.* |
| **6.8.3.3 Workplace environment**<br>The employer shall supervise the environment of machine use to reduce to an acceptable level the risk of injury. | *E6.8.3.3 Workplace environment*<br><br>*This includes items such as lighting, adjacent noise, protection from the elements, janitorial services, location of stock, egress means, kickback path location, kickback curtains, slip-resistant sur-* |

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| | *faces, etc., are ones under the control of the employer and the employer is in the best position to determine or have determined what needs to be done to reduce to an acceptable level the risk of injuries.* |
| **6.8.3.3.1 Employer noise level survey and noise exposure sampling/monitoring.**<br>The employer shall measure the sound pressure level(s) employee(s) are exposed to that are generated by machines covered by this standard, and, in compliance with OSHA threshold requirements, administer a Hearing Conservation Program, in accordance with OSHA 29 CFR 1910.95, and/or other appropriate criteria. | *E6.8.3.3.1 Employer noise level survey and noise exposure sampling/monitoring.*<br><br>*Specific machine applications create differing amounts of sound pressure levels. Other noise (sound) sources and the acoustic environment will determine ambient sound levels (background sound) which add to the sound emitted by any specific machine. Where circumstances such as high worker mobility, significant variations in sound level, or a significant component of impulse noise make area monitoring generally inappropriate, 1910.95(d)(1)(ii) instructs employers to use representative personal sampling to comply with the monitoring requirements.*<br><br>*To verify employee protection in compliance with good practice and regulations such as 29 CFR 1910.95, sound surveys and personal sampling are needed.* |
| **6.8.3.4 Employer risk reduction measure responsibilities.** | |
| **6.8.3.4.1 Risk reduction measure use**<br>The employer shall supervise the installation, maintenance and use of all required engineering controls furnished with the machine or other equivalent appropriate risk reduction measures are in place and functional for every operation. | |
| **6.8.3.4.2 Equivalent risk reduction measures**<br>Where operations require deviations from the requirements of this standard, the employer shall furnish risk reduction measures providing equal or greater safety. For each risk reduction measure, the employer shall provide education and training on its use. | |
| **6.8.3.4.3 Confined Space Risk Management** | *E6.8.3.4.3 Confined Space Risk Management* |

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| OSHA (29 CFR 1910.146 Permit Required Confined Spaces) defines confined spaces and permit-required confined spaces and shall be used to determine regulatory applicability. Persons who are designated as a confined space entrant, rescuer, or may be working in or around the vicinity of a confined space shall be qualified in accordance with the fitness for duty and medical suitability provisions of ANSI/ASSP Z117.1, NFPA 1670, NFPA 350, and the applicable OSHA general industry and construction standards. This examination by a licensed healthcare provider (LHCP) shall include among other indices, an assessment for claustrophobic reactions in accordance with the standards cited and regulations cited in this clause. | *Typical confined spaces in wood manufacturing facilities include boilers, conveyor enclosures, dust bins, dust collectors, furnaces, hoppers, pits, precipitators, sewers, silos, tanks, and vats.* |
| **6.8.3.5 Employee operation responsibility**<br>It shall be the responsibility of the employee to use safety equipment and to follow instructions provided by the employer. | |
| **6.8.4 Employer inspection and maintenance responsibilities**<br>The employer shall establish and supervise a program of maintenance and inspection of a woodworking machine to maintain the intended operating condition of the machine's parts, auxiliary equipment, and engineering controls. | *E6.8.4 Employer inspection and maintenance responsibilities*<br><br>*Periodic and regular inspection using an appropriate checklist can help maintain the intended operating condition by determining potential problems before they cause an accident.* |
| **6.8.4.1 Pre-inspection shutdown procedure**<br>The employer shall establish a safe shutdown procedure (commonly referred to as a Hazardous Energy Control procedure or lockout/tagout) based on manufacturer specifications prior to performing inspection or maintenance on a woodworking machine and to supervise compliance with the procedure. On completion of the inspection or maintenance, the employer shall be responsible for the machine being restored to a safe operating condition before allowing it to be put back in use. | *E6.8.4.1 Pre-inspection shutdown procedure*<br>*See ANSI/ASSE Z244.1, Control of Hazardous Energy – Lockout/Tagout and Alternative Methods. For safety inspections not requiring air, hydraulic, or electric power to be used, the following procedures are typical:*<br><br>• *Bring the machine to a deenergized state;*<br><br>• *Shut down and disconnect electrical power;*<br><br>• *Shut down, disconnect, and bleed-off other power sources including air, hydraulic, line shaft, gas, steam, capacitors, etc.;* |

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| | • *Verify absence of coasting motion or potential stored energy.*<br><br>• *Take positive action to prevent reactivation of power such as locking out all energy sources.*<br><br>• *Attempt to activate machine by depressing the start or cycle control to verify that power is off. This should verify absence of power. Be sure the start or cycle control is off before continuing.*<br><br>• *Secure all loose or freely movable machine members.* |
| **6.8.4.2 Employer Blades, bands, and knives responsibilities** | |
| **6.8.4.2.1 Circular saw blades**<br>The employer shall be responsible for supervising the proper use of circular saw blades.<br><br>a) Blades shall be suitable for the intended use.<br>b) A cracked, vibrating, dull, badly set or improperly filed or tensioned saw blade(s) shall be immediately removed from service, not be used until it has been properly inspected and repaired. Exception: Blades 12-in. (304.8mm) diameter or less are excluded from the tensioning requirement.<br><br>A saw blade(s) on which gum or tar has accumulated on the sides shall be removed from service until it has been properly cleaned of the accumulation. | *E6.8.4.2.1 Circular saw blades*<br><br>*Defective blades can stick, jam, kickback or throw teeth and should be inspected and repaired only by a qualified sawsmith. If a skilled sawsmith is not available, saw blades should be returned to the manufacturer or distributor for welding, slotting, or tensioning as required for safe operating speed and service. Excessive gum accumulation can accentuate kickback and should be cleaned off before the thickness of the gum is approximately two-thirds the tooth set. It is strongly recommended that users obtain and follow instructions for proper maintenance of all saw blades.*<br><br>*On blades of 12-in. (304.8mm) diameter or less, the method of manufacture and size of the blade provides acceptable stability when new and only requires balancing when re-ground.* |
| **6.8.4.2.2 Band saw blades and wheels** | |
| **6.8.4.2.2.1 Cleanliness**<br>The employer shall see that band saw blades and wheels shall be kept clean and free from accumulation of sap, gum, resins or any foreign substance. | |

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| **6.8.4.2.3 Joints**<br>To avoid blade breakage and grabbing in the stock, the employer shall not allow the use of a saw blade with a brazed or welded joint thickness that is wider than the thickness of the band stock. | |
| **6.8.4.2.4 Defective blade**<br>To reduce the risk of blade breakage, the employer shall supervise the inspection of and the removal from service of any cracked, missing, dull, badly set teeth, or improperly brazed or welded saw blade. | |
| **6.8.4.3 Knives and cutterheads** | |
| **6.8.4.3.1 Maintenance**<br>The employer shall see that all knives and cutting heads of woodworking machines shall be kept sharp, balanced, properly adjusted, and firmly secured. | |
| **6.8.4.3.2 Vibration**<br>The employer shall require and supervise the removal from service of a cutting tool(s) or arbor(s), or both, with excessive vibration or excessive axial or radial play as defined by the manufacturer's instructions. | |
| **6.8.4.4 Employer accessories responsibilities**<br>The employer shall only allow the use of accessories which facilitate safety protocols that reduce operational risks to an acceptable level. | |

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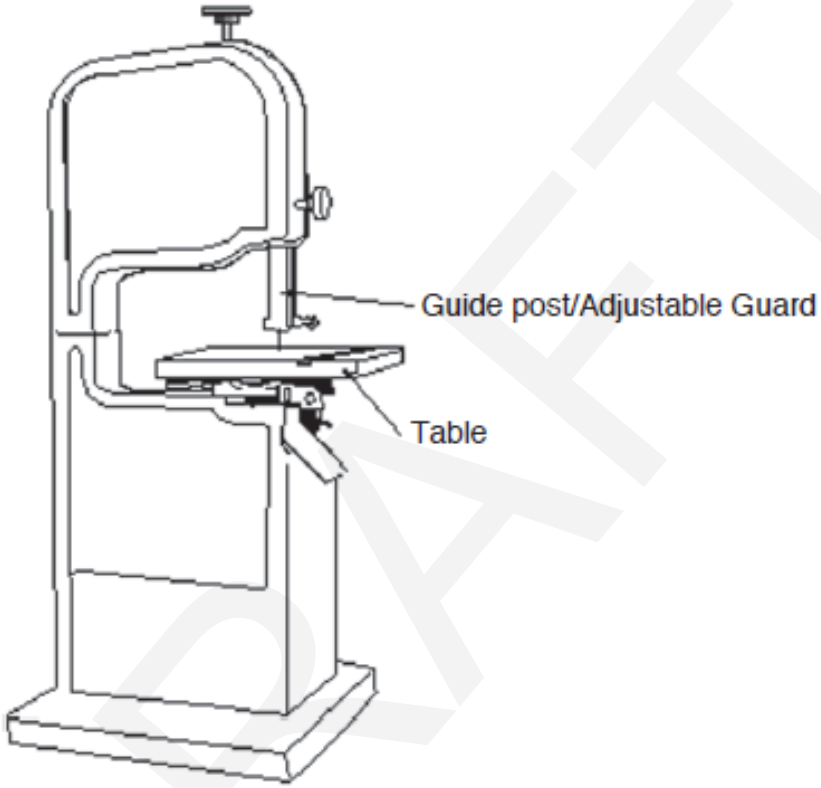
# APPENDIX A

NOTE: The illustrations in this appendix are intended to be generic representations and do not depict all of the possible design variations of a particular machine type.

### A2.2.1 Band saw

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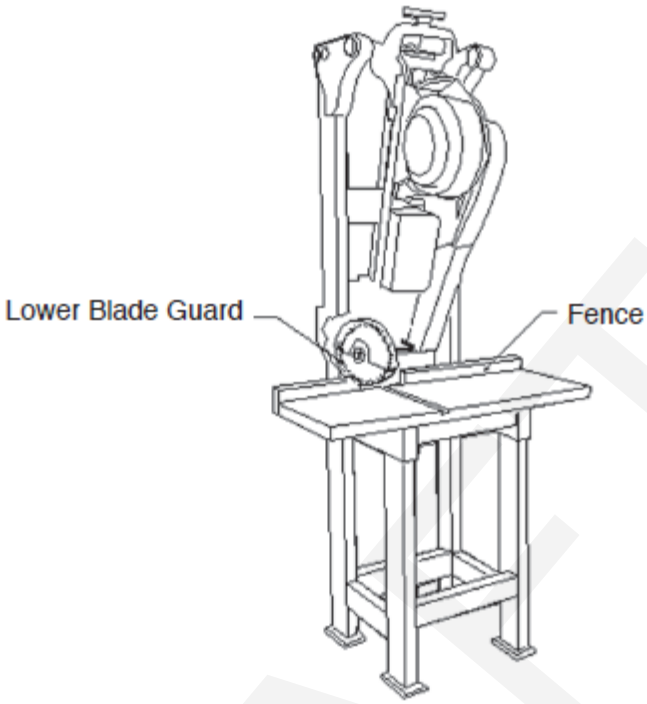
#### A2.2.3.1 Overhead swing cut-off saw




#### A2.2.3.2 Straight line cut-off saw

At the time of publication, the ASC O1 was unable to obtain images of standard compliant machines.

#### A2.2.3.3 Inverted swing cut-off saw

At the time of publication, the ASC O1 was unable to obtain images of standard compliant machines.

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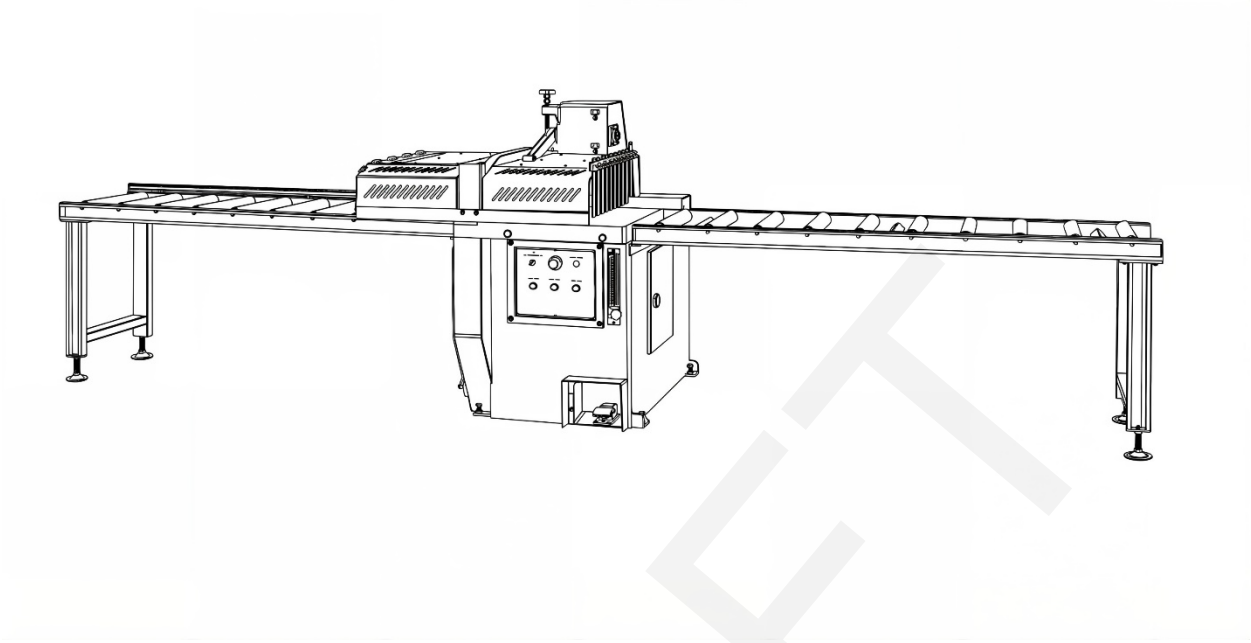
### A2.2.4 Jump saw



### A2.2.5 Miter saw

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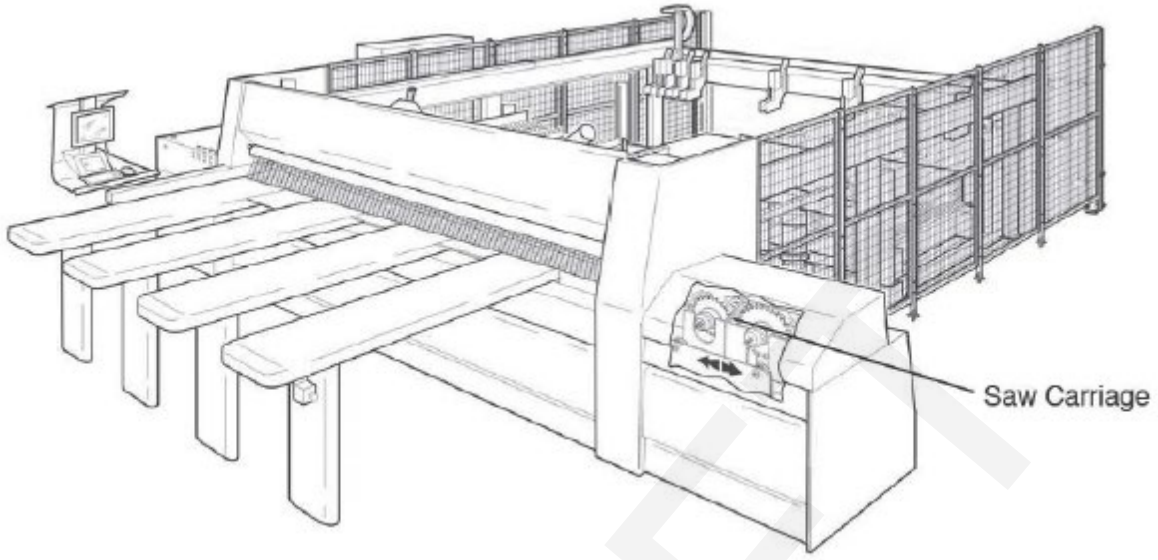
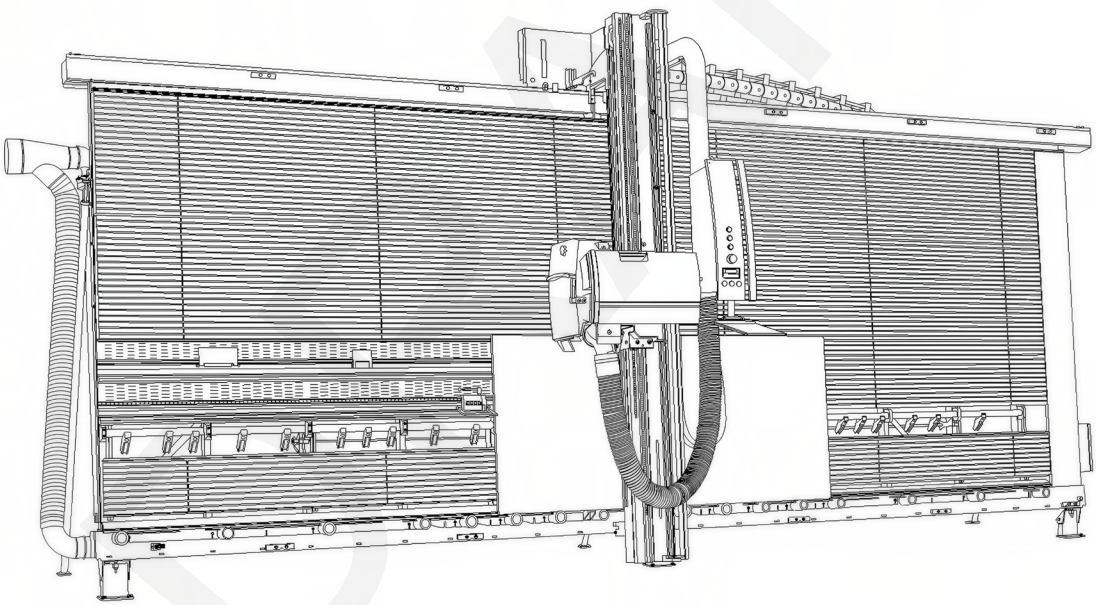
## A2.2.6 Panel saw

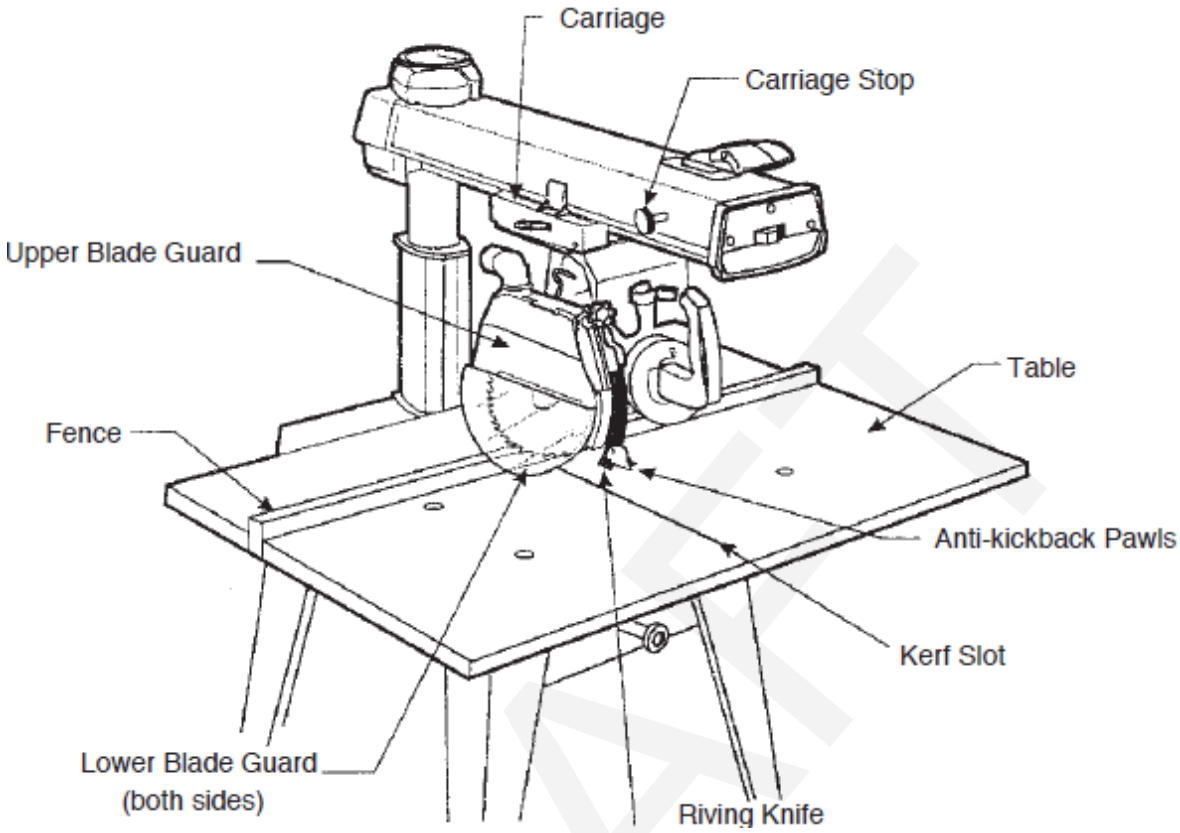



*Horizontal Beam Panel Saw*

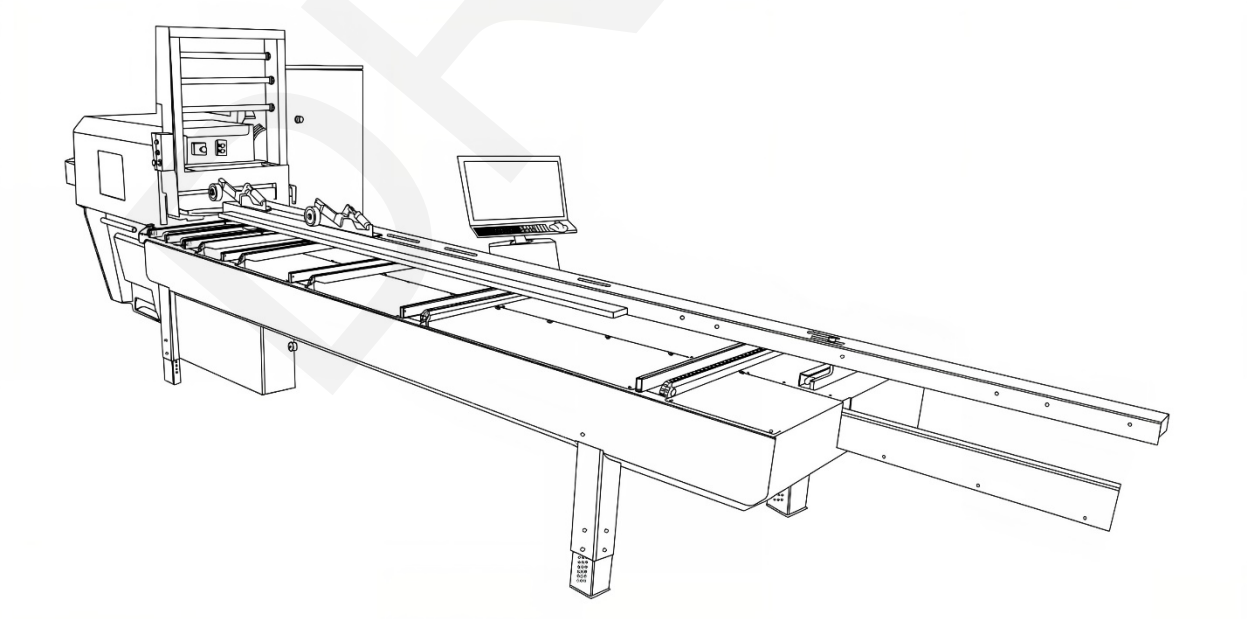


*Vertical Panel Saw*

### A2.2.7 Radial arm saw




### A2.2.8 Rip saw, power fed



*Gang Rip Saw with power feed table*

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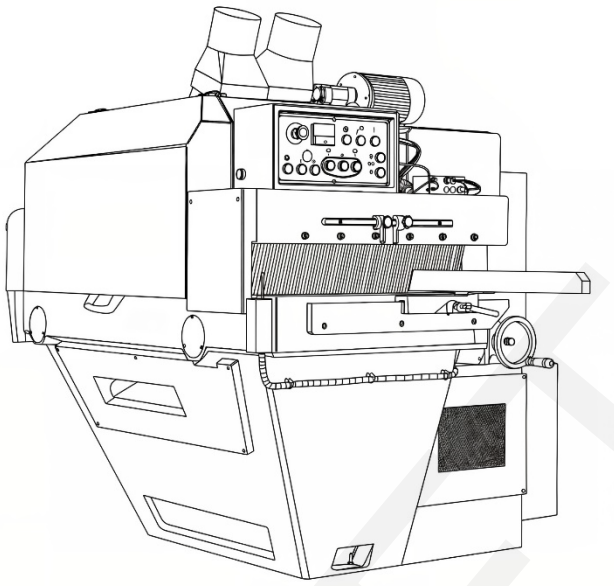
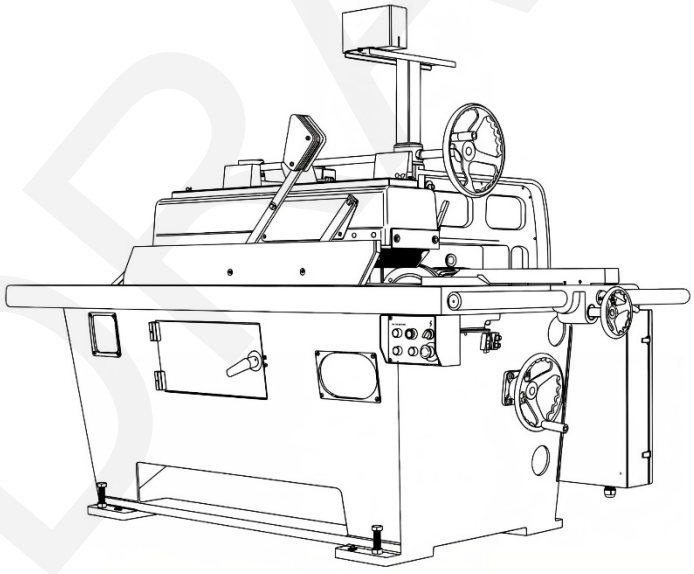


*Power Feed Gang Rip Saw*

**A2.2.8.1 Straight-line rip saw**



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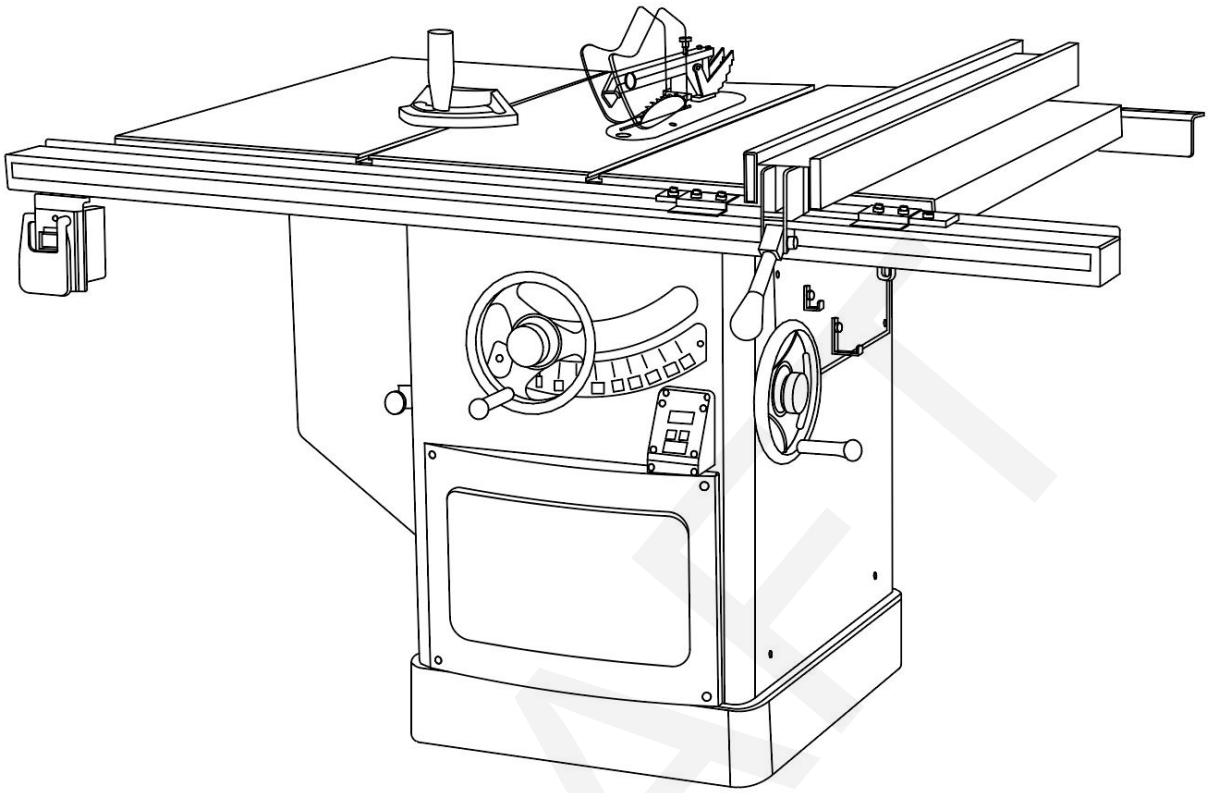
### A2.2.9 Table saw



### A2.2.11 Dovetailer

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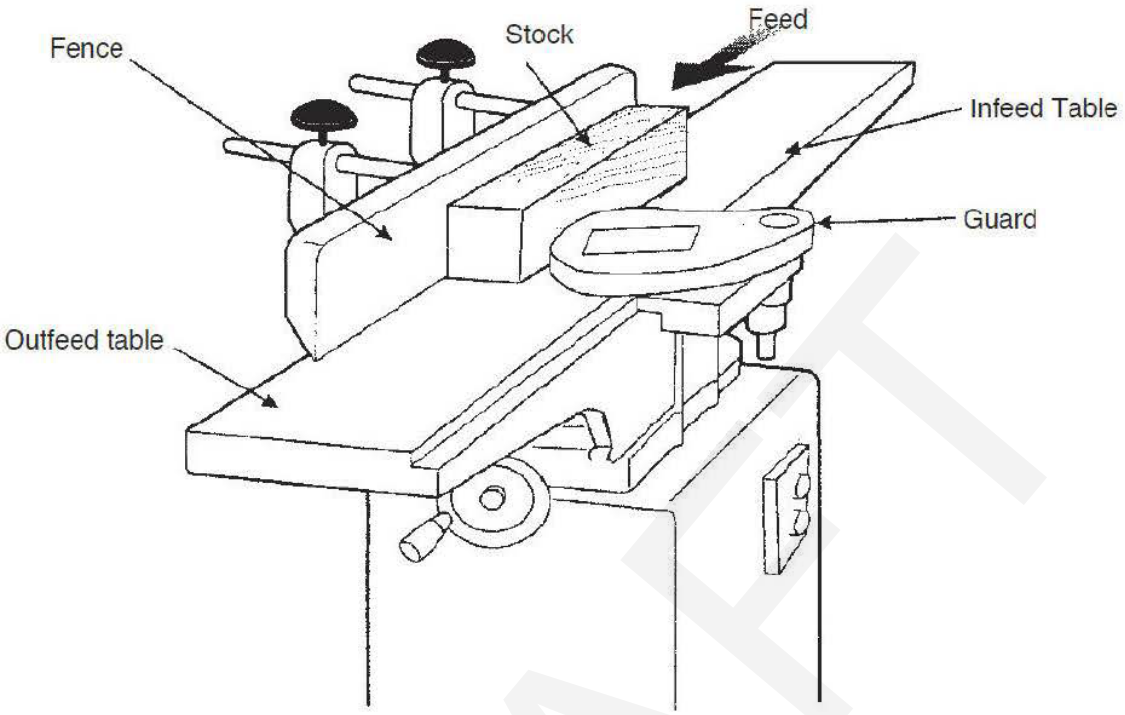
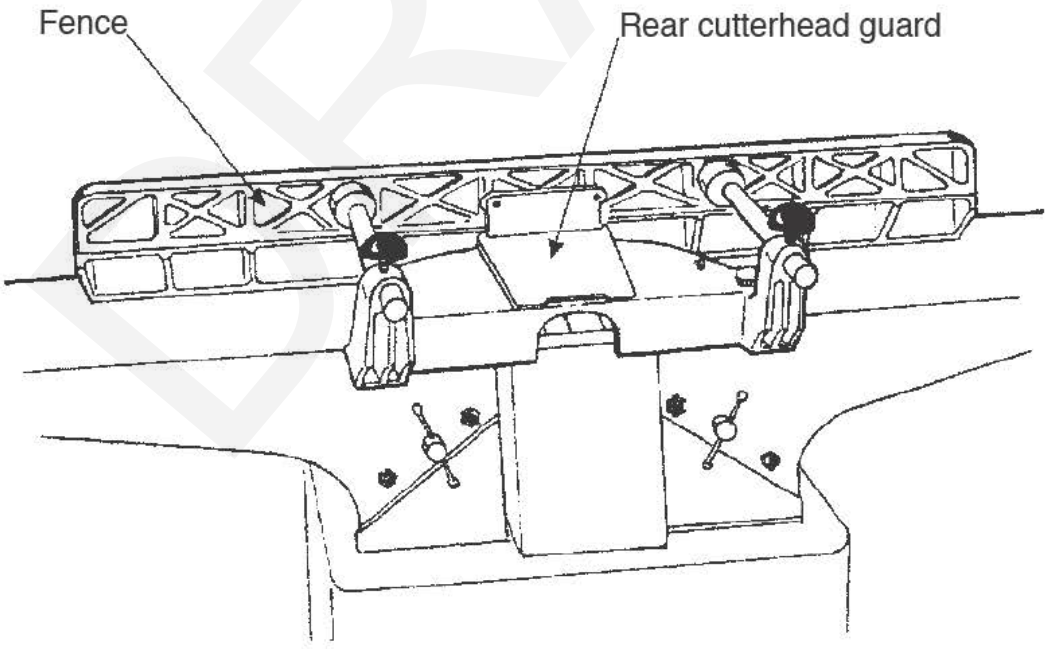
**A2.2.12 Jointer**




*Jointer Rear Cutterhead Guard*

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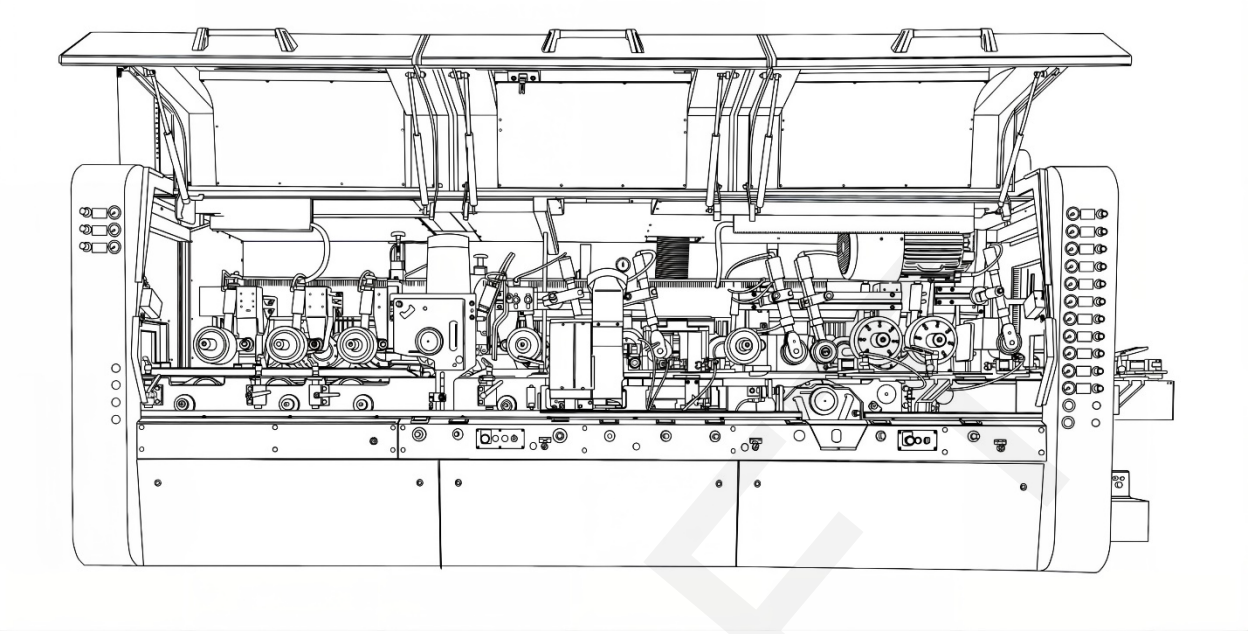
### A2.2.13 Molder/multi-head planer



### A2.2.14 Profiler/engraver/carver

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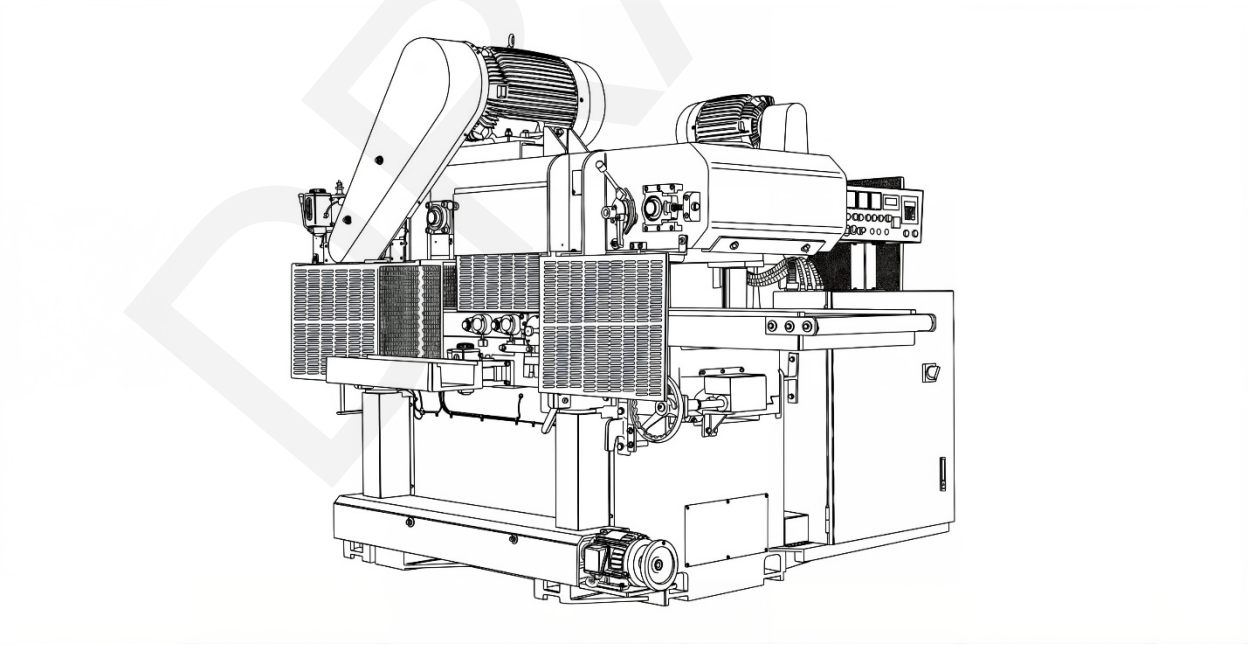
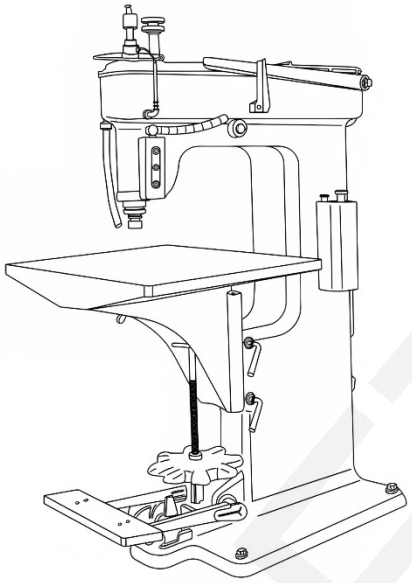
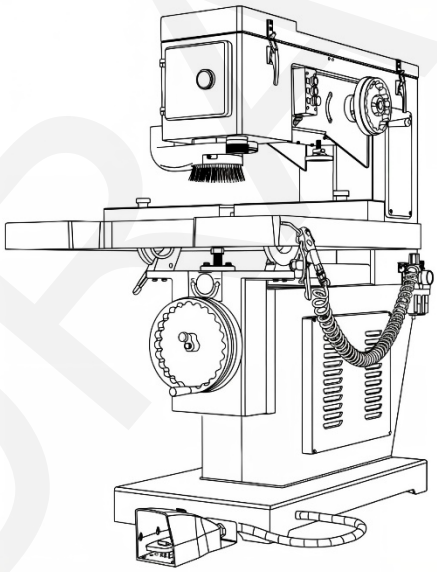
### A2.2.15 Planer



## A2.2.16 Router



*Legacy Design Overhead Pin Router*



*Overhead Pin Router*

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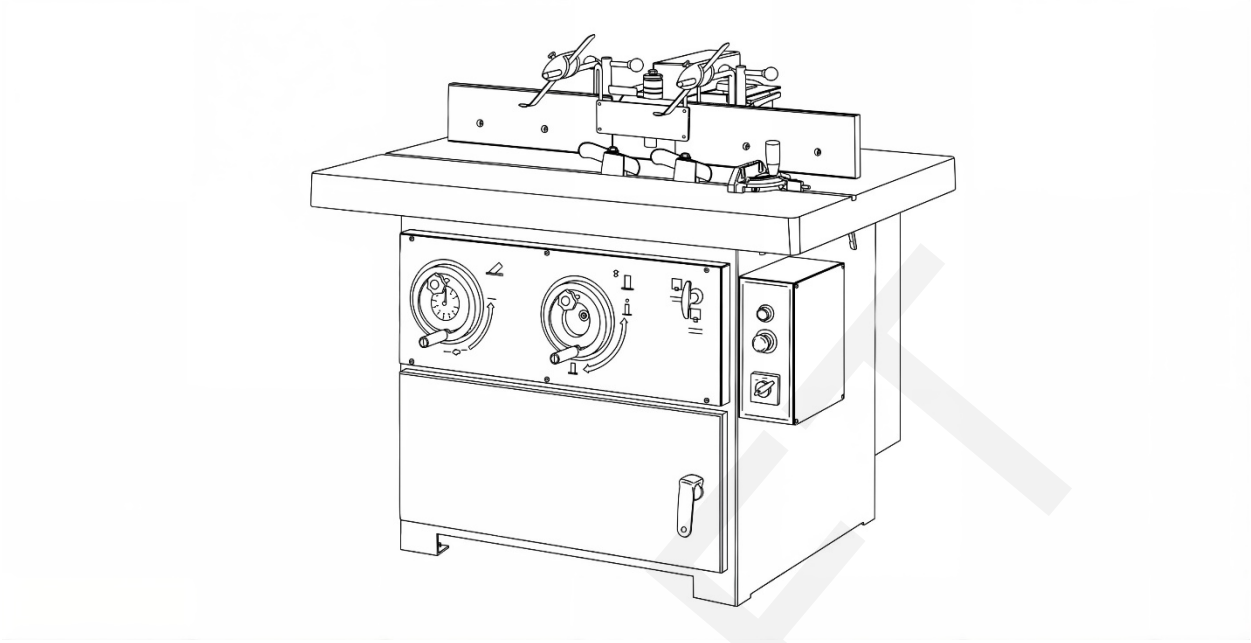
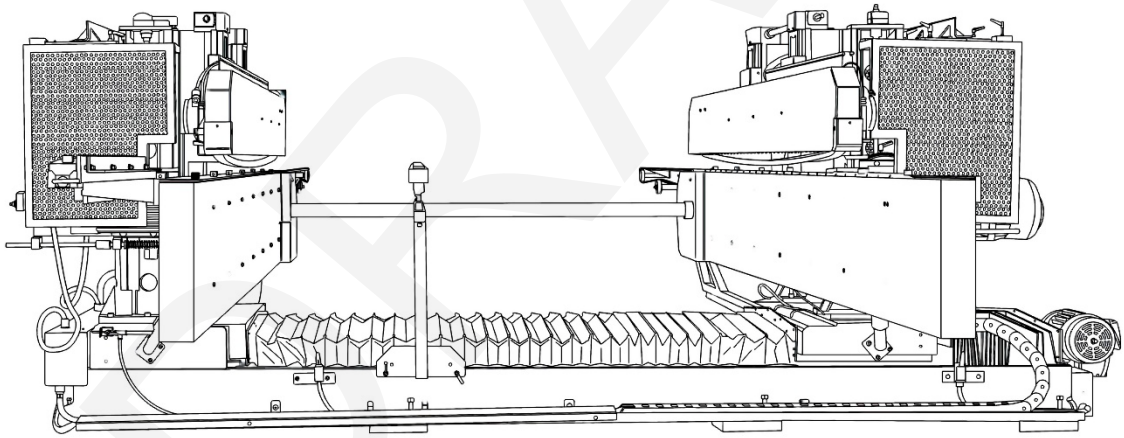
### A2.2.17 Shaper



### A2.2.18 Tenoner/trim saw



### A2.2.19 Drilling/boring machine

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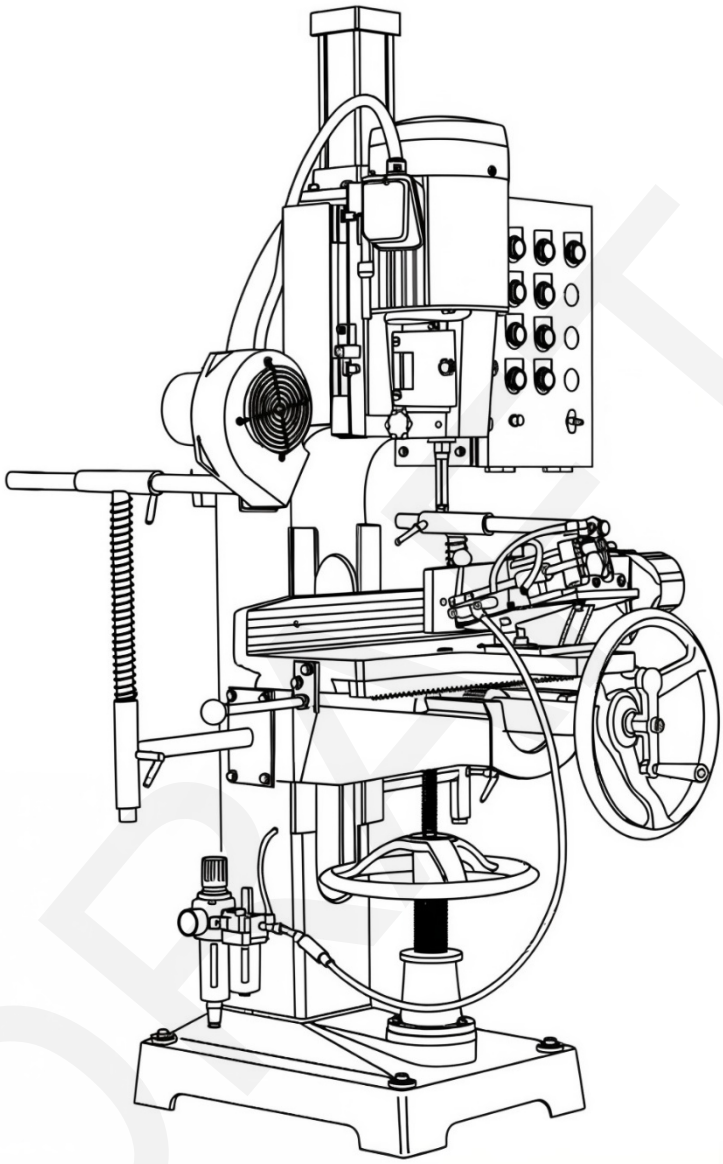
## A2.2.20 Mortiser



*Mortiser - Single Spindel*

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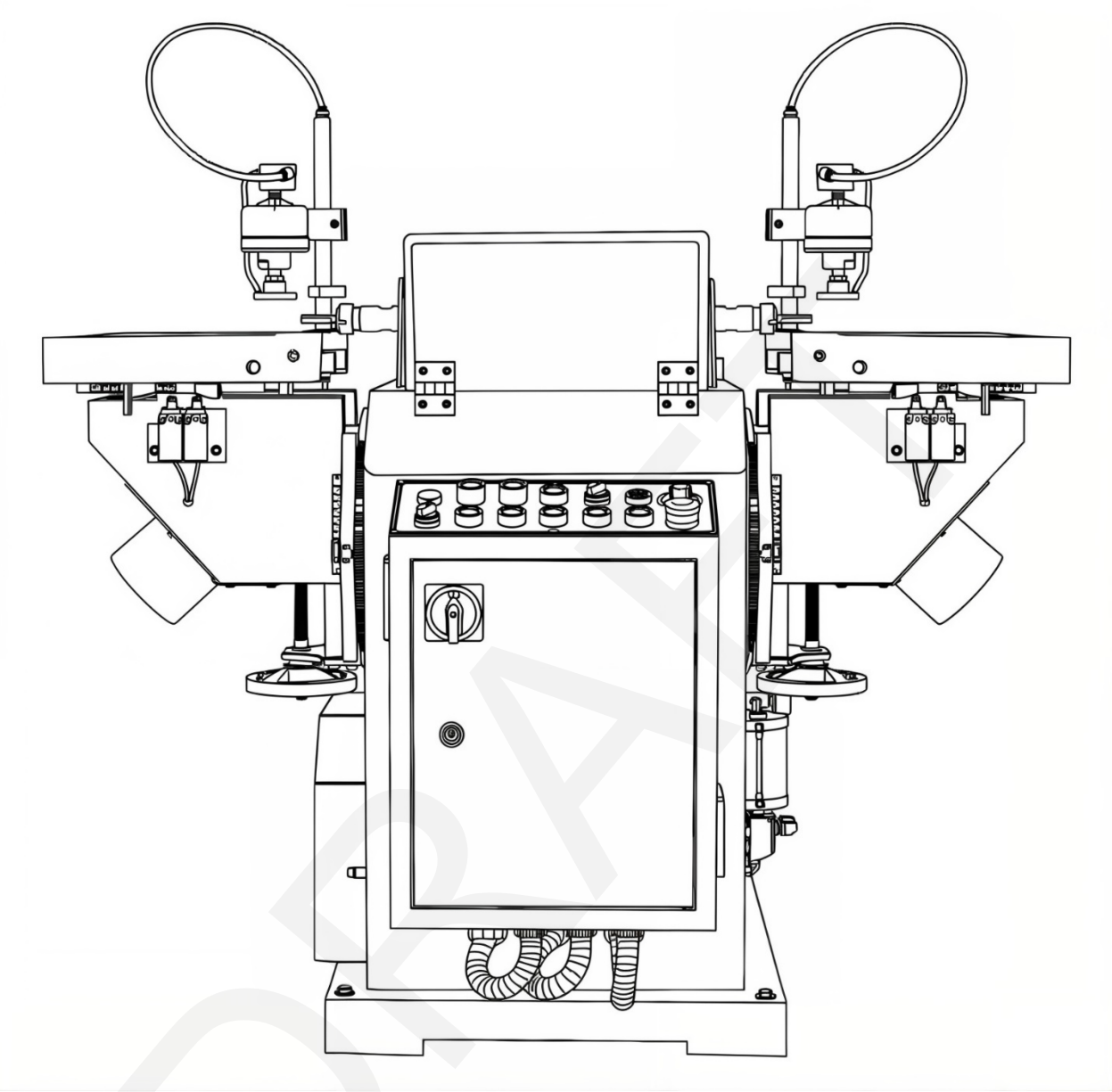

*Mortiser - Double Spindle*

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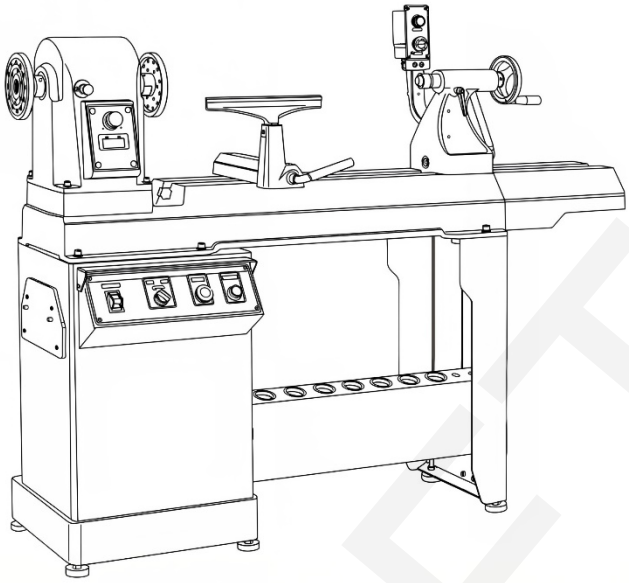
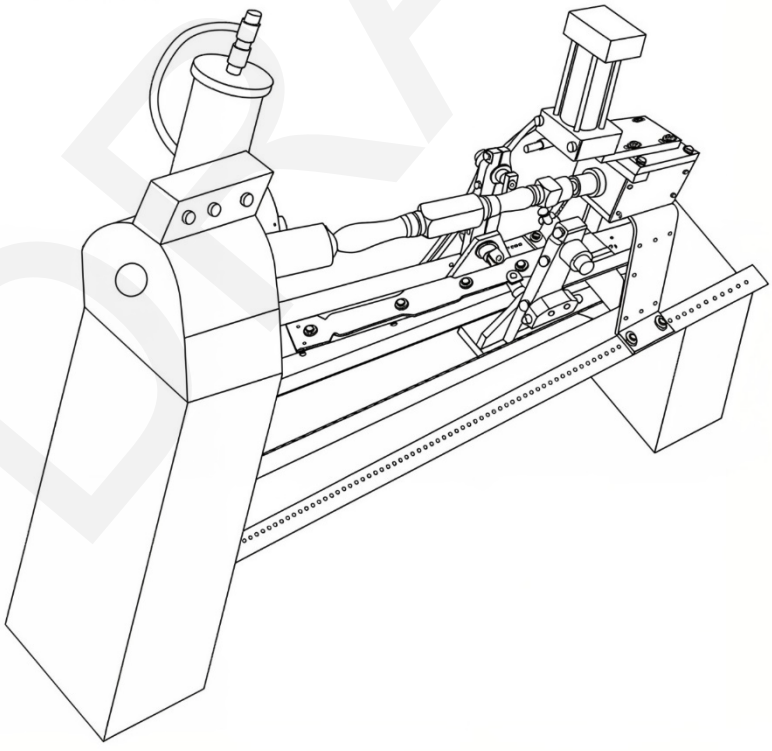
### A2.2.21.1 Manual lathe



### A2.2.21.2 Copying/tracer lathe



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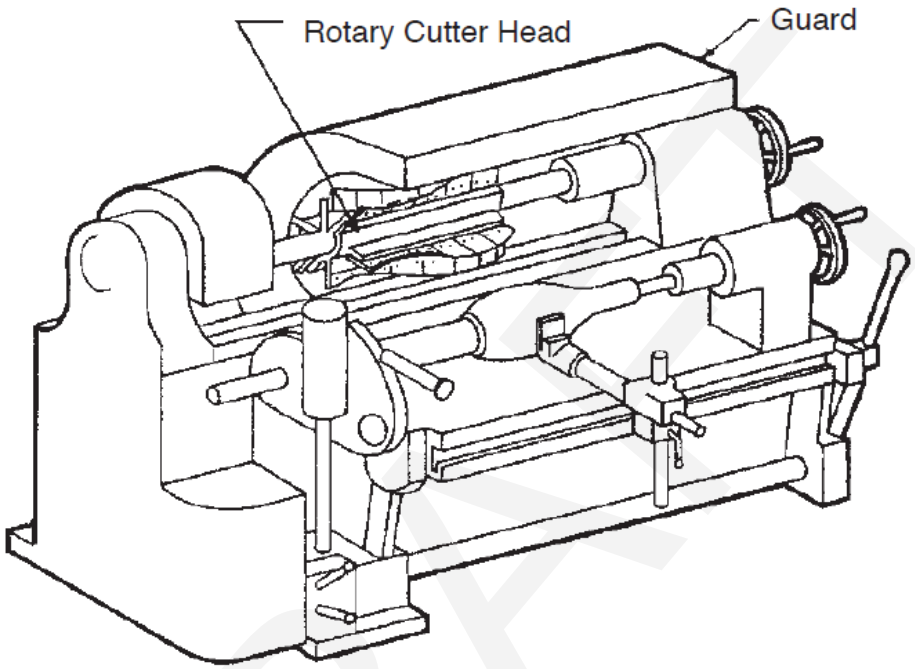
### A2.2.21.3 Back knife lathe

At the time of publication, the ASC O1 was unable to obtain images of standard compliant machines.

### A2.2.21.4 Swing-head lathe

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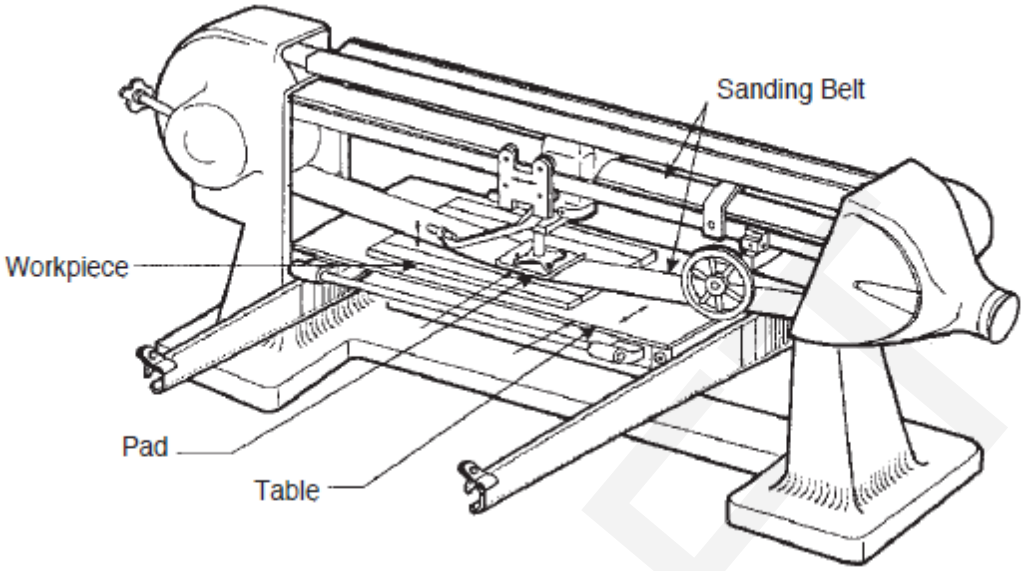
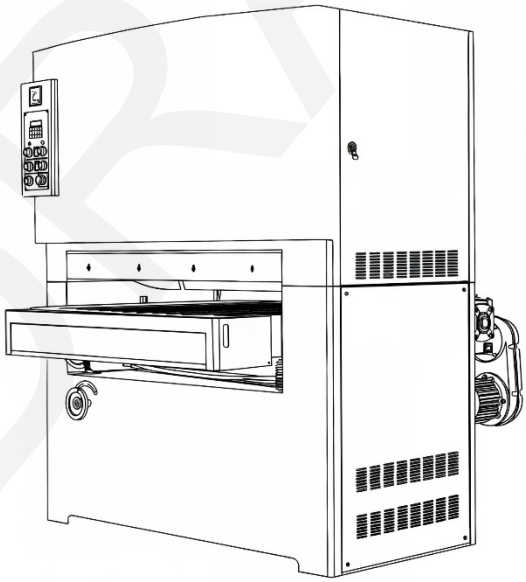
### A2.2.22.2 Manual belt sander




### A2.2.22.3 Power feed belt sander



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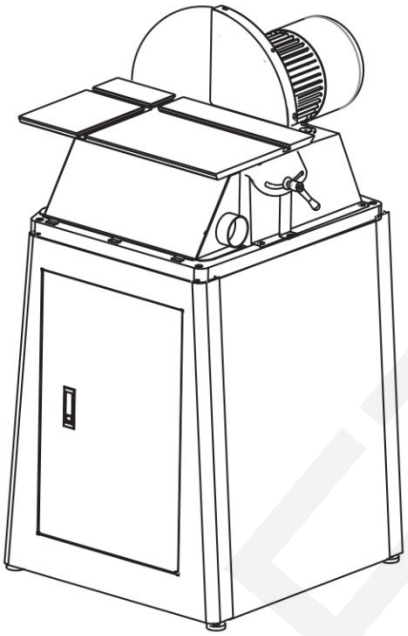
### A2.2.22.4 Disc sander



### A2.2.22.5 Profile sander

At the time of publication, the ASC O1 was unable to obtain images of standard compliant machines.

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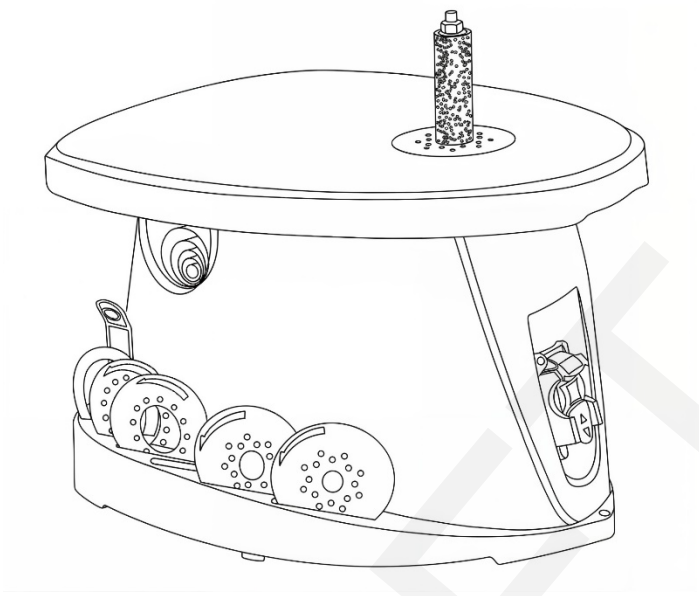
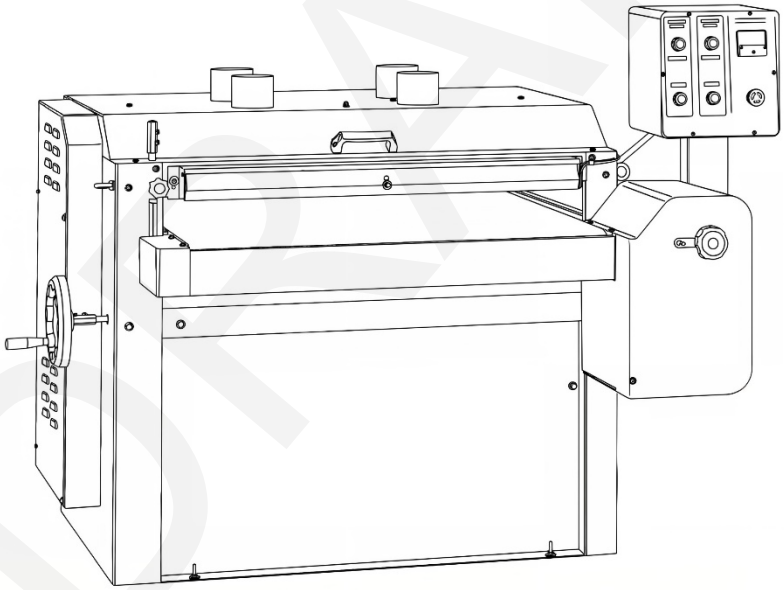
### A2.2.22.7 Oscillating drum sander



### A2.2.22.8 Horizontal drum sander



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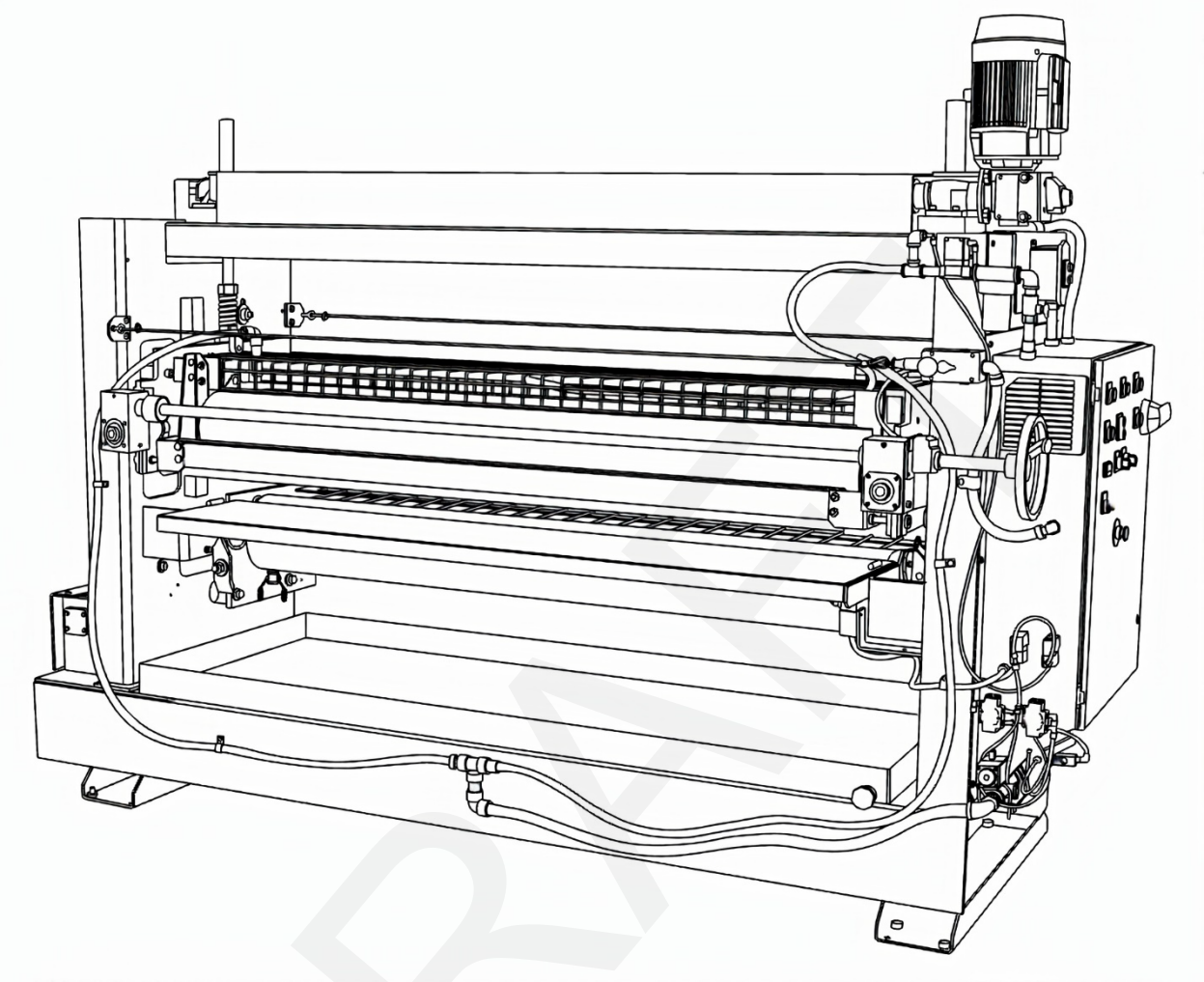
### A2.2.23.1 Surface gluing machines



### A2.2.23.2 Edge gluing machines

At the time of publication, the ASC O1 was unable to obtain images of standard compliant machines.

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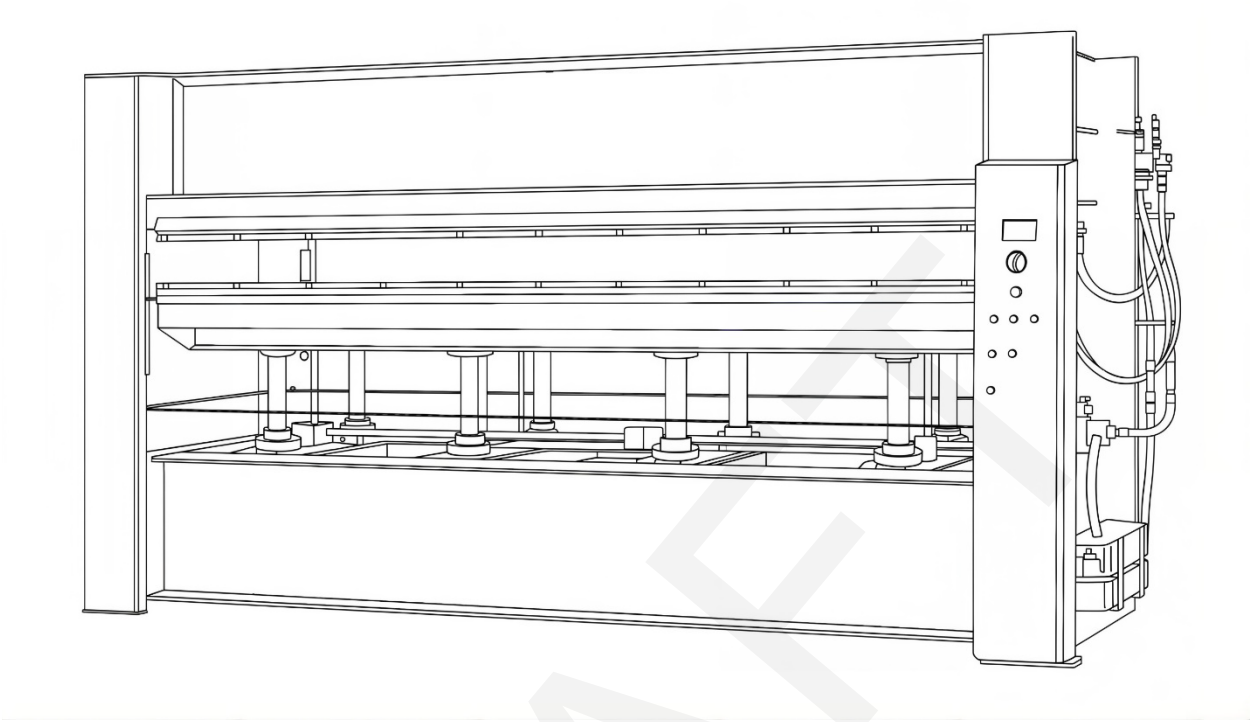
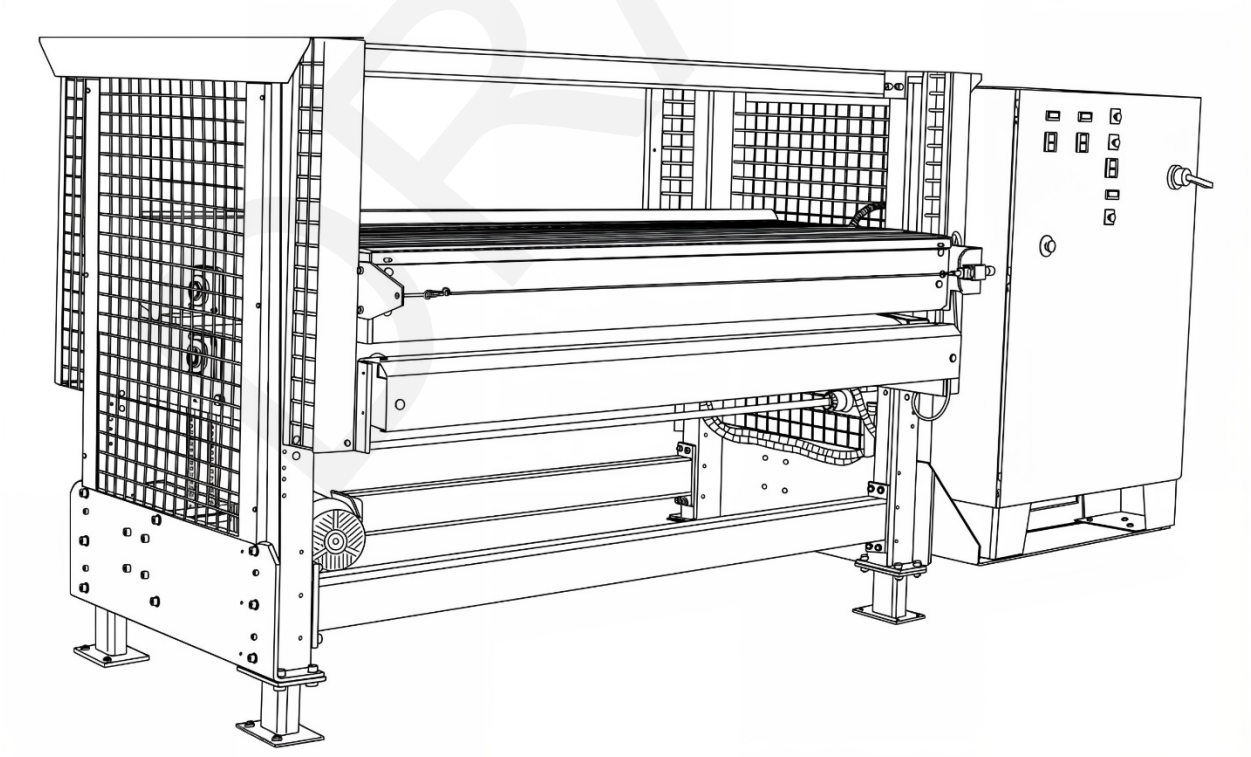
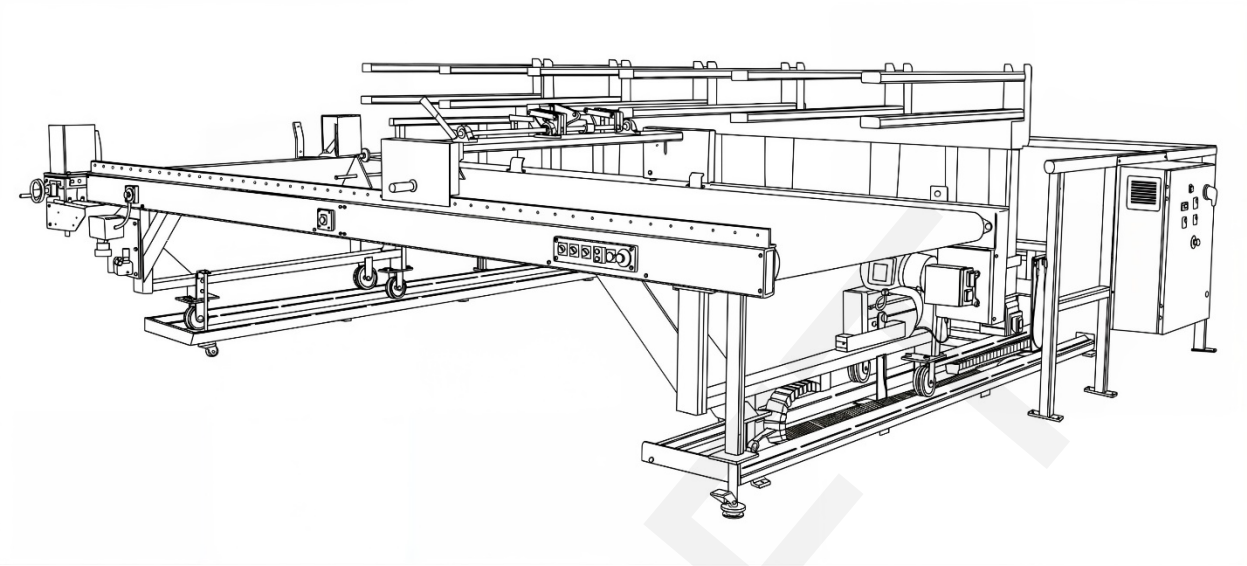
### A2.2.24.1 Vertical clamping platen presses



### A2.2.24.2 High pressure roll type press



### A2.2.25 Laminate indexing machines



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