



SAFETY REGULATION

no. 6

PROPERTY OF
NEW JERSEY STATE



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Trenton, N. J.

Relating to

WOODWORKING MACHINERY

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STATE OF NEW JERSEY
DEPARTMENT OF LABOR & INDUSTRY
BUREAU OF ENGINEERING & SAFETY
Trenton, N. J.

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FOREWORD

This Regulation establishes reasonable standards for the safe installation, operation and maintenance of Woodworking Machinery. The requirements of the Regulation have been extracted from "United States of America Standard Safety Code for Woodworking Machinery," 01.1-1954.

The appendix attached hereto is not a part of Safety Regulation No. 6. It has likewise been drawn from the same United States Standard, and presents recommendations and illustrations relating to the regulatory requirements.

This regulation is promulgated by the Commissioner of Labor and Industry of the State of New Jersey under authority vested in him by Section 9 of the Worker Health and Safety Act, P. L. 1965, c. 154, N. J. S. A. 34:6A as follows:

The commissioner shall make and promulgate rules and regulations reasonably necessary to implement the purposes of this act. Such rules and regulations shall have the force and effect of law and shall be enforced in the manner provided in this act. . . .

The same statute provides authority for the Commissioner to grant exceptions from the requirements of rules and regulations in accordance with section 23 as follows:

The commissioner shall have the power and authority to grant exceptions from the literal requirements of rules and regulations promulgated under this act. Such exception shall be granted in any particular case only where it is clearly evident that it is necessary to prevent undue hardship or where existing conditions prevent compliance. In no case shall any exception be granted unless in the opinion of the commissioner reasonable protection of the health and safety of workers and the public will be maintained hereby. An application for an exception shall be filed in writing with the commissioner, setting forth specifically the requirements of the rules and regulations from which an exception is desired and the reason why enforcement of the applicable provisions of the rules and regulations is unreasonable. The commissioner shall grant or deny the exception within 30 days from the date of receipt by him of the applications. The commissioner shall maintain a record of all exceptions granted and shall make such record reasonably available for public examination and shall mail a copy of all rulings granting exceptions to the members of the board.

Prior to its promulgation this Regulation was submitted to the New Jersey State Industrial Safety Committee and the Industrial Safety Board in accordance with the requirements of the act cited above.

SECTION 1 — PURPOSE, SCOPE AND DEFINITIONS

- 1.1 *Purpose.* The purpose of this regulation is to establish reasonable standards for the safe installation, operation and maintenance of woodworking machinery.
- 1.2 *Scope.* This Regulation applies to woodworking machinery used in any place of employment subject to the Worker Health and Safety Act, P. L. 1965, c. 154, N. J. S. A. 34:6A. Included within its scope are cooperage operations and the making of veneer. Not included is the manufacture of structural plywood.
- 1.3 *Definitions*
 - 1.3.1 *Approved* — approved by the Commissioner.
 - 1.3.2 *Commissioner* — the Commissioner of Labor and Industry or his authorized representative.
 - 1.3.3 *Point of Operations* — shall mean that point at which cutting, shaping, boring, or forming is accomplished upon the stock.
 - 1.3.4 *Push Stick* — shall mean a narrow strip of wood or other soft material with a notch cut into one end and which is used to push short pieces of material through saws.
 - 1.3.5 *Block* — shall mean a short block of wood, provided with a handle similar to that of a plane and a shoulder at the rear end, which is used for pushing short stock over revolving cutters.

SECTION 2 — PLANT LAYOUT

- 2.1 *Machinery*
 - 2.1.1 *Machine Layout*
 - (a) Machines shall be so located that there will be sufficient space in which to handle the material with the least possible interference from or to workmen or machines. Machines shall be so placed that it will not be necessary for anyone to stand in or so near an aisle as to be liable to hazard. (See Appendix A2.1.1 (a).)
 - (b) Woodworking machinery shall be firmly secured to substantial floors or foundations. Small units shall be secured to benches,

tables, or stands of adequate strength and designed so as to prevent overturning or unintentional movement. This rule does not apply to portable hand tools. Wherever plant layout permits, it is advisable to locate heavy-duty machines on the ground floor. (See Appendix A2.1.1 (b).)

- (c) Machines should be located, with respect to sources of both natural and artificial light, so that light of sufficient intensity will fall on the work. Supplementary illumination at the point of operation should be provided where necessary. Direct or reflected glare and shadows, including moving shadows, should be avoided.
- (d) Provision should be made for the removal of shavings and dust.

2.2 *Floors and Aisles*

- 2.2.1 *Floor Maintenance.* All floors shall be kept in good repair and shall be free from protruding nails, splinters, holes, unevenness, and loose boards.
- 2.2.2 *Non-slip Floors.* Floors in the working area about all woodworking machines shall be provided with effective means to prevent slipping. (See Appendix A2.2.2 for suggestions for non-slip floors.)
- 2.2.3 *Aisles.* Aisles for one-way traffic shall be not less than the width of the widest vehicle or load plus 3 feet. For two-way traffic the minimum width of aisles shall be not less than twice the width of the widest vehicles or loads plus 3 feet. Lines shall be painted on the floor, or some similar method employed to mark aisleways.

SECTION 3 — MACHINES AND EQUIPMENT

3.1 *Machine Construction, Drive, Feed, Speed, and Control.* (See Appendix A3.1.)

3.1.1 *Machine Construction*

- (a) The height of the table or working surface of each machine should be designed to provide the best efficiency and the least amount of fatigue for the operator. (See Appendix A3.1.1.) This also applies to auxiliary tables or supports for the work in operation; these supports should be provided so that large or unwieldy pieces can be handled in a safe and nonfatiguing manner.
- (b) Each machine shall be so constructed as to be free from sensible vibration when the largest size tool is mounted and run idle at full speed.

- (c) Arbors and mandrels shall be constructed so as to have firm and secure bearing and be free from play.
- (d) The use of wooden band-saw wheels other than those of commercial manufacture shall be prohibited.
- (e) Any automatic cut-off saw that strokes continuously without the operator being able to control each stroke shall not be used.
- (f) Saw frames or tables shall be constructed with lugs cast on the frame or with an equivalent means to limit the size saw that can be mounted, so as to avoid overspeed caused by mounting a saw larger than intended.
- (g) Circular saw fences shall be so constructed that they can be firmly secured to the table or table assembly without changing their alignment with the saw. For saws with tilting tables or tilting arbors the fence shall be so constructed that it will remain in a line parallel with the saw, regardless of the angle of the saw with the table.
- (h) Circular saw gages shall be so constructed as to slide in grooves or tracks that are accurately machined, to insure exact alignment with the saw for all positions of the guide.
- (i) Hinged saw tables shall be so constructed that the table can be firmly secured in any position and in true alignment with the saw.
- (j) All belts, pulleys, gears, shafts, and moving parts shall be guarded in accordance with the specific requirements of Safety Regulation No. 4 relating to the Safeguarding of Mechanical Power Transmission Apparatus.

3.1.2 *Machine Drive. (See Appendix A3.1.2.)*

- (a) Driving power for woodworking machinery should be provided by individual motor or motors mounted on the machine whenever possible, or on a separate base adjacent to the machine with power transmission medium properly guarded.
- (b) Power-driven woodworking machinery, including the metal frame of the machine, should be properly grounded.
- (c) It is recommended that each power-driven woodworking machine be provided with a disconnect switch that can be locked in the off position.
- (d) The frames and all exposed, non-current-carrying metal parts of portable electric woodworking machinery operated at more than 90 volts to ground shall be grounded, and other portable motors driving electric tools which are held in the hand while being operated shall be grounded if they operate at more than

90 volts to ground. The ground shall be provided through use of a separate ground wire and polarized plug and receptacle.

- (e) Hand-held, power-driven woodworking tools shall be provided with "dead man" control, such as a spring-actuated switch, valve, or equivalent device, so that the power will be automatically shut off whenever the operator releases the control.

3.1.3 *Machine Control*

- (a) A mechanical or electrical power control shall be provided on each machine to make it possible for the operator to cut off the power from each machine without leaving his position at the point of operation.
- (b) On machines driven by belts and shafting, a locking-type belt shifter or an equivalent positive device shall be used. (See Appendix A3.1.3.)
- (c) On applications where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.
- (d) Power controls and operating controls should be located within easy reach of the operator while he is at his regular work location, making it unnecessary for him to reach over the cutter to make adjustments. This does not apply to constant pressure controls used only for setup purposes.
- (e) On each machine operated by electric motors, positive means shall be provided for rendering such controls or devices inoperative while repairs or adjustments are being made to the machines they control.
- (f) Each operating treadle shall be protected against unexpected or accidental tripping.

3.1.4 *Self-Feed.* Automatic feeding devices on machines should be installed wherever the nature of the work will permit. Feeder attachments shall have the feed rolls or other moving parts so covered or guarded as to protect the operator from hazardous points.

3.1.5 *Speeds.* The operating speed shall be etched or otherwise permanently marked on all circular saws over 20 inches in diameter or operating over 10,000 peripheral feet per minute. A saw so marked shall not be operated at a speed other than that stipulated on the blade. When a marked saw is retensioned for a different speed, the marking shall be corrected to show the new speed. (See Appendix A3.1.5.)

SECTION 4 — WOODWORKING MACHINERY

4.1 *Circular, Rip, Crosscut, Resaw, and Swing Cut-off Saws*

4.1.1 *Guarding of Saws Beneath and Behind Tables.* For all circular saws where conditions are such that there is a possibility of contact with the portion of the saw either beneath or behind the table, that portion of the saw shall be covered with an exhaust hood, or, if no exhaust system is required, with a guard that shall be so arranged as to prevent accidental contact with the saw.

4.1.2 *Hand-Fed Rip Saws*

(a) *Hoods.* Each circular hand-fed rip saw shall be guarded by a hood which shall completely enclose that portion of the saw above the table and that portion of the saw above the material being cut. The hood and mounting shall be arranged so that hood will automatically adjust itself to the thickness of and remain in contact with the material being cut, but it shall not offer any considerable resistance to insertion of material to saw or to passage of the material being sawed. The hood shall be made of adequate strength to resist blows and strains incidental to reasonable operation, adjusting, and handling, and shall be so designed as to protect the operator from flying splinters and broken saw teeth. It shall be made of material that is soft enough so that it will be unlikely to cause tooth breakage. The material should not shatter when broken, should be nonexplosive, and should be no more flammable than wood. The hood shall be so mounted as to insure that its operation will be positive, reliable, and in true alignment with the saw; and the mounting shall be adequate in strength to resist any reasonable side thrust or other force tending to throw it out of line. (For discussion of various hoods and hood mountings, see Appendix A4.1.2(a).)

(b) *Spreaders.* Each hand-fed circular rip saw shall be furnished with a spreader to prevent material from squeezing the saw or being thrown back on the operator. The spreader shall be made of hard tempered steel, or its equivalent, and shall be thinner than the saw kerf. It shall be of sufficient width to provide adequate stiffness or rigidity to resist any reasonable side thrust or blow tending to bend or throw it out of position. The spreader shall be attached so that it will remain in true alignment with the saw even when either the saw or table is tilted, and should be placed so that there is not more than $\frac{1}{2}$ inch space between the spreader and the back of the saw when the

largest saw is mounted in the machine. The provision of a spreader in connection with grooving, dadoing, or rabbeting is not required. On the completion of such operations, the spreader shall be immediately replaced. (For discussion of spreaders, see Appendix A4.1.2(b).)

- (c) *Non-Kickback Fingers or Dogs.* Each handfed circular rip saw shall be provided with non-kickback fingers or dogs so located as to oppose the thrust or tendency of the saw to pick up the material or to throw it back toward the operator. They shall be designed to provide adequate holding power for all the thicknesses of materials being cut. (For discussion of kickbacks, see Appendix A4.1.2(c).)

4.1.3 *Hand-Fed Crosscut Table Saws (Including Trimmer Saws)*

- (a) Each circular crosscut table saw shall be guarded by a hood which shall meet all the requirements of 4.1.2(a) for hoods for circular rip saws.
- (b) Each circular crosscut saw should also be provided with a spreader which should meet all the requirements of 4.1.2(b).
- (c) Hoods for trimmer saws with mechanical feed should remain in contact with the material being cut. (For discussion of jigs and fixtures for circular saws, see Appendix A4.1.3.)

4.1.4 *Revolving Double Arbor Saws.* Revolving double arbor saws shall be fully guarded in accordance with all the requirements for circular crosscut saws or with all the requirements for circular rip saws, according to the kind of saws mounted on the arbors.

4.1.5 *Circular Resaws*

- (a) Each circular resaw shall be guarded by a hood or shield of metal above the saw. This hood or shield shall be so designed as to guard against danger from flying splinters or broken saw teeth.
- (b) Each circular resaw (other than self-feed saws with a roller or wheel at back of the saw) shall be provided with a spreader fastened securely behind the saw. The spreader shall be slightly thinner than the saw kerf and slightly thicker than the saw disk.

4.1.6 *Self-Feed Circular Saws*

- (a) *Hoods.* Feed rolls and saws shall be protected by a hood or guard to prevent the hands of the operator from coming in contact with the inrunning rolls at any point. The guard shall be constructed of heavy material, preferably metal, and the bottom of the guard shall come down to within $\frac{3}{8}$ inch of the

plane formed by the bottom or working surfaces of the feed rolls. This distance ($\frac{3}{8}$ inch) may be increased to $\frac{3}{4}$ inch, provided the lead edge of the hood is extended to be not less than $5\frac{1}{2}$ inches in front of the nip point between the front roll and the work.

- (b) *Non-Kickback Fingers.* Each self-feed circular rip saw shall be provided with sectional non-kickback fingers for the full width of the feed rolls. They shall be located in front of the saw and so arranged as to be in continual contact with the wood being fed.

4.1.7 *Swing Cut-Off Saws.* The requirements of 4.1.7 are also applicable to sliding cut-off saws mounted above the table. (For radial saws, see 4.1.9.)

- (a) *Hood.* Each swing cut-off saw shall be provided with a hood that will completely enclose the upper half of the saw, the arbor end, and the point of operation at all positions of the saw. The hood shall be constructed in such a manner and of such material that it will protect the operator from flying splinters and broken saw teeth. Its hood shall be so designed that it will automatically cover the lower portion of the blade, so that when the saw is returned to the back of the table the hood will rise on top of the fence, and when the saw is moved forward the hood will drop on top of and remain in contact with the table or material being cut.
- (b) *Counterweights.* Each swing cutoff shall be provided with an effective device to return the saw automatically to the back of the table when released at any point of its travel. Such a device shall not depend for its proper functioning upon any rope, cord, or spring. If there is a counterweight, the bolts supporting the bar and counterweight shall be provided with cotter pins; and the counterweight shall be prevented from dropping by either a bolt passing through both the bar and counterweight, or a bolt put through the extreme end of the bar, or, where the counterweight does not encircle the bar, a safety chain attached to it.
- (c) *Limit Stops.* Limit chains or other equally effective devices shall be provided to prevent the saw from swinging beyond the front or back edges of the table, or beyond a forward position where the gullets of the lowest saw teeth will rise above table top.

- (d) *Latches.* A latch or equivalent device should be provided to catch and retain the saw at the rear of the table to prevent its rebounding.

4.1.8 *Inverted Swing Cut-off Saws (Jump Saws).* Inverted swing cut-off saws shall be provided with a hood that will cover the part of the saw that protrudes above the top of the table or above the material being cut. It shall automatically adjust itself to the thickness of and remain in contact with the material being cut.

4.1.9 *Radial Saws. (See Appendix A4.1.9.)*

- (a) *Hoods and Guards.* The upper hood shall completely enclose the upper portion of the blade down to a point that will include the end of the saw arbor. The upper hood shall be constructed in such a manner and of such material that it will protect the operator from flying splinters, broken saw teeth, etc., and will deflect sawdust away from the operator. The sides of the lower exposed portion of the blade shall be guarded to the full diameter of the blade by a device that will automatically adjust itself to the thickness of the stock and remain in contact with stock being cut to give maximum protection possible for the operation being performed.
- (b) *Spreaders.* When radial saws are used for ripping, a spreader should be provided (See 4.1.2(b).)
- (c) *Non-Kickback Fingers or Dogs.* Each radial saw used for ripping shall be provided with non-kickback fingers or dogs located on both sides of the saw so as to oppose the thrust or tendency of the saw to pick up the material or to throw it back toward the operator. They shall be designed to provide adequate holding power for all the thicknesses of material being cut. (For discussion of kickbacks, see Appendix A4.1.2(c).)
- (d) *Adjustable Stops and Return Devices*
 - (1) An adjustable stop shall be provided to prevent the forward travel of the blade beyond the position necessary to complete the cut in repetitive operations.
 - (2) Installation shall be in such a manner that the front end of the unit will be slightly higher than the rear, so as to cause the cutting head to return gently to the starting position when released by the operator. CAUTION! Tilt should not be enough to cause rebound.
- (e) *Direction of Feed.* Ripping and ploughing shall be against the direction in which the saw turns. The direction of the saw rotation shall be conspicuously marked on the hood. In addi-

tion, a permant label not less than $1\frac{1}{2}$ inches by $\frac{3}{4}$ inches shall be 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

Such a label should be colored standard danger red.

- (f) *Tenoning*. For tenoning operations, see 4.4.
- (g) *Boring and Mortising*. See 4.5. The portions applying to the guard apply.
- (h) *Shaping*. See 4.6.
- (i) *Planing, Molding, Sticking, Matching, etc.* (including notching operations). See 4.7.
- (j) For all other operations, refer to 4.10.

4.1.10 *Portable Circular Saws*. All portable, power-driven saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to covering position. (See 3.1.2.)

4.2 *Band Saws and Band Resaws*

4.2.1 *Enclosing Band-Saw Blades*. All portions of the saw blade shall be enclosed or guarded, except for the working portion of the blade between the bottom of the guide rolls and the table. Band saw wheels shall be fully encased. The outside periphery of the enclosure shall be solid. The front and back of the band wheels shall be either enclosed by solid material or by wire mesh or perforated metal. Such mesh or perforated metal shall be not less than 0.037 inch (U.S. Gage No. 20), and the openings shall be not greater than $\frac{3}{8}$ inch. Solid material used for this purpose shall be of an equivalent strength and firmness. The guard for the portion of the blade between the sliding guide and the upper-saw-wheel guard shall protect the saw blade at the front and outer side. This portion of the guard shall be self-adjusting to raise and lower with the guide. The upper-wheel guard shall be made to conform to the travel of the saw on the wheel, and the top member of the guard should have at least a 2-inch clearance outside the saw and be lined with smooth material,

preferably metal. Effective brakes should be provided to stop the wheel in case of blade breakage.

4.2.2 *Tension.* Each band-saw machine shall be provided with a tension control device to indicate a proper tension for the standard saws used on the machine, in order to assist in the elimination of saw breakage due to improper tension.

4.2.3 *Feed Rolls.* Feed rolls of band resaws shall be protected with a suitable guard to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be constructed of heavy material, preferably metal, and the edge of the guard shall come to within $\frac{3}{8}$ inch of the plane formed by the inside face of the feed roll in contact with the stock being cut.

4.3 *Jointers*

4.3.1 *Point of Operation*

- (a) Each hand-fed planer and jointer with horizontal head shall be equipped with a cylindrical cutting head, the knife projection of which shall not exceed $\frac{1}{8}$ inch beyond the cylindrical body of the head.
- (b) The opening in the table shall be kept as small as possible. The clearance between the edge of the rear table and the cutter head shall be not more than $\frac{1}{8}$ inch. The table throat opening shall be not more than $2\frac{1}{2}$ inches when tables are set or aligned with each other for zero cut.

4.3.2 *Automatic Guards*

- (a) Each hand-fed jointer with a horizontal cutting head shall have an automatic guard which will cover all the section of the head on the working side of the fence or gage. The guard shall effectively keep the operator's hand from coming in contact with the revolving knives. The guard shall automatically adjust itself to cover the unused portion of the head and shall remain in contact with the material at all times.
- (b) Each hand-fed jointer with horizontal cutting head shall have a guard which will cover the section of the head back of the gage or fence.

4.3.3 *Vertical-Head Jointers.* Each wood jointer with vertical head shall have either an exhaust hood or other guard so arranged as to enclose completely the revolving head, except for a slot of such width as may be necessary and convenient for the application of the material to be jointed.

4.4 *Tenoning Machines*

4.4.1 *Guarding of Cutting Heads*

- (a) Each tenoning machine shall have all cutting heads, and saws if used, covered by metal guards. These guards shall cover at least the unused part of the periphery of the cutting head. If such a guard is constructed of sheet metal, the material used shall be not less than $\frac{1}{16}$ inch in thickness, and if cast iron is used, it shall be not less than $\frac{3}{16}$ inch in thickness.
- (b) Where an exhaust system is used, the guard shall form part or all of the exhaust hood and shall be constructed of metal of a thickness not less than that specified in 4.4.1(a).

4.4.2 *Feed Chains and Sprockets*

- (a) Feed chains and sprockets of all double end tenoning machines shall be completely enclosed, except for that portion of chain used for conveying the stock.
- (b) At the rear ends of frames over which feed conveyors run, sprockets and chains shall be guarded at the sides by plates projecting beyond the periphery of sprockets and the ends of lugs.
- (c) Where space permits, the rear end of the frame over which the feed conveyors run should be so extended that the material, as it leaves the machine, will be guided to a point within easy reach of the person "taking away" at the rear of the tenoner.

4.4.3 *Hand-Fed Tenoners.* Hand-fed tenoning machines should be provided with a clamping or "hold-down" device to help the operator hold the material being cut.

4.5 *Boring and Mortising Machines*

4.5.1 *Chucks.* Safety-bit chucks with no projecting set screws shall be used.

4.5.2 *Boring Bits.* Boring bits should be provided with a guard that will enclose all portions of the bit and chuck above the material being worked.

4.5.3 *Chain Mortiser.* The top of the cutting chain and driving mechanism shall be enclosed.

4.5.4 *Counterweights.* If there is a counterweight, one of the following or equivalent means shall be used to prevent its dropping:

- (a) It shall be bolted to the bar by means of a bolt passing through both bar and counterweight;

- (b) A bolt shall be put through the extreme end of the bar;
- (c) Where the counterweight does not encircle the bar, a safety chain shall be attached to it;
- (d) Other types of counterweights shall be suspended by chain or wire rope and shall travel in a pipe or other suitable enclosure wherever they might fall and cause injury.

4.5.5 *Universal Joints.* Universal joints on splindles of boring machines shall be completely enclosed in such a way as to prevent accidental contact by the operator.

4.5.6 *Guarding Operating Treadles.* Each operating treadle shall be covered by an inverted U-shaped metal guard, fastened to the floor, and of adequate size to prevent accidental tripping. (See 3.1.3(f).)

4.6 *Wood Shapers, etc.*

4.6.1 *Guarding of Cutting Heads*

- (a) The cutting heads of each wood shaper, hand-fed panel raiser, or other similar machine not automatically fed, shall be enclosed with a cage or adjustable guard so designed as to keep the operator's hands away from the cutting edge. The diameter of circular shaper guards shall be not less than the greatest diameter of the cutter. In no case shall a warning device of leather or other material attached to the spindle be acceptable.
- (b) Cylindrical heads should be used whenever the nature of the work will permit. Single cutter knives in shaper heads shall not be used unless properly balanced.
- (c) Templates, jigs, and fixtures which will remove the operator's hands from the point of operation should be used whenever the nature of the work will permit. (See Appendix A4.6.1.)

4.6.2 *Spindle Starting and Stopping Devices.* All double-spindle shapers shall be provided with a spindle starting and stopping device for each spindle.

4.7 *Planing, Molding, Sticking, and Matching Machines, etc.*

4.7.1 *Guarding of Cutting Heads*

- (a) Each planing, molding, sticking, and matching machine shall have all cutting heads, and saws if used, covered by a metal guard. If such guard is constructed of sheet metal, the material used shall be not less than $\frac{1}{16}$ inch in thickness; and if cast iron is used, it shall be not less than $\frac{3}{16}$ inch in thickness.

- (b) Where an exhaust system is used, the guards shall form part or all of the exhaust hood and shall be constructed of metal of a thickness not less than that specified in 4.7.1(a).

4.7.2 *Feed Rolls*

- (a) Feed rolls shall be guarded by a hood or suitable guard to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be fastened to the frame carrying the rolls so as to remain in adjustment for any thickness of stock.
- (b) Surfacers or planers used in thicknessing multiple pieces of material simultaneously shall be provided with sectional infeed rolls having sufficient yield in the construction of the sections to provide feeding contact pressure on the stock, over the permissible range of variation in stock thickness specified or for which the machine is designed. In lieu of such yielding sectional rolls, suitable section kickback finger devices shall be provided at the infeed end.

4.8 *Profile and Swing-Head Lathes (Including Wood Heel Turning Machines)*

4.8.1 *Guarding of Cutting Heads*

- (a) Each profile and swing-head lathe shall have all cutting heads covered by a metal guard. If such a guard is constructed of sheet metal, the material used shall not be less than $\frac{1}{16}$ inch in thickness; and if cast iron is used, it shall be not less than $\frac{3}{16}$ inch in thickness.
- (b) Cutting heads on wood-turning lathes, whether rotating or not, shall be covered as completely as possible by hoods or shields, which should be hinged to the machines so that they can be thrown back for making adjustments.
- (c) Shoe-last and spoke lathes, doweling machines, wood heel turning machines, and other automatic wood-turning lathes of the rotating knife type shall be equipped with hoods enclosing the cutter blades completely except at the contact points while the stock is being cut.
- (d) Lathes used for turning long pieces of wood stock held only between the two centers shall be equipped with long curved guards extending over the tops of the lathes in order to prevent the work pieces from being thrown out of the machines if they should become loose.
- (e) Guards covering the work pieces on wood-turning lathes should be constructed of expanded metal or other suitable material which will permit observation of the turning operations.

- (f) Wood-turning lathes should be equipped with suction hoods, properly connected to efficient exhaust systems, that will remove at their point of origin the chips and dusts produced.
- (g) Where an exhaust system is used, the guard shall form part or all of the exhaust hood and shall be constructed of metal of a thickness not less than that specified in 4.8.1(a).

4.9 *Sanding Machines*

- 4.9.1 *Feed Rolls.* Feed rolls of self-feed sanding machines shall be protected with a semi-cylindrical guard to prevent the hands of the operator from coming in contact with the in-running rolls at any point. The guard shall be constructed of heavy material, preferably metal, and firmly secured to the frame carrying the rolls so as to remain in adjustment for any thickness of stock. The bottom of the guard should come down to within $\frac{3}{8}$ inch of a plane formed by the bottom or contact face of the feed roll where it touches the stock. Guarding shall conform to the requirements of the Department's Regulation governing Machinery Using Rolls of Any Type.
- 4.9.2 *Drum Sanding Machines.* Each drum sanding machine shall have an exhaust hood, or other guard if no exhaust system is required, so arranged as to enclose the revolving drum, except for that portion of the drum above the table, if a table is used, which may be necessary and convenient for the application of the material to be finished.
- 4.9.3 *Disk Sanding Machines.* Each disk sanding machine shall have the exhaust hood, or other guard if no exhaust system is required, so arranged as to enclose the revolving disk, except for that portion of the disk above the table, if a table is used, which may be necessary for the application of the material to be finished. The distance between the disk and the table edge should be kept at a minimum.
- 4.9.4 *Belt Sanding Machines.* Belt sanding machines shall be provided with guards at each nip point where the sanding belt runs on to a pulley. These guards shall effectively prevent the hands or fingers of the operator from coming in contact with the nip points. The unused run of the sanding belt shall be guarded against accidental contact.

4.10 *Miscellaneous Machines*

- 4.10.1 *Combination or Universal Woodworking Machines.* For combination or universal woodworking machines each point of operation

of any tool shall be guarded as required for such a tool in a separate machine. Such machines should be provided with a separate stopping and starting device for each point of operation.

- 4.10.2 *Routers.* The pulleys, spindles, and cutting tools should be guarded. Turn plates, jigs, and fixtures which will require the operator's hands to be removed from the point of operation should be used.
- 4.10.3 *Glue Spreaders (Roll Type).* The feed rolls shall be guarded by a semicylindrical guard. The bottom of the guard shall come to within $\frac{3}{8}$ inch of a plane formed by bottom or contact face of the feed roll where it touches the stock.
- 4.10.4 *Other Machines Not Excluded.* The mention of specific machines in 4.1 to 4.9, inclusive, is not intended to exclude other woodworking machines from the requirement that suitable guards and exhaust hoods be provided to reduce to a minimum the hazard due to the point of operation of such machines.

SECTION 5 — VENEER MACHINERY

5.1 *Steaming Equipment and Soaking Pits*

5.1.1 *Steam Vats and Soaking Pits*

- (a) Sides of steam vats shall extend to a height of not less than 36 inches above the floor, working platform, or ground.
- (b) Large steam vats divided into sections shall be provided with substantial walkways between sections. Each walkway shall be provided with a standard handrail on each exposed side. These handrails may be removable, if necessary. Provided the size of stock handled will permit, it is advisable to keep the size of the vat sections to 8 feet or less.

5.1.2 *Loading and Unloading.* One or more of the following means shall be used in loading and unloading vats and soaking pits:

- (a) The floor surface at the sides being used shall be so constructed as to prevent slipping, or all employees working at the vats shall be provided with and shall wear footwear having soles and heels of such composition as to prevent slipping.
- (b) The employee shall be provided with a safety belt attached to a life line. The life line shall be attached to a traveling trolley on a monorail or to a fixed anchorage or similar arrangement. The life line shall be permanently adjusted so that the employee, in the event of slipping, falling, or tripping, cannot fall into the vat.

- (c) Mechanical handling or conveying equipment shall be provided and so designed that the logs are removed without requiring assistance from an employee at the edge of the vat. Facilities should conform to the requirements of the Department's Regulation relating to Conveyors, Cableways and Related Equipment.
- (d) Hydraulic equipment shall be provided for draining the liquid from the vat. No employee shall be permitted to stand on the vat and no unloading shall be started until the liquid has been drained from the vat.

5.1.3 *Ventilation*

- (a) Insofar as possible, vats should be located in buildings or in special sheds heated in cold weather to keep the amount of steam at a minimum.
- (b) Means shall be provided to ventilate buildings in which steam vats are located. High ceilings with roof ventilators or louvers are desirable. Where ceilings or roofs are low, exhaust fans shall be provided.

5.2 *Log Handling Equipment*

5.2.1 *Cranes, Log Trolleys, etc.*

All gears, sprockets, and other dangerous parts shall be enclosed with standard guards. Specific requirements have been promulgated in Safety Regulation No. 4 relating to the Safeguarding of Mechanical Power Transmission Apparatus. The use of log trolleys or cranes is urgently recommended except where the stock handled is very small.

5.3 *Saws*

- 5.3.1 *Drag Saws.* Drag saws shall be so located as to give at least a 4-foot clearance for passage when the saw is at the extreme end of the stroke; or if such clearance is not obtainable, the saw and its driving mechanism shall be provided with a standard enclosure.

5.4 *Veneer Cutters and Wringers*

- 5.4.1 *Veneer Slicer.* Knives shall be guarded to prevent accidental contact with knife edge, at both front and rear.

5.4.2 *Veneer Clippers*

- (a) Veneer clippers shall have automatic feed or shall be provided with a guard which will make it impossible to place a finger or fingers under the knife while feeding or removing the stock.

- (b) Sprockets on chain or slat-belt conveyors shall be enclosed. It is recommended that conveyors or traveling tables be installed to remove material from clippers.
- (c) Where practicable, hand and footpower guillotine veneer cutters shall be provided with rods or plates or other satisfactory means, so arranged on the feeding side that the hands cannot reach the cutting edge of the knife while feeding or holding the stock in place.
- (d) Power-driven guillotine veneer cutters, except continuous feed trimmers, shall be equipped with:
 - (1) Starting devices which require the simultaneous action of both hands to start the cutting motion and of at least one hand on a control during the complete stroke of the knife; or
 - (2) An automatic guard which will remove the hands of the operator from the danger zone at every descent of the blade, used in conjunction with one-hand starting devices which require two distinct movements of the device to start the cutting motion, and so designed as to return positively to the non-starting position after each complete cycle of the knife.
- (e) Where two or more workers are employed at the same time on the same power-driven guillotine veneer cutter equipped with two-hand control, the device shall be so arranged that each worker shall be required to use both hands simultaneously on the controls to start the cutting motion, and at least one hand on a control to complete the cut.
- (f) Power-driven guillotine veneer cutters, other than continuous trimmers, shall be provided, in addition to the brake or other stopping mechanism, with an emergency device which will prevent the machine from operating in the event of failure of the brake when the starting mechanism is in the nonstarting position.

SECTION 6 — COOPERAGE MACHINERY

- 6.1 *General.* All belts, pulleys, gears, shafts, and moving parts shall be guarded in accordance with specific requirements of Safety Regulation No. 4 relating to the Safeguarding of Mechanical Power Transmission Apparatus.

6.2 Saws

6.2.1 Heading Bolt Sawing Machine

- (a) Each heading saw shall be guarded by a hood curved to the contour of the saw. The hood shall cover the saw at least to the depth of the teeth, except for that portion actually used in making the cut. The exhaust hood shall be so arranged and maintained as to guard effectively the bottom portion of the saw. The hood shall be made of adequate strength to resist strains incidental to reasonable operation.
- (b) The balance wheel shall be covered to enclose the rim and outside portion of the wheel. Expanded metal curved to fit the contour of the wheel is recommended.
- (c) The swing carriage shall be provided with an effective device that will return the carriage automatically to a position in front of the saw. Such a device shall not depend entirely upon any rope, cord, or spring for its proper functioning. If a counterweight is used, a safety chain shall be attached to it to prevent dropping, should the bar break or the weight become disengaged. All bolts supporting the bar, weight, and chain shall be provided with cotter pins or equally effective devices. A bolt shall be put through the extreme end of the counterweight bar to prevent dropping of the weight.
- (d) A limit stop shall be provided to prevent the carriage from swinging too far back and thereby exposing the unguarded portion of the saw to contact.

6.2.2 Bolt Equalizer, Stave, and Heading (Tilting Table Style)

- (a) All heading and stave bolt equalizer saws shall be guarded by hoods, curved to the contour of the saws. The hood shall cover the saw at least to the depth of the teeth, except for that portion actually used in making the cut. The exhaust hood shall be so arranged and maintained as to guard effectively the bottom portion of the saws.
- (b) Hoods shall be attached to each end of the tilting table and shall extend forward to cover the portion of the saws which cannot be enclosed by a stationary guard.
- (c) A limit stop shall be provided to prevent the table from coming too far back and thereby exposing the unguarded portion of the saws to contact.

6.2.3 Barrel Stave Saws (Cylindrical Saws)

- (a) Each machine of this type shall have the saw and the revolving part (head) to which the saw blade is bolted enclosed with a

hinged guard to prevent accidental contact, except for that part of the saw immediately adjacent to the carriage, which is the point of operation of the saw.

- (b) The exhaust hood shall be so arranged and maintained as to guard effectively the bottom portion of the saw. The hood shall be made of adequate strength to resist strains incidental to reasonable operation.

6.2.4 *Hand-Fed Rip Saws*

- (a) *Hoods.* Each circular hand-fed rip saw shall be guarded with a hood. The hood shall be stationary and cover the saw to a distance of approximately $\frac{3}{4}$ inch above the stave being ripped. This will prevent the material being cut from being raised by upward centrifugal force of the saw in cases of pinching or binding before the stave reaches the splitter. The hood shall provide inside clearance between the top edge of saw and guard to allow an accidental blow to strike it to the table and not engage the teeth with the guard. The hood shall be constructed of heavy material, preferably metal. That portion of the saw remaining below the table shall be completely enclosed in an exhaust hood. The enclosure should be constructed to permit easy access for changing saws. Where double rip saws are used, a protective screen should be erected on the table between the saws. The protective screen should be high enough to prevent dust and small wood particles from striking the operator.
- (b) *Spreaders.* For rules governing this equipment, see 4.1.2(b).

6.2.5 *Self-Feed Stave and Heading Equalizer Saws*

- (a) Self-feed equalizer saws shall be guarded with a hood guard which will cover the top and sides of the saws. The hood should adjust itself automatically to the thickness of, and remain in contact with, the material being cut.
- (b) The hood should be constructed of material sufficiently heavy to serve as a hold-down device while the stave is passing between the saws.
- (c) The portion of the saw blade extending beneath the mandrel shall be enclosed in an exhaust hood and be easily accessible for changing saws.

6.3 *Stave and Heading Planers (Single and Double Heads)*

- 6.3.1 *Guarding of Cutter Heads.* The exhaust hood, or other guards if no exhaust system is required, shall be so arranged and maintained

as to guard effectively all cutting heads and knives of single and double planers.

6.3.2 *Point of Operation*

- (a) Feed rolls, except for such portion as may be necessary to admit stock, shall be completely enclosed. Sectional feed rolls should be provided for heading planers. Effective kickback dogs should be provided for all heading planers, regardless of the type of feed rolls.
- (b) Pressure bars or hold-down arrangements shall be properly adjusted to assure correct pressure and clearance at all times.

6.4 *Stave Jointing Machine (Wheel)*

6.4.1 *Guarding*

- (a) Stave jointer wheels shall be covered on both sides with a removable metal hood connected to the exhaust system, except for that portion where the stock is applied to the knives.
- (b) A limit stop should be installed on the frame to prevent any part of the carriage from coming in contact with any moving part of the wheel.
- (c) The foregoing recommendations include double independent stave jointer wheels, double jointer stave wheels, single jointer stave wheels, and all kinds of keg stave jointer wheels.

6.5 *Heading Jointer and Doweler Machine (Wheel)*

6.5.1 *Guarding*

- (a) Each heading jointer shall be equipped with a removable guard covering the upper half of the wheel, except for that portion where the stock is applied to the knives.
- (b) The lower portion of the wheel shall be guarded with sheet metal or expanded metal to prevent accidental contact with the knives.
- (c) A guard should be placed over both dowel bit pulleys and belts.

6.6 *Heading Rounder*

- 6.6.1 *Guarding.* The cutter head shall be enclosed in a hood attached to the exhaust system, arranged and maintained in such a manner as to guard effectively the entire cutting mechanism, except for that portion of the cutting head where the stock is applied.

6.7 *Power Windlass Machine*

- 6.7.1 *Guarding.* Windlass machines having counterweights shall operate with the weights in a stationary casing. On all machines having a friction gear, the gear shall be properly guarded.

6.8 *Crozing Machine (Stationary Heads)*

6.8.1 *Guarding*

- (a) Feed chains and sprockets shall be completely enclosed.
- (b) The foregoing recommendations include all types of barrel, keg, bucket, tub, and individual stave crozers, chamfering, crozing, and howeling machines.

6.9 *Heading-up Machine*

- 6.9.1 *Guarding.* The outside portion and teeth of both drive gears for the racks shall be completely guarded. This includes all types of heading-up machines.

6.10 *Head Charring Machine*

- 6.10.1 *Guarding.* All tripping mechanisms shall be completely guarded.

6.11 *Bilge Truss Hoop Ring Removing Machine*

6.11.1 *Guarding*

- (a) Both eccentric cams and gear works on horizontal machines shall be guarded.
- (b) Combined fly wheel and gear shall be completely enclosed by a guard.
- (c) The foregoing recommendations include the horizontal and upright-type machines.

6.12 *Hoop Elevators and Conveyors*

- 6.12.1 *Guarding.* Lower sprockets and chains shall be guarded by complete enclosure to a height of at least 7 feet.

6.13 *Barrel Sanding Machine*

- 6.13.1 *Guarding.* Belt sanding machines shall be provided with guards at each nip point where the sanding belt runs onto a pulley. This guard may be a part of the exhaust system. The unused run of the sanding belt shall be enclosed.

6.14 *Hoop Drivers and Trussers*

6.14.1 *Guarding*

- (a) All friction pulleys shall be enclosed by a guard. A hinged gate should be provided for that portion of the guard covering adjustments to the friction blocks.
- (b) The foregoing recommendations cover drivers for keg hoops, tin barrel hoops, truss hoops, and both screw and rack and pinion-type drivers.

6.15 *Head Sanding Machine*

6.15.1 *Hand Sanders.* When the heads are sanded with portable electric hand sanders, they should be properly grounded. The barrel shall be placed under or adjacent to a hood connected to the exhaust system while being sanded.

6.15.2 *Machine Sanders.* The exhaust hood of automatic horizontal disk head sanders shall be so arranged as to enclose each disk, except for that portion necessary for the application of the barrel being finished.

6.16 *Hand Jointer*

6.16.1 *Guarding.* All hand-fed jointers shall be guarded in accordance with the provisions of 4.3.

6.17 *Hoop Punching and Coiling Machine*

6.17.1 *Guarding.* Miter gears, spur gears, drive pulley, and pulley for coiling attachment shall be guarded. This includes the horizontal hoop punching and coiling machine as well as the upright hoop punching machine.

6.18 *Hoop Riveting Machine*

6.18.1 *Guarding.* The balance and drive wheels shall be effectively guarded. This includes automatic, single, and double hoop riveters.

6.19 *Hoop Flaring and Expanding Machine*

6.19.1 *Guarding.* Gearing shall be completely enclosed.

SECTION 7 — OPERATING RULES

7.1 *Inspection and Maintenance*

7.1.1 *Inspection.* Emphasis is placed upon the importance of maintaining systematic inspection of all woodworking machines and safety equipment to insure the discovery of developing defects and permit their prompt correction.

7.1.2 *Maintenance*

- (a) Dull, badly set, improperly filed, or improperly tensioned saws shall be immediately removed from service, before they begin to cause the material to stick, jam, or kickback when it is fed to the saw at normal speed. Saws to which gum has adhered on the sides shall be immediately cleaned. (See Appendix A7.1.2.)
- (b) All knives and cutting heads of woodworking machines shall be kept sharp, properly adjusted, and firmly secured. Where two or more knives are used in one head, they shall be properly balanced.
- (c) Bearings shall be kept free from lost motion and shall be well lubricated.
- (d) Arbors of all circular saws shall be free from play.
- (e) Sharpening or tensioning of saw blades or cutters shall be done only by persons of demonstrated skill in this kind of work.
- (f) Emphasis is placed upon the importance of maintaining cleanliness around woodworking machinery, particularly as regards the effective functioning of guards and the prevention of fire hazards in switch enclosures, bearings, and motors.

7.2 *Selection and Operation of Machines*

7.2.1 *Selection of Suitable Machines and Tools*

- (a) Machines should not be used for operations of such variety as to necessitate the removal of safeguards suitable for the usual service. The specific operations involving special hazards should be assigned to machines suitable for such work. (See Appendix A7.2.1(a).)
- (b) No saw, cutter head, or tool collar shall be placed or mounted on a machine arbor unless the tool has been accurately machined to size and shape to fit the arbor.

7.2.2 *Circular Rip and Cut-off Saws*

- (a) All cracked saws shall be removed from service. (See Appendix A7.2.2.)
- (b) The practice of inserting wedges between the saw disk and the collar to form what is commonly known as a "wobble saw" shall not be permitted.
- (c) Push sticks or push blocks shall be provided at the work place in the several sizes and types suitable for the work to be done.

7.2.3 *Band Saws and Band Resaws*

- (a) Before starting a band-saw machine not equipped with a tension indicator, the blade should be tested with fingers and proper tension secured. Tension should be released from the blade when it is not in use. (See Appendix A7.2.3.)
- (b) The back thrust should be adjusted carefully to the normal position of the saw blade.
- (c) To secure satisfactory operation, means should be provided for preventing the accumulation of dust on the face of band wheels.
- (d) Using a small saw for large work or forcing a wide saw to cut on a small radius is bad practice. The saw blade should in all cases be as large as the nature of the work will permit.
- (e) Saws should not be stopped too quickly or by thrusting a piece of wood against the cutting edge of teeth when power is off.
- (f) Twists or kinks shall be promptly removed with a hammer.
- (g) To avoid vibration, brazed joints shall be the same thickness as the saw blade.
- (h) In order to detect cracks or other defects, each saw should be carefully examined as it is put on or taken off the band wheel. Cracked saws or saws which indicate probability of breakage should be promptly removed to avoid injury both to saw and to operator.

7.2.4 *Jointers.* The hazard of jointing too short pieces is excessive. Minimum length of the piece jointed should be not less than 4 times the width of the bed opening. Neither half of the jointer table should be adjusted horizontally so that the clearance between the edge of the table and the revolving knives is more than $\frac{1}{4}$ inch. The knife blade shall be so installed and adjusted that it does not protrude more than $\frac{1}{8}$ inch beyond the cylindrical body of the head. Push sticks or push blocks shall be provided at the work place in the several sizes and types suitable for the work to be done.

7.2.5. *Lathes*. Particular care should be taken to have all material fastened securely to faceplates or held properly between centers.

7.2.6 *Combs (Featherboards)*. Combs (featherboards) or suitable jigs shall be provided at the work place for use when a standard guard cannot be used, as in dadoing, grooving, jointing, moulding, and rabbeting.

7.3 *Veneer Machines and Equipment*

7.3.1 *Steam Vats*

- (a) Covers shall be removed only from that portion of steaming vats on which men are working, and a portable railing shall be placed at this point to protect the operators.
- (b) Workmen shall not ride or step on logs in steam vats.

7.3.2 *Log Handling*

- (a) All cranes, log trolleys, and other hoisting equipment used in veneer industry should be tested and inspected frequently.
- (b) When attaching dogs to log, care should be taken not to place hand or fingers where they might be caught between log and dog.

7.3.3 *Saws*

- (a) Particular attention should be given to inspection and maintenance of veneer saws.
- (b) Care should be taken to see that all material is securely fastened to the carriage.

7.3.4 *Veneer Cutters*

- (a) Whenever veneer slicers or rotary veneer-cutting machines have been shut down for the purpose of inserting logs or to make adjustments, operators shall make sure that machine is clear and other workmen are not in a hazardous position before starting the machine.
- (b) Operators shall not ride the carriage of a veneer slicer.

7.4 *Clothing and Goggles Worn by Operators*

7.4.1 *Clothing*

- (a) Gloves should not be worn while operating machines.
- (b) Loose flowing garments, sleeves, neckties, etc., offer a decided accident hazard and shall not be worn by operators of machines.
- (c) Where there is danger of kickback from any operation, anti-kickback aprons shall be provided and worn.

- 7.4.2 *Goggles.* Where danger from dust, flying chips, etc., exists, proper eye protection shall be provided and used.

7.5 *Selection and Training of Operator*

- (a) Before an inexperienced workman is permitted to operate any woodworking machine, he shall receive careful instructions in the hazards of the machine and the safe method of operation.
- (b) Minors under 18 years of age shall not be permitted to operate or assist in the operation of power-driven woodworking machines.

APPENDIX

This appendix is not a part of Safety Regulation No. 6. It includes a discussion of the rules and recommendations, ways and means of putting the rules into effect, and illustrations of a few typical saw guards. The numbers in this appendix refer to the pertinent sections in the Regulation.

- A1.4.4 Push blocks should be at least $\frac{3}{8}$ inch thick if made of hardwood or $\frac{3}{4}$ inch thick if made of softwood. Wherever space permits, the block should be at least 10 inches by 6 inches so as to give protection to the hand pushing down on the work.

- A2.1.1 (a) In order to give each operator sufficient space in which to handle the material with the least possible interference from or to other workmen or machines it is suggested that the following conditions be maintained:

- (1) *Rip and Crosscut Bench or Table Saws.* The minimum distance or clearance on each working side of the saw table should be equal to 3 feet more than the longest material handled.

In a production shop which uses jigs and fixtures, definite space either at the saw or in a storeroom should be provided for storing these fixtures.

It is also important in the location of a rip saw to be sure that no other employee is regularly working in line with the saw where he might be hit by material in case of a kickback. If it is necessary to locate a machine in such a position, a heavy metal or plank barricade should be erected to protect the workman.

- (2) *Band Saws.* The minimum distance or clearance on 3 sides of the table should be equal to a circle with the point of operation of the saw blade as a center and a radius equal to twice the diameter of the band wheels.

- (3) *Jointers*. The minimum distance or clearance should be at least 3 feet greater than the length of the longest material worked on the machine.
- (4) *Shapers*. The minimum distance or clearance should be at least 3 feet greater than the longest dimension of the material worked on the machine. It is vitally important to both safety and production to protect shaper operators from interference. To this end, shaper machines should be so set that the operator faces the aisle and is protected at the back by a partition or railing.

A2.1.1 (b) By locating heavy-duty machinery on the ground floor, most of the vibration due to high operating speed can be eliminated. Undue vibration and noise caused by high-speed machinery may be eliminated to a large extent by cushioning the machine foundation. This can be done by inserting rubber, felt, cork, or other elastic material between machine base and the floor beams or girders to which the machine is fastened. It must be borne in mind, however, that the bolts that hold the machine to the foundation must not pass through or touch the girders or floor beams of the building. The cushioning material must be fastened to the floor beams or girders by bolts that are independent of the machine base.

A2.1.1 (c) *Lighting*. Proper lighting is of vital importance. It is a widespread belief among men experienced in accident-prevention work that improper lighting is a factor in perhaps 25 percent of all avoidable accidents in the country. Too much light is often as bad as insufficient illumination.

It is also important that proper attention be given to the maintenance of all lighting equipment, i.e., cleaning and adjustment of reflectors. Dust accumulated on the lamp bulbs quickly cuts down the intensity of the light. Makeshift reflectors or those whose adjustment has been impaired have a tendency to spoil the efficiency of any carefully worked out lighting system. Recent investigations indicate that the color of ceilings, walls, floors, and equipment has a definite bearing on the absorption of light and the amount of energy required for the seeing task. In general, it is suggested that preference be given to colors which absorb less light and that important or dangerous parts of equipment be in a contrasting color in order that they will be seen easily.

A2.2.2 Suggestions for treatment of smooth slippery floors about woodworking machines:

- (a) Paint the floor with glue or paint and throw on sharp sand or abrasive grains and, after the glue or paint has set, remove material which does not adhere.
- (b) Some manufacturers now make a paint which includes an abrasive, making it non-slip.
- (c) If a non-slip platform, mat, or other non-slip material is placed about the machine, the edges should be beveled to not more than $\frac{1}{8}$ inch high at the point or edge of the bevel, or the floor should be recessed so that the material will be flush with the floor. Excellent maintenance to avoid tripping hazards is essential.
- (d) Wood chips and sawdust, particularly on top of a wooden floor, may in themselves cause a slipping or a tripping hazard. The continued rubbing or sliding of chips and sawdust over a wooden floor may also cause the floor itself to become very smooth and slippery. It is therefore important that provisions should be made for collecting chips or sawdust so that they will not get on the floor, or the floors should be thoroughly cleaned at frequent periods.

A3.1 In order to attain the safest and most efficient operation, the proper type of saw blade should be used for plastics, plywoods, and synthetic boards.

A3.1.1 (a) For maximum efficiency, it is recommended that the height of the table or point of operation above the floor for various machines be approximately as follows for operators of average stature:

Circular Saws (hand fed)	36 inches
Circular Saws (power fed)	32 inches
Band Saws	42 inches
Shapers	36 inches
Jointers	36 inches

Whenever machines are used by persons of less-than-average stature, suitable adjustments should be made in the above distances.

A3.1.2 *Motor Drive.* The initial expense of individual motor drive is frequently higher than that of other power-transmission equipment such as line shafting, etc., but it has a great many advantages. It offers a better control of the individual machine. It also eliminates overhead shafting and belting, thereby improving lighting and the general appearance of the shop. Then, too, it eliminates injuries due to oiling and maintenance of overhead transmission equipment.

A3.1.3 Where there is electrical control, it is recommended that hand-fed circular saws, band saws, and machines of like operation be provided with an emergency foot switch which will make it possible for the operator to cut off the power without removing his hands from the work.

A3.1.5 The following table shows revolutions per minute for various diameters of saws when the peripheral speed is 10,000 feet per minute.

Diameter of Saw (Inches)	Rpm
8	4774
10	3819
12	3183
14	2728
16	2387
18	2122
20	1910
22	1736
24	1592
26	1469
28	1364
30	1273

A4.1.2 (a) *Circular-Saw Hoods and Mountings*

(1) *Hood Construction*

- a. Hoods may be made of aluminum or magnesium alloy.
- b. If made of plywood, they should be of substantial construction.
- c. Hoods should have thin liner piece of wood at bottom of cast-metal hood to protect the saw teeth.

(2) *Hood Mounting.* Saws are used for so many operations that it is doubtful if any one type of mounting will fit all possible conditions. For efficiency and serviceability of the guard, mountings are recommended in the following order:

- a. Hood mounted on spreader attached to throat piece (throat piece should be locked in position).
- b. Other spreaders attached to frame, carriage, or table.
- c. Arm mounting attached to table or frame.
- d. Ceiling, side-suspension, or floor-stand mountings should be used only when other types of mounting are impractical.

(3) *Discussion of Mountings*

- a. If the hood is mounted on spreader, it can be used even if material being cut extends beyond the sides of the saw table, but this mounting is not practical for grooving, dadoing, or rabbeting operations.

- b. If the hood is mounted on an arm attached to the side of the table, it can be used on most grooving, dadoing, and rabbeting operations, but this arm will restrict the size of work that can be cut on that side of the table.
- c. The design and quality of material used will also affect the amount of supervision needed to be sure that the guards are properly used. Attachments should be such that it is easy to attach the mounting the right way or in the right position, but, at the same time, difficult or impossible to attach it the wrong way or out of line with the saw. Counterweights are used to make it easier for the workman to lift the hood, then extra supervision may be required to see that the counterweight is not altered or adjusted to keep the hood in a raised position at all times.
- d. It will be an added advantage in some operations if the hood and mounting can be so designed that the hood will prevent the material being cut from being raised off the table by the centrifugal upward force of the saw in case of pinching or binding before material reaches the spreader.
- e. For tilting-arbor or tilting-table saws, the hood should be mounted on the saw frame or carriage so that the hood will remain in line with the saw when the saw or table is tilted at an angle.
- f. For multiple saws such as equalizer saws, hoods should be mounted so that they will be adjusted to true alignment with the saw whenever the location of the saw is changed. When these machines are provided with individual motors for each saw, the hood should be mounted to the same frame as the motor so that it will automatically move with each new location of the saw.

A4.1.2 (b) *Circular-Saw Spreaders.* Each spreader should be so shaped on the side toward the saw that it will follow the curve of the saw approximately and should be not less than $3\frac{1}{2}$ inches wide at the level of the table. In some special cases this width cannot be obtained, but it should be not less than 2 inches.

The value of a spreader depends on its location directly behind the saw. If a saw machine is regularly used with a saw blade smaller than the maximum size permissible on the machine, serious consideration should be given to the possibility of locating the spreader within $\frac{1}{2}$ inch of the clearance of the saw blade regularly used on the machine, even

though this would require moving the spreader if the machine were to be used for the maximum size saw.

The design of the spreader mounting should provide for ease in attaching the spreader in the correct location and should make it difficult or impossible to mount the spreader in an incorrect or dangerous position.

For operations which do not permit the use of a spreader, serious consideration should be given to the use of jigs or fixtures to hold the work so that the hands of the operator are removed at least 12 inches from the point of operation. A spreader mounted on the saw arbor frame, and no higher than the saw teeth, may be used to good advantage in certain operations, such as grooving.

A4.1.2 (c) *Circular-Saw Kickbacks.* Kickbacks on rip saws are usually caused by one of the following:

- (1) Failure to provide spreader
- (2) Improperly conditioned saw, allowing material to pinch on saw and rise from the table
- (3) Improper alignment of gage or fence
- (4) Improperly conditioned or twisted grain lumber
- (5) Improper design or mounting of kickback dogs

Some dogs are so designed as to be very effective for one thickness of material but have very little holding power when used on either much thicker or much thinner material. Other dogs have very good holding power but are so located that they do not come in contact with the material when it is in position to be thrown upward by the saw. For a circular saw, where the arbor is above the table, the rotation of the saw is reversed, and it would therefore be necessary to locate the kickback fingers in front or ahead of the saw to oppose the upward thrust of the saw.

A4.1.3 (a) *Fillister Piece.* In order to use the hood guard effectively on circular rip saws when cutting narrow strips, a fillister piece should be used. This should be made of wood about 2 inches wide. It should be about $\frac{3}{4}$ inch thick or slightly thinner than the thickness of the material being cut. It should be provided with cleats or brackets at the ends, so that it will either fit down over the front and back ends of the table or can be quickly attached to the fence or gage.

(b) Special consideration should be given to the use of jigs or fixtures when cutting irregular pieces or oblique angles. A special application of this principle is the jig for cutting wedges and pointing stakes.

A4.1.9 *Blade Coasting After Power Shutoff.* A large percentage of radial saw accidents is caused by rotation of the saw blade after the power has been shut off. (Coasting time up to five minutes is not uncommon.) The practice of stopping this rotation by placing a piece of wood against the rotating blade can cause injury to the operator and can cause the blade to crack, warp, or lose temper. It is recommended that a braking device to stop coasting, or a warning signal to indicate that the blade is still in motion, be provided.

A4.6.1 *Shapers*

(a) Knife blades and collars for shaper heads should be precision ground so as to give uniform pressure on all knife blades and keep them from flying out while the machine is in motion.

(b) It is recommended that collars be provided with "stop-pins" and that knife blades have a recess cut in them for the pin. This is an added precaution to keep the blades from flying out.

(c) Attention is called to the desirability of incorporating an automatic brake in the design of shapers, jointers, and similar machines in order to stop the revolving heads as soon as possible after the power is shut off.

A7.1.2 *Maintenance.* A large proportion of circular and band-saw accidents is caused by dull, badly set, improperly filed, and improperly tensioned saws, and by gum adhering to saws. Such conditions cause the material to stick, jam, stall the saw, or kickback at the operator. It is strongly recommended that users obtain and follow instructions from the saw manufacturers for proper maintenance of all saws. Band-saw wheels should be kept clean and free from accumulations of sap, gum, or resins.

A7.2.1 (a) *Selection of Suitable Machines.* Under 7.2.1 of this code the statement is made that machines should not be used for operations of such variety as to necessitate the removal of safeguards suitable for the usual service. It is well to plan or route the work in such a way as to avoid too frequent adjustment of machines and altering of position of guards. The proper regard for this rule will increase production by reducing the time lost because of making adjustments and will also reduce accidents by insuring continued use of safeguards suitable to the work.

A7.2.2 (a) *Cracked Circular Saws.* Saws should be inspected for cracks each time that the teeth are filed or set. Most cracks will start in the gullets of the saw teeth. If cracked saws are continued in service, the crack

frequently grows larger and may eventually cause fragments of the saw to fly apart. If the saw is removed from service as soon as a crack is visible to the naked eye, the blade can usually be repaired either by welding the crack or by slotting the saw to remove the material on both sides of the crack and then making other slots to balance the blade. In either case, the saw should be retensioned after the repairs are made. Unless a skilled sawsmith is employed, saws should be returned to the manufacturer for welding, slotting, or tensioning.

To prevent cracking:

- (1) The saw should be tensioned for the speed at which it is to operate. If not, the saw will wobble and vibrate causing it to heat, expand, and crack.
- (2) The teeth must have sufficient clearance (set or hollow grinding) to prevent burning. If the saw gets hot and expands, then cracking results.
- (3) The saw should be in perfect round. In other words, the rim should be concentric with the eye.
- (4) The saw must be in perfect balance or cracking will result.
- (5) Saws must be kept sharp at all times; otherwise, if the saw is not cutting, it will pound itself through the wood and thus cause heat and vibration, expansion, and then cracking.

A7.2.3 *Band Saws.* Because of the increased breakage of cold saw blades, band saws should be operated at a temperature of not less than 45F.°