

# **MACHINERY**

## **AFOSH STANDARD 91-501, Chapter 18**

### **Tilting-Arbor and Tilting-Table Saws:**

1. Is the table saw equipped with a hood that covers the blade and automatically adjusts itself to the thickness of the material upon which it rides? (Reference **18.4.2.1.**)
2. Does the hood cover the part of the saw blade exposed above the material? (Reference **18.4.2.1.1.**)
3. Is the hood adaptable to cover tilted blades? (Reference **18.4.2.1.1.**)
4. Is a spreader provided at the table saw to prevent the wood's internal stresses from clamping down on the saw blade? (Reference **18.4.2.1.2.**)
5. Are table throat openings kept as small as possible to prevent material from dropping below the level of the table? (Reference **18.4.2.1.3.**)
6. Are several size throat pieces available to accommodate rabbiting, grooving, and dadoing operations? (Reference **18.4.2.1.3.**)
7. Are anti-kickback dogs/fingers or safety hold-down wheels installed when material is being ripped? (Reference **18.4.2.1.4.**)
8. Are anti-kickback dogs/fingers inspected before each use? (Reference **18.4.2.1.4.**)
9. Are anti-kickback dogs/fingers kept sharp to maintain their holding power? (Reference **18.4.2.1.4.**)
10. Is a helper positioned at the output end of the saw whenever it appears it might be necessary to reach over a revolving saw blade? (Reference **18.4.2.1.5.**)
11. Are saw blades allowed to come to a stop on their own rather than by thrusting a piece of wood against the cutting edge or side of the blade? (Reference **18.4.2.1.6.**)
12. Do saw tables extend far enough on either side of a machine to give full support to a length of board that may be cut? (Reference **18.4.2.1.7.**)
13. Is the blade or cutting head inspected for proper cutting conditions (i.e., teeth sharp and properly set, no cracks, free of foreign residue) before a job is started? (Reference **18.4.2.1.8.**)
14. Is the correct blade matched to the work being done? (Reference **18.4.2.1.9.**)

15. Are the following precautions taken?
  - a. A crosscut blade is never used for rip sawing? (Reference **18.4.2.1.9.**)
  - b. A ripping blade is never used for crosscutting? (Reference **18.4.2.1.9.1.**)
  - c. Do Services hobby shop supervisors label each saw with a sign or decal that states which type blade is installed and what it is to be used for? (Reference **18.4.2.1.9.1.**)
  - d. Are special blades used for materials in which there may be nails or other metal (example: plywood or lumber)? (Reference **18.4.2.1.9.2.**)
  - e. Is a carbide- tipped, controlled-cut blade used when warped, twisted- grain, knotty, or frozen lumber is ripped? (Reference **18.4.2.1.9.2.**)
16. Do operators take care that they do not crowd (force material faster than it can be cut) the saw? (Reference **18.4.2.1.10.**)
17. If the saw does not cut a clean, straight line, is the saw or running speed checked and conditions remedied? (Reference **18.4.2.1.10.**)
18. Do operators only adjust the rip fence after the saw has been turned off and the blade rotation has stopped? (Reference **18.4.2.1.11.**)
19. Is a permanent line marked on the table in front of and in line with the saw blade to enable the operator to set the rip fence without lifting the saw guard? (Reference **18.4.2.1.11.**)
20. Are hands kept out of the line of cut when feeding saws? (Reference **18.4.2.1.12.**)
21. Is material moved forward with push stick when there's not enough room for hand movement the rip fence and saw blades? (Reference **18.4.2.1.12.**)
22. Is the hood left in place when narrow material is ripped? (Reference **18.4.2.1.13.**)
23. Are saw blades only set high enough to cut through the material being worked? (Reference **18.4.2.1.14.**)
24. Is one of the following practices used to ensure the above:
  - a. No more than three teeth protrude above the material being cut, or (Reference **18.4.2.1.14.**)

b. No more than one-eighth of an inch of saw blade protrudes above the material being cut. (Reference **18.4.2.1.14.**)

25. Are feather boards used as side guides and top hold downs on operations (rabbeting, grooving, and dadoing) when a blade hood cannot be used? (Reference **18.4.2.1.15.**)

### **Radial Arm Saws:**

1. Are radial saws equipped with a hood, which encloses a saw blade, and the arbor ends? (Reference **18.4.2.2.1.**)

2. Is the lower section of the hood hinged so it rises and falls, adjusting itself automatically to the thickness of the material as the saw passes through it? (Reference **18.4.2.2.1.**)

3. Is an anti-kickback device or hold-down wheels installed on saws used for ripping? (Reference **18.4.2.2.2.**)

4. Does the device adapt to any thickness of stock to be cut? (Reference **18.4.2.2.2.**)

5. Are manually operated radial saws installed so the front end of the table is slightly higher than the rear so the cutting head does not move forward when the motor is turned on. (Reference **18.4.2.2.3.**)

6. Prior to starting the saw does the operator pull the saw cutting head all the way forward and, with the operator's hand on the pull grip and exerting little or no force, follow the head back to the original non-cutting position? (Reference **18.4.2.2.4.**)

7. Is the unit turned off and the rollers checked for wear if the saw has a tendency to drag, is jerky, or requires excessive force? (Reference **18.4.2.2.4.**)

8. Does the operator turn the saw on and check to see that the cutting head does not move forward? (Reference **18.4.2.2.5.**)

9. Is the unit taken out of service and the malfunction corrected any time sluggish or hesitant movement of the saw is detected? (Reference **18.4.2.2.6.**)

10. Do operators take the unit out of service if at any time the saw rolls or moves as a result of vibration? (Reference **18.4.2.2.7.**)

11. Does the saw have a positive limit-stop to prevent the saw from traveling beyond the front edge of the table? (Reference **18.4.2.2.8.**)

12. Is material measured by placing the material to be cut against a stop gauge (when ever repeat cuts are necessary)? (Reference **18.4.2.2.10.**)

13. If it is necessary to measure with a ruler, is the material kept well away from the saw until measuring is completed? (Reference **18.4.2.2.10.**)

14. Is the saw head rotated 90 degrees right or left and clamped in position when ripping with a radial saw is necessary? (Reference **18.4.2.2.11.**)

15. Is the material fed against the revolving blade from the side where the blade rotates upward toward the operator? (Reference **18.4.2.2.11.**)

16. Do the teeth of the saw extend slightly through the material being cut? (Reference **18.4.2.2.11.**)

17. Is the direction of the saw rotation conspicuously marked on the hood? (Reference **18.4.2.2.11.B**)

18. Is a permanent decal or sign not less than 1 inch by three-fourths of an inch, reading "**CAUTION: NEVER RIP FROM THIS END**" (or the nearest commercially available equivalent) affixed to the rear of the guard at approximately the level of the arbor? (Reference **18.4.2.2.11.**)

19. Is the saw allowed to return to its stopped position before the stock is removed from the table? (Reference **18.4.2.2.12.**)

20. Is the locking device on the saw head securely fastened when angle or miter cuts are being made? (Reference **18.4.2.2.13.**)

21. Does the stock lie solidly on the table when crosscutting? (Reference **18.4.2.2.14.**)

22. Does the operator ensure that the blade being used is the proper one for the work being performed? (Reference **18.4.2.2.15.**)

23. When removing short pieces from a table close to a saw blade, does the operator ease the saw back to the idling position and make sure that all bouncing has stopped before putting his/her hand(s) down to the table? (Reference **18.4.2.2.16.**)

24. Is cylindrical stock securely clamped before being cut on a radial saw? (Reference **18.4.2.2.16.**)

### **Band Saws:**

1. Are both upper and lower wheels completely enclosed on both sides of band saws? (Reference **18.4.2.3.1.**)

2. Are these enclosures capable of being easily removed to permit saw blade maintenance? (Reference **18.4.2.3.1.**)
3. Is the working part of a saw blade (between the guide rolls and upper wheel enclosure) guarded to prevent accidental contact with the saw blade? (Reference **18.4.2.3.2.**)
4. Is the guard self-adjusting and attached to the gauge so that (in any position of the gauge) the guard will completely cover the portion of the saw blade between the guide rolls and the upper wheel enclosure? (Reference **18.4.2.3.2.**)
5. Is the saw equipped with an automatic tension control? (Reference **18.4.2.3.3.**)
6. Does the feed roll on a self-fed band saw have a guard to prevent the operator's hands from coming into contact with the in-running rolls at any point? (Reference **18.4.2.3.4.**)
7. Is the saw always operated within the safe limit recommended by the manufacturer? (Reference **18.4.2.3.5.**)
8. If material binds or pinches on the blade, is the machine turned off and blade motion allowed to stop before the operator attempts to back the work away from the blade? (Reference **18.4.2.3.6.**)
9. If a saw blade breaks, does the operator shut off the power, lock the start switch in the off position and not attempt to remove any part of the saw blade until the machine has completely stopped? (Reference **18.4.2.3.7.**)

### **Jointers:**

1. Is each hand fed planer and jointer (with a horizontal or vertical head) equipped with a cylindrical cutting head? (Reference **18.4.2.4.1.**)
2. Does the knife on these machines project only one-eighth of an inch beyond the cylindrical body of the head? (Reference **18.4.2.4.1.**)
3. Is the opening in the table kept as small as possible? (Reference **18.4.2.4.2.**)
4. Is the clearance between the edge of the rear table and the cutting head circle or knives no more than one-eighth of an inch? (Reference **18.4.2.4.2.**)
5. Is the table throat opening no more than 2 inches when tables are set or aligned with each other for a zero cut? (Reference **18.4.2.4.2.**)
6. Are jointers with front-table-mounted fences equipped with an adjustable device to prevent thin stock from slipping laterally under the portion of the fence at the rear of the table? (Reference **18.4.2.4.3.**)

7. Is an automatic guard provided to cover the section of the cutter head near the operator (on the working side of the fence) and to contact the wood to prevent any opening from remaining between the guard and wood during the operation? (Reference **18.4.2.4.4.**)
8. Does the guard cover the section of the cutter head on the non-working side of the fence? (Reference **18.4.2.4.4.**)
9. Does the guard over the section of the cutting head on the rear side of the fence consist of a sliding metal shield, which automatically adjusts to the exposed length of the cutter head? (Reference **18.4.2.4.4.**)
10. When power feeders are used, is the feeding mechanism guarded by a metal shield or hood? (Reference **18.4.2.4.6.**)
11. Do operators use hold down push blocks, jigs, or fixture? (Reference **18.4.2.4.7.**)

### **Power Feed Planers:**

1. Are guards provided for feed rolls, cutting heads and hold down rolls at the discharge end of power feed planers? (Reference **18.4.2.5.1.**)
2. Are feed rolls guarded by a metal strip in front of the rolls under which material may pass, but will prevent an operator's fingers from being drawn into the machine? (Reference **18.4.2.5.1.**)
3. If the top roll is corrugated does the strip extend over the top of the roll? (Reference **18.4.2.5.1.**)
4. Are cutting heads and discharge roll guarded by a solid metal enclosure of substantial construction? (Reference **18.4.2.5.1.**)
5. When other than corrugated top feeders are used, is an anti-kickback device installed? (Reference **18.4.2.5.2.**)
6. Does the operator examine each planner before using it to ensure that knives are not set to take too heavy a cut for one pass? (Reference **18.4.2.5.3.**)
7. Do helpers position themselves where they won't be pinned between the material and an immovable object? (Reference **18.4.2.5.4.**)

8. Do operators take precautions to keep fingers from being pinched between the tabletop and the material if the infeed rolls trip quickly up and down the material? (Reference **18.4.2.5.5.**)

### **Shapers:**

1. Are shapers equipped with a braking device that will bring the cutting head to a stop within 10 seconds after power is shut off? (Reference **18.4.2.6.1.**)

2. Is a double spindle machine equipped with separate braking device? (Reference **18.4.2.6.1.**)

3. Does the fence have as small an opening for knives as possible? (Reference **18.4.2.6.2.**)

4. Does the fence extend at least 18 inches on either side of the spindle? (Reference **18.4.2.6.2.**)

5. Are cutting heads enclosed by a guard? Is this guard less than the greatest diameter of the cutter? (Reference **18.4.2.6.3.**)

6. Are hold-downs and jigs used to limit exposure of hands to cutters, whenever possible? (Reference **18.4.2.6.4.**)

7. When a blade is removed from a spindle, are all other blades removed at the same time? (Reference **18.4.2.6.5.**)

### **Lathes:**

1. Is a hinged metal shield or hood (that completely covers the knives and material when the machine is in operation) provided on rotating, cutter-type lathes? (Reference **18.4.2.7.1.**)

2. Is a brake (that will bring the rotating material to a quick, but not instantaneous stop after the power is shut off) installed on automatic lathes? (Reference **18.4.2.7.2.**)

3. Are automatic lathes placed with the backside against a wall or barrier, which will contain knives if they are thrown backwards? (Reference **18.4.2.7.3.**)

4. Are tool rests set parallel and as close as possible to the work and high enough so the tools butt into the wood slightly above the horizontal center of the piece being turned? (Reference **18.4.2.7.4.**)

5. Is a control stop provided on faceplate type lathes? (Reference **18.4.2.7.5.**)
6. Are guards that will contain the work piece if it separates from its anchorage installed on lathes used for turning long pieces of material? (Reference **18.4.2.7.6.**)
7. Do operators stand to the side when working with hand-turning tools? (Reference **18.4.2.7.7.**)
8. Is sandpaper held in the fingers and pressed lightly against a small area at the top of the rotating material? (Reference **18.4.2.7.8.**)
9. Is only good quality wood used for wood turning? (Reference **18.4.2.7.9.**)

### **Sanding Machines:**

1. Is a guard installed on the feed rolls of self-feed sanding machines? (Reference **18.4.2.8.1.**)
2. Are guards installed at each nip point on a belt-sanding machine? Is the unused run of the sanding belt guarded? (Reference **18.4.2.8.2.**)

### **Boring and Mortising Machines:**

1. Are set screws on safety-bit chucks non-projecting? (Reference **18.4.2.9.1.**)
2. Is a guard, enclosing all portions of the bit and chucks above the material being worked, installed on boring bits? (Reference **18.4.2.9.2.**)
3. Is the top of the driving mechanism enclosed? (Reference **18.4.2.9.3.**)
4. If there is a counterweight, is one of the following (or equivalent) methods used to prevent its dropping? (Reference **18.4.2.9.4.**)
  - a. Bolted to the bar by a bolt passing through both the bar and counter-weight;
  - b. A bolt put through the extreme end of the bar;
  - c. A safety chain attached if the counterweight does not encircle the bar.
  - d. Are other types of counterweights suspended by chain or wire rope and travel in a pipe other suitable enclosure whenever they might fall and cause injury or damage? (Reference **18.4.2.9.4.4.**)

5. Are universal joints on spindles of boring machines completely enclosed?  
(Reference **18.4.2.9.4.5.**)

6. Are "hold down" devices installed on table-type boring or mortising machines?  
(Reference **18.4.2.9.4.6.**)

### **Tenoning Machines:**

1. Are feed chains and sprockets of double end tenoning machines completely enclosed (except for the portion of cabin used for conveying the stock)?  
(Reference **18.4.2.10.**)

2. Are sprockets and chains guarded at the sides by plates projecting beyond the periphery of sprockets and the ends of lugs at the rear ends of frames over which feed conveyors run? (Reference **18.4.2.10.2.**)

3. Are cutting heads and saws (if used) on tenoning machines covered by metal guards? Do these guards cover at least the unused part of the periphery of the cutting head?

(Reference **18.4.2.10.3.**)

4. If an exhaust system is used, does the guard form part or the entire exhaust hood?  
(Reference **18.4.2.10.3.**)

### **Electrical Requirements and Safeguards:**

1. Is the motor "START" switch protected against accidental/inadvertent operation?  
(Reference **18.4.2.11.1.**)

2. Is machinery installed in accordance with the National Electrical Code (NEC)?  
(Reference **18.4.2.11.2.**)

3. Are control switches available to workers at their operating positions so they do not need to reach over moving parts of machinery? (Reference **18.4.2.11.3.**)

4. Is the stop control switch identified by a printed word or color-coded ref?  
(Reference **18.4.2.11.3.**)

5. Do operators know the controls are not to be wedged for continuous operation?  
(Reference **18.4.2.11.3.**)

6. Are under voltage protective devices installed on machines that are not adequately safeguarded to protect the worker during under voltage situations? (Reference **18.4.2.11.4.**)

7. Have base/installation safety offices and shop supervisors identified those machines that require under voltage protection? (Reference **18.4.2.11.4.**)
8. Are foot treadle controls protected against unexpected or accidental tripping? Do these controls have a no slip surface? (Reference **18.4.2.11.5.**)
9. Are exposed non-current carrying metal components (that may become energized) grounded? (Reference **18.4.2.11.6.**)
10. Are all machine energy sources or energy isolating devices, such as disconnect switches or circuit breakers, locked out or tagged out before maintenance is performed or major adjustments are made with guards and panels removed? Is a machine or equipment with a simple wall plug as the power source unplugged? (Reference **18.4.2.11.7.**)
11. Is an AF Form 982, *Do Not Start* tag used temporarily until lockout is accomplished -- or in conjunction with the lockout? (Reference **18.4.2.11.7. & Chapter 21**)

### **Safeguarding by Location or Distance:**

1. Is the machine or its dangerous moving parts positioned so hazardous areas are not accessible or do not present a hazard to a worker during the normal operation of the machine? (Reference **18.4.2.12.**)
2. Before attempting the use of any safeguarding techniques, is a thorough hazard analysis made of each machine and particular situation? (Reference **18.4.2.12.1.**)
3. Does the supervisor and installation safety office perform this analysis and publish the results? (Reference **18.4.2.12.1.**)
4. Does the analysis clearly identify that workers are protected from dangerous moving parts and is one of the following restrictions used? (Reference **18.4.2.12.1**)
  - a. Unguarded moving parts of machines are a minimum distance of 8 feet above the work level (floor, platform, or passageway), or (Reference **18.4.2.12.2.**)
  - b. Machines are in an enclosed area with a locked entrance and the enclosure (wall or fence) is a least 8 feet high. Is the main source of power disconnected and locked in the "OFF" position when maintenance, service, or machine adjustments are made? (Reference **18.4.2.13.**)

### **Safeguarding Devices:**

1. If a safeguarding device is used to replace a guard, does it perform one or more of the following functions? (Reference **18.4.2.13.1.**)

- a. Stop the machine if a body part is inadvertently placed in the danger area?  
(Reference **18.4.2.13.1.1.**)
  - b. Restrain or withdraw the operator's hands from the danger area during operation?  
(Reference **18.4.2.13.1.2.**)
  - c. Require the operator to use both hands on machine controls? (Reference **18.4.2.13.1.3.**)
  - d. Provide a barrier, which is synchronized with the operating cycle of the machine?  
(Reference **18.4.2.13.1.4.**)
2. Are safeguarding devices installed, adjusted, and used according to manufacturer's operating and maintenance instruction? (Reference **18.4.2.13.2.**)

### **Safeguarding by Barrier or Enclosure:**

1. Are hazardous parts, which are not protected by the device, guarded according to **18.4.2.14**?
2. Does the guard by design, construction, application, and adjustment:
  - a. Prevent hands or fingers or other body parts from entering into the hazardous areas by reaching through, over, under, or around the guard? (Reference **18.4.2.14.1.1.**)
  - b. Not create a pinch point between the guard and moving machine parts?  
(Reference **18.4.2.14.1.2.**)
  - c. Be not easily removed by the worker? (Reference **18.4.2.14.1.3.**)
  - d. Offer maximum visibility of the point of operation consistent with operational / maintenance requirement? (Reference **18.4.2.14.1.4.**)
3. Is the guard securely affixed to the machine? (Reference **18.4.2.14.1.5.**)
4. When a point of operation guard cannot be used because of unusual shapes or cuts, are jigs or fixtures used? (Reference **18.4.2.14.2.**)
5. Whenever a guard is removed for other than an operational requirement, is the machine shut down and the control switch(s) locked and tagged in the "OFF" position?  
(Reference **18.4.2.14.3.**)

6. Are enclosure and barrier guards interlocked with the machine control (whenever possible) so the machine cannot be activated unless the guard itself or the hinged or movable sections of the guard are in position? (Reference **18.4.2.14.4.**)
7. Does the guard prevent the operator from opening the interlocked section and reaching into the point of operation? (Reference **18.4.2.14.4.1.**)
8. Do guards, which are interlocked with the machine cycle, stop the related component, interrupt the machine cycle, or shut down the machine? (Reference **18.4.2.14.4.3.**)
9. When the periphery of the blades of a fan are less than 7 feet above the floor or working level, are the blades guarded? (Reference **18.4.2.14.5.**)
10. Does the fan guard have openings no larger than one-half of an inch in width and depth? (Reference **18.4.2.14.5.**)
11. Is the mesh able to withstand being pushed into the fan blade during normal use? (Reference **18.4.2.14.5.**)
12. Is the guard designed and installed so no part of the body can be inadvertently placed in, on, under, or over the edges of the guard where it might contact a moving part? (Reference **18.4.2.14.6.1.**)
13. Are guards made of expanded metal; perforated or solid sheet metal; or wire mesh, plastic, or other material of equal or greater strength? (Reference **18.4.2.14.6.2.**)
14. Are guards fastened to the framework of the machinery? (Reference **18.4.2.14.6.2.**)
15. Does the base civil engineer, base ground safety officer, or the base BEE determine the best material for guard construction (if required) in environments where chemicals/corrosive operations are performed? (Reference **18.4.2.14.6.2.**)
16. Is the enclosure guard and its supports designed and installed so an adult person leaning on, or falling against, the enclosure will not receive an injury from the moving part? (Reference **18.4.2.14.6.3.**)
17. Is the enclosure capable of containing the broken parts (if there is a reasonable possibility of the moving part failing and causing injury)? (Reference **18.4.2.14.6.3.**)
18. When parts failure is considered a hazard, is the guard filler material a solid metallic sheet, plate stock, or casting? (Reference **18.4.2.14.6.4.**)
19. If sheet or molded plastics or other metals are used, have they been impact-tested to resist penetration of a specific failing part? (Reference **18.4.2.14.6.4.**)

20. Do openings to permit lubrication, adjustment or inspection have hinged, sliding, or bolted cover plates and are they closed prior to starting the machine? (Reference **18.4.2.14.6.5.**)
21. Are horizontal belts and ropes above floors or platforms guarded for their entire length if located over passageways or workplaces, if center-to-center distance between pulleys is 10 feet or more, or if the belt is 8 inches or more in width? (Reference **18.4.2.14.6.6.**)
22. Are vertical belts running over a lower pulley above the floor or platform guarded at the bottom in the same manner as overhead belts? (Reference **18.4.2.14.6.7.**)
23. Where loose pulleys or idlers are not practical, are belt perches (brackets, rollers, etc) used to keep idler belts away from the shafts? Are these perches of strong materials and designed for the safe shifting of belts? (Reference **18.4.2.14.6.8.**)
24. When the belt or rope is in motion is belt dressing applied (only when necessary) where belts leave the pulleys, not where they approach them? (Reference **18.4.2.14.6.9.**)
25. Is a guard provided to prevent the belt from leaving the pulley on the side where insufficient clearance exists, unless the distance to the nearest fixed pulley, clutch, or hanger exceeds the width of the belt used? (Reference **18.4.2.14.6.10.**)
26. Where there are overhanging pulleys on line, jack or counter shaft, with no bearing between the pulley and the outer end of the shaft, is a guard installed to prevent the belt from running off the pulley? (Reference **18.4.2.14.6.10.**)
27. Are pulleys with cracks or pieces broken out of the rims taken out of service? (Reference **18.4.2.14.6.11.**)
28. Are pulleys that are used in areas where they would be exposed to corrosion made of corrosion-resistant material? (Reference **18.4.2.14.6.12.**)
29. Are pulleys located in corrosive environments inspected semiannually to ensure they are in satisfactory condition? (Reference **18.4.2.14.6.12.**)
30. Do operators and maintenance personnel pay close attention to the integrity of guards? (Reference **18.4.2.14.6.13.**)
31. If exhaust hoods serve as guards for table saws or wheels of band saws do they meet the construction criteria for guards? (Reference **18.4.2.14.6.14.**)

## **Related Equipment:**

1. Are holding tools used when it would otherwise be necessary to place hands in the danger zone? Are these tools used only to supplement guard protection and not used as a substitute for guarding? (Reference **18.4.2.15.2.**)

## **Power Presses:**

1. Does the supervisor ensure that either a fixed barrier guard, safeguard device, or combination of both is installed and used on every operation when the opening between the die (tool) and base (anvil) is more than one-fourth of an inch? (Reference **18.5.2.1.1.**)

2. Do the functional manager and base safety official approve guarding by location? (Reference **18.5.2.1.1.**)

3. Do personnel know that the use of hand-feeding tools, regardless of size, does not replace a guard or device? (Reference **18.5.2.1.1.**)

4. Are guards designed and constructed so a worker cannot reach through over under or around the guard? (Reference **18.5.2.1.2.**)

5. If fixed guarding is not possible because of the nature of an operation is a properly installed and functioning device used to protect against point of operation hazards? (Reference **18.5.2.1.3.**)

6. If a type A gate is used, does it enclose the point of operation before a stroke can be initiated and remain closed as long as the slide is moving? (Reference **18.5.2.1.3.1.1.**)

7. If a type B gate is used, does it prevent access prior to the start of the motion or die closure? (Reference **18.5.2.1.3.1.2.**)

8. Does the supervisor take special efforts to ensure pull out devices are used correctly and are properly aligned? (Reference **18.5.2.1.3.2.**)

9. Are holdout or restraint devices securely anchored adjusted to prevent the operator from reaching into the point of operation at any time? (Reference **18.5.2.1.3.3.**)

10. Are presence-sensing devices used only on part-revolution clutch presses? (Reference **18.5.2.1.3.4.**)

11. Are areas that are not protected by the presence-sensing devices guarded? (Reference **18.5.2.1.3.4.**)

12. Are sweep type devices used in conjunction with type safeguarding for point-of-operation guarding? (Reference **18.5.2.1.3.5.**)
13. Do the buttons on two-hand control devices operate only when the buttons are depressed concurrently? Do the buttons also operate only when depressed continuously (holding time) on the down stroke or else is the clutch disengaged, the brake applied, and the slide stopped? (Reference **18.5.2.1.4.**)
14. Are two-hand trips and presence sensing devices located far enough away from the point operation that when operators release the control buttons or disturb the presence-sensing field, they do not have time to reach into the point of operation before the die closes or slide stops? (Reference **18.5.2.1.4.2.**)
15. When devices such as two-hand controls, presence-sensing devices, type B gate, or movable barriers are used on part-revolution clutch presses, is a control reliability system and brake monitor system used? (Reference **18.5.2.1.4.4.**)
16. Are energy controls isolated by a lockout device and safety blocks during machine repairs or alterations of the die area? (Reference **18.5.2.1.4.6.**)
17. Are single or dual hand-lever-operated power presses equipped with a spring latch on the operating lever to prevent premature or accidental tripping? (Reference **18.5.2.1.4.7.**)
18. Are the operating levers on hand-tripped machinery with more than one operating station interlocked? (Reference **18.5.2.1.4.8.**)
19. Is a means provided to select "OFF," "INCH," "SINGLE STROKE," or "CONTINUOUS" modes of operation? Is it integrated with the clutch/brake control to govern the operation mode of the presses? (Reference **18.5.2.1.4.9.**)
20. During the "inch" operating mode, is exposure to the worker's hands to the point of operation protected by one of the following: (Reference **18.5.2.1.4.10.**)
  - a. Concurrent use of both hands to actuate the clutch? (Reference **18.5.2.1.4.10.1.**)
  - b. Use of a single control protected against accidental actuation? Is the control located so the worker cannot reach into the point of operation while actuating the control? (Reference **18.5.2.1.4.10.2.**)
21. Do two-handed controls for single-stroke press machines ensure safe operation (by design, construction, and/or operation) so that: (Reference **18.5.2.1.4.11.**)
  - a. The concurrent use of both hands is required to trip the press? (Reference **18.5.2.1.4.11.1.**)

b. Machine adjustments can be made, but the concurrent use for both hands is required during the die-closing portion of the stroke? (Reference **18.5.2.1.4.11.2.**)

c. Repetitive operation is not possible unless the controls are activated in proper sequence? Does the control system require that all operators' hand controls be released before an interrupted stroke can be resumed? (Reference **18.5.2.1.4.11.3.**)

22. Are individual operator's two-hand trip controls designed and constructed so that the use of both hands is required to protect against unintentional operations? Is a control arrangement used that requires concurrent operation of both the individual operator's hand controls? Is bypass of control inter-locks prohibited? (Reference **18.5.2.1.4.12.**)

23. Do two-hand trip systems on full-revolution/clutch machines provide anti-repeat protection for operations? (Reference **18.5.2.1.4.12.**)

24. When two-hand trip systems are used on multiple operator machines, does each operator have a separate set of controls? (Reference **18.5.2.1.4.13.**)

25. Are operators provided picks, pliers, tongs, and other hand-feeding tools required for the safe handling of stock, dies, or materials? (Reference **18.5.2.1.4.14.**)

26. Are these tools used in addition to the required protective clothing, equipment, or machine guarding? (Reference **18.5.2.1.4.14.**)

27. Is a die setter's safety bar used for turning the flywheel when the power is off? (Reference **18.5.2.1.4.14.**)

28. Are individual die guards attached to the die shoe, stripper, or die block in a fixed position as alternates or supplements to other guarding methods? Are they designed so the operator cannot reach over, under, or around the guard into the danger zone? (Reference **18.5.2.1.4.15.**)

29. Are attachment points provided on dies requiring mechanical handling? (Reference **18.5.2.1.4.15.1.**)

30. Are die stops or other means used too prevent inadvertent movement of the die on inclined presses? (Reference **18.5.2.1.4.15.2.**)

### **Hydraulic Presses:**

1. Are hydraulic power presses safeguarded to prevent the operator's hands entering the area between the dies during press cycling? (Reference **18.5.2.2.**)

2. Do controls meet the requirements of paragraphs **18.5.2.15 – 18.5.2.16**? (Reference **18.5.2.2.1.**)
3. When two hand control systems are installed, do they incorporate an anti-repeat feature? (Reference **18.5.2.2.1.1.**)
4. Is the "Stop and Auto Return" switch (when provided) color-coded yellow? Is a power disconnected or "Stop" switch (capable of being locked) provided? (Reference **18.5.2.2.1.2.**)
5. Are energy sources controlled as referenced in paragraph **18.4.2.11**? (Reference **18.5.2.2.2.**)
6. Do pneumatic and hydraulic systems meet the requirements of paragraph **18.5.2.19**? (Reference **18.5.2.2.3.**)

### **Press Brakes:**

1. Do press brake controls meet the requirements of paragraph **18.5.2.15 – 18.5.2.16**? (Reference **18.5.2.3.1.**)
2. Are energy sources controlled as referenced in paragraph **18.4.2.11**? (Reference **18.5.2.3.2.**)
3. Do pneumatic and hydraulic systems meet the requirements of paragraph **18.5.2.19**? (Reference **18.4.2.9.**)
4. Is the type of safeguard used geared to the operation being performed? (Reference **18.5.2.3.4.**)
5. Does the supervisor ensure that safeguards are available and used? (Reference **18.5.2.3.4.**)
6. Are the following requirements used, based upon the type of safeguard available and installed for the operation?
  - a. Paragraph **18.4.2.13.** - Safeguarding by Distance or Location?
  - b. Paragraph **18.4.2.13.** - Safeguarding by Device?
  - c. Paragraph **18.5.2.20** - Related Tools?
  - d. Paragraph **18.5.2.21** - Safeguarding of Power Transmission Equipment?

e. Paragraph **18.5.2.22.** - Safeguarding for Automatic Material Clamping Equipment?

### **Shapers, Forming Rolls, Calendars, and Cold Headers:**

1. Do controls meet the requirements of paragraph **18.5.2.15 – 18.5.2.16?** (Reference **18.5.2.4.1.**)
2. Are energy sources controlled as referenced in paragraph **18.4.2.11?** (Reference **18.5.2.4.2.**)
3. Are all pneumatic and hydraulic components designed and maintained to meet paragraph **18.5.2.19** requirements? (Reference **18.5.2.4.3.**)
4. Is the primary function of the safeguards to protect the operator's hands, fingers, and other body parts from contacting the point of operation and slide mechanisms? (Reference **18.5.2.4.4.**)
5. Are adjustable barrier or enclosure safeguards used to the maximum extent possible? (Reference **18.5.2.4.4.**)
6. Are the requirements of paragraph **18.4.2.13 –18.4.2.14** used in evaluating the safeguard? (Reference **18.5.2.4.4.**)
7. Are additional barrier guards provided at the refuse drop areas? (Reference **18.5.2.4.4.1.**)
8. Is the rear of the reciprocating ram guarded to protect other employees? (Reference **18.5.2.4.4.1.**)
9. Is a chip guard provided to prevent flying chips from striking the operator or other workers? (Reference **18.5.2.4.4.2.**)
10. Are all materials securely clamped in position on the machine table? (Reference **18.5.2.4.4.2.**)

### **Shears:**

1. Is safeguarding provided to protect the operators from the hazardous areas? (Reference **18.5.2.5.**)
2. Do controls meet the requirements of paragraphs **18.4.2.15 – 18.4.2.16?** (Reference **18.5.2.5.1.**)

3. Are energy sources controlled as referenced in paragraph **18.4.2.11**? (Reference **18.5.2.5.2.**)
4. Do pneumatic and hydraulic systems meet the standards of paragraph **18.5.2.11**? (Reference **18.5.2.5.3.**)
5. Is barrier or enclosure guarding considered the primary means of safeguarding shearing machines? (Reference **18.5.2.5.4.**)
6. Are paragraphs **18.4.2.13 – 18.4.2.14** and **18.5.2.20 – 18.5.2.22** used to evaluate the adequacy of installed guards or devices? (Reference **18.5.2.5.4.**)
7. Is the area where sheared or punched refuses drops barricaded to prevent injuries to operators and helpers? (Reference **18.5.2.5.4.**)
8. Are machines equipped with an emergency stop control? (Reference **18.5.2.5.4.**)

### **Lathes, Screw/Bar, and Chucking Machines:**

1. Do controls meet the requirements of paragraphs **18.5.2.15 – 18.5.2.16**? (Reference **18.5.2.6.1.**)
2. Do pneumatic and hydraulic systems (when installed) meet the standards in paragraph **18.5.2.19**? (Reference **18.5.2.6.3.**)
3. Is a fixed or movable barrier device or awareness device installed when a lathe operates in the automatic or semi-automatic mode? (Reference **18.5.2.6.4.**)
4. Is a barrier guard, rigid awareness barrier (protective railing), or awareness device installed during machine operation on power-indexed turrets that contain an exceptionally long tool or tool-holding device, which extends in the operator's workspace? (Reference **18.5.2.6.5.**)
5. Is one of the above safeguards installed when a rotating work piece extends beyond the normal confines of the machine? (Reference **18.5.2.6.5.**)
6. Is a spindle-breaking device installed on lathes procured after the date of this standard (if the operator must stop the spindle to manually unload a work piece)? (Reference **18.5.2.6.6.**)
7. Are chucks always started on the lathe spindle by hand? (Reference **18.5.2.6.7.**)
8. Is the tail stock end of the work countersunk deeply enough so there is minimal chance of the work being torn loose? (Reference **18.5.2.6.8.**)

9. Are tools adjusted in the tool rest so they are slightly above the center?  
(Reference **18.5.2.6.9.**)
10. When chips are being generated, is a tool, puller, brush, or shovel used to remove them? (Reference **18.5.2.6.10.**)
11. Do operators know they are not to brake the lathe by grasping the chuck, work, or any other machine component? (Reference **18.5.2.6.11.**)

### **Drilling, Milling, and Boring Machines:**

1. Is a barrier guard or guarding device installed and used when: (Reference **18.5.2.7.**)
  - a. Machines are operated in an automatic or semi-automatic mode?
  - b. Cutting devices are exposed?
  - c. Any part of the operator's body is within 1 foot of the cutting device?
2. Are awareness barriers used only in situations when a guard or guarding devices would (of itself) present a hazard? (Reference **18.5.2.7.**)
3. Does the type of guarding depend on the machine, location, and operation?  
(Reference **18.5.2.7.**)
4. Do the requirements identified in paragraph **18.5.2.20** apply to the design and installation of shields?
5. Are operators cautioned not to handhold stock? (Reference **18.5.2.7.1.**)
6. Is a hold-down fixture or stock vise used to prevent injuries? (Reference **18.5.2.7.1.**)
7. Are only drill chucks without protruding setscrews used? (Reference **18.5.2.7.2.**)
8. Are auxiliary devices and extra tools stored properly? (Reference **18.5.2.7.3.**)
9. Are drill presses operated only at speeds specified by the press or drill manufacturer for the particular materials to be drilled? (Reference **18.5.2.7.4.**)
10. Are automatic and high production drilling machines equipped with barricades or enclosures to separate operators and other personnel from drilling operations?  
(Reference **18.5.2.7.5.**)

11. Are steps or stairs (when necessary for making adjustments to the machine or work) well constructed, provided with non-slip treads, and in good repair? (Reference **18.5.2.7.5.**)

12. Do operator/mechanical controls meet the requirements of paragraphs **18.5.2.15 – 18.5.2.16?** (Reference **18.5.2.7.6.**)

13. Are energy sources controlled as referenced in paragraph **18.4.2.11.1 – 18.4.2.11.7?** (Reference **18.5.2.7.7.**)

14. Do pneumatic and hydraulic systems (when provided) conform to paragraphs **18.5.2.19.1 – 18.5.2.19.7?** (Reference **18.5.2.19.**)

### **Planers:**

1. Is the reciprocating work and table barricaded, or enclosed, to prevent personnel from being struck by material? (Reference **18.5.2.8.**)

2. Is a chip shield provided to prevent chips from flying and striking personnel? (Reference **18.5.2.8.1.**)

3. Are safety dogs placed at each end of the plane table? (Reference **18.5.2.8.2.**)

4. Is material securely clamped in position on the planer table? (Reference **18.5.2.8.3.**)

### **Saws:**

1. Do saws meet the general requirements in paragraphs **18.5.2.15 – 18.5.2.18.4?**

2. Do the supervisor and base safety office develop requirements on machine safeguards for saws not covered in this standard? (Reference **18.5.2.9.**)

### **Bandsaws:**

1. Are both upper and lower wheels completely enclosed on both sides? Can the enclosures be easily removed for maintenance? (Reference **18.5.2.10.1**)

2. Is the working part of a saw blade guarded to prevent accidental contact with the saw blade? Is the guard self-adjusting and attached to the gauge so that the guard will completely cover the portion of the saw blade between the guide rolls and the upper wheel enclosure? (Reference **18.5.2.10.2.**)

3. Are saws equipped with an automatic tension control to ensure proper tension of saw blade? (Reference **18.5.2.10.3.**)
4. Are feed rolls on self-fed band saws guarded? (Reference **18.5.2.10.4.**)
5. Is the saw speed kept within the limits recommended by the manufacturer? (Reference **18.5.2.10.5.**)

### **Hacksaws:**

1. Is loss of coolant and lubricants minimized by proper maintenance of the coolant system and the installation of splash shields? (Reference **18.5.2.11.1.**)
2. Are vises, fixtures, and other work-holding equipment used to hold the work piece securely? (Reference **18.5.2.11.2.**)
3. Does the operator know not to handhold stock that is being cut by a power hacksaw? (Reference **18.5.2.11.3.**)

### **Circular Metal Saws:**

1. Does the safeguard have enough strength to protect the operator from a broken saw blade or teeth? (Reference **18.5.2.12.1.**)
2. Does the safeguard enclose the spindle end and nut? (Reference **18.5.2.12.2.**)
3. Is the safeguard provided with an opening or means of removing chips that, in it, will not create a hazard to the operator? (Reference **18.5.2.12.3.**)
4. Does the safeguard enclose all unused portions of the exposed saw blade? Is the part of the blade used for cutting protected by a barrier? (Is the barrier positioned to protect the operator from exposure to the blade? (Reference **18.5.2.12.4.**)
5. Is the loss of coolant and lubricants minimized by proper maintenance of the coolant system and the installation of splash shields? (Reference **18.5.2.12.5.**)
6. Are vises, fixtures, and other work-holding equipment used to hold the work piece securely? (Reference **18.5.2.12.6.**)
7. Are all circular sawing machines equipped with a pair of flanges? (Reference **18.5.2.12.7.**)

### **Cut-Off and Contour Saws:**

1. Are both the upper and lower wheels on both sides of saws enclosed? Is the enclosure hinged to permit easy access to the saw blade? (Reference **18.5.2.13.1.**)
2. Is the working part of the saw blade guarded to prevent accidental contact with the saw blade? Is the guard self-adjusting and is it attached to the gauge so the guard will completely cover the portion of the saw blade between the guide rolls and the upper wheel enclosure? (Reference **18.5.2.13.2.**)
3. Are abrasive cut-off saws connected to an exhaust system? (Reference **18.5.2.13.3.**)
4. Do operators know not to handhold stock being cut by a power hacksaw? (Reference **18.5.2.13.4.**)

### **Riveting Machines:**

1. Is a guard provided to prevent the operator from placing his or her hands between dies? (Reference **18.5.2.14.**)

### **Operator Controls:**

1. Are controls within easy reach of the machine operator? Are they placed so the worker does not have to reach past moving parts? (Reference **18.5.2.15.1.**)
2. Are controls positioned or protected against accidental or inadvertent operation? (Reference **18.5.2.15.2.**)
3. Do operators know not to wedge controls for continuous operations? (Reference **18.5.2.15.3.**)
4. Are controls clearly identified when their function is not self-evident? Do they not initiate motion unrelated to its designation? (Reference **18.5.2.15.4.**)
5. If jog circuits are used, are they designed to prevent continuous run or automatic operation? (Reference **18.5.2.15.5.**)
6. Are foot (treadle) controls protected against unexpected and accidental tripping? Do these have a non-slip surface? (Reference **18.5.2.15.6.**)
7. Are energy sources controlled as referenced in paragraph **18.4.2.11?**

### **Mechanical Controls:**

1. Do hand wheels turned in a clockwise rotation produce a linear movement to the right away, or upward? If the hand wheel produces a rotary motion, does clockwise rotation cause clockwise movement of the controlled component? (Reference **18.5.2.16.1.**)
2. Do control levers move in the same direction as the controlled component when both motions are parallel? (Reference **18.5.2.16.2.**)
3. Is an adjustable barrier guard installed when crank and hand wheel controls with protrusions rotates at more than 50 surface feet per minute? (Reference **18.5.2.16.3.**)

### **Multiple Control Stations:**

1. When a setup control station is provided, does selection of the setup station render the operator's station inoperative, except for emergency stop? (Reference **18.5.2.17.1.**)
2. Does switching from one control station not create a hazard? (Reference **18.5.2.17.1.**)
3. When more than one operator is required to operate the machine from different control station, is each station provided with a cycle start button (which must be depressed concurrently in order to initiate the cycle)? (Reference **18.5.2.17.2.**)
4. Are all cycle start buttons other than the one being used made inoperative (when one operator can operate the machine from more than one station)? (Reference **18.5.2.17.3.**)
5. Where parts are manually loaded and the operator may be exposed to a hazard due to cutter or machine table movements, is the rapid traverse from one part or position to the other initiated by the operator? (Reference **18.5.2.17.4.**)

### **Emergency Stop Control:**

1. Do all machines incorporate one or more emergency stop controls that, upon momentary operations, de-energize all machine motions? (Reference **18.5.2.18.1.**)
2. Are these emergency stops located at each operator control station? If inherent hazards are present at other operating position, is an emergency stop provided? (Reference **18.5.2.18.1.**)
3. Is the emergency stop color-coded red? (Reference **18.5.2.18.2.**)
4. Does the emergency stop control override all other controls? When actuated, does it not create other hazards? (Reference **18.5.2.18.3.**)

5. Can machines motions that are stopped by the emergency or master switch only be restarted by deliberate action by the operator? (Reference **18.5.2.18.4.**)

### **Pneumatic and Hydraulic Systems:**

1. Are circuits designed and components selected, applied, and adjusted so loss of control media will not cause a hazard? (Reference **18.5.2.19.1.**)
2. Are circuits designed and components applied so pressure variations do not cause a hazard? (Reference **18.5.2.19.2.**)
3. Are components used that cannot be adjusted outside the safe working range of the circuits? (Reference **18.5.2.19.3.**)
4. Are means provided to prevent operation when loss of working pressure can cause a hazard? (Reference **18.5.2.19.4.**)
5. Do circuits employing accumulator tanks automatically vent the accumulator pressure or isolate the accumulator when the machine is shut off? (Reference **18.5.2.19.5.**)
6. Are non-vented accumulators identified with a sign saying "WARNING - PRESSURIZED VESSEL" or the nearest commercially available equivalent? (Reference **18.5.2.19.6.**)
7. Is charging and discharging information for proper servicing given on or near the accumulator (in a visible location) and in the maintenance manual? (Reference **18.5.2.19.6.**)
8. Are gas-charged accumulators operating above 200 psig charging pressure charged with inert gas? (Reference **18.5.2.19.7.**)
9. Are flexible hoses arranged so they do not create a tripping hazard? (Reference **18.5.2.19.8.**)
10. If failed flexible hoses may constitute a whipping hazard, are they restrained or contained? (Reference **18.5.2.19.8.**)
11. Whenever pressure is maintained after power is off, is a warning plate used? (Reference **18.5.2.19.9.**)
12. Are procedures for de-pressurizing the circuit noted in the maintenance manual? (Reference **18.5.2.19.9.**)

## **Related Equipment:**

1. Are shields used to provide protection from flying particles? (Reference **18.5.2.20.1.**)
2. Is a splash shield installed when chips or coolant fluids are splashed on the operator or on the work area and passageway floor? (Reference **18.5.2.20.1.**)
3. Are holding tools used when it would otherwise be necessary to place hands in the danger zone? Are these tools used in addition to guards? (Reference **18.5.2.20.2.**)

## **Power Transmission Belts and Pulleys:**

1. Are horizontal belts and ropes above floor or platforms guarded for their entire length if: (Reference **18.5.2.21.1.**)
  - a. Located over passageways or workplaces,
  - b. Center-to-center distance between pulleys is 10 feet or more, or
  - c. The belt is 8 inches or more in width?
2. Are vertical belts running over a lower pulley above the floor or platforms guarded at the bottom in the same manner as overhead belts? (Reference **18.5.2.21.2.**)
3. Where loose pulleys or idlers are not practical, are belt perches used to keep idler belts away from the shafts? Are the perches made of strong materials and designed for the safe shifting of belts? (Reference **18.5.2.21.3.**)
4. Do operators know that belt dressing should not be applied when the belt or rope is in motion? But, if it is necessary, is dressing applied where belts leave the pulley, not where they approach them? (Reference **18.5.2.21.4.**)
5. Is a guard provided to prevent the belt from leaving the pulley on the side where insufficient clearance exists (with exception)? (Reference **18.5.2.21.5.**)
6. Where there are overhanging pulleys on a line, jack, or countershaft (with no bearing between the pulley and the outer end of the shaft) is a guard installed to prevent the belt from running off the pulley? (Reference **18.5.2.21.5.**)
7. Are pulleys with cracks or pieces broken out of rims taken out of service? (Reference **18.5.2.21.6.**)
8. Are pulleys (used in areas where they would be exposed to corrosion) made of corrosion-resistant material? Are they inspected semiannually to ensure they are in satisfactory condition? (Reference **18.5.2.21.7.**)

### **Powered Clamping, Work-Holding Devices:**

1. Are these devices provided with a safeguard to warn the operator or contain the work piece when there is a lack of clamping pressure? (Reference **18.5.2.22.**)
2. If an electrical interlock is installed does it shut off power to the lathe when hydraulic pressure drops or electrical interruption occurs? (Reference **18.5.2.22.**)
3. If an audible or visual warning device is used, is it visible or audible to the operator at his normal work position? (Reference **18.5.2.22.**)

### **Exhaust Ventilation:**

1. Are local exhaust ventilation systems provided and used whenever dry grinding, polishing, or buffing is performed to maintain employee exposures within permissible exposure limits? (Reference **18.6.2.1.**)

### **Wheel and Spindle Speeds:**

1. Is the spindle rpm of the grinders shown on the machine and in a location that is readily visible to the operator? (Reference **18.6.2.2.1.**)
2. Are grinding wheels that do not have the operating speed affixed to the wheel, tagged and removed from service until the rpm rating is validated? (Reference **18.6.2.2.2.**)

### **Safe Operating Procedures:**

1. Are abrasive wheel machines only operated with safety guards installed? (Reference **18.6.2.3.1.**)
2. Are peripheral protectors (tongue guards) positioned so that there is no more than one-fourth of an inch opening between the wheel and the guard? (Reference **18.6.2.3.2.**)
3. Are work rests always used during all off-hand grinding operations? (Reference **18.6.2.3.3.**)
4. Are work rests rigidly constructed? (Reference **18.6.2.3.3.**)
5. Are work rests designed so that they may be adjusted to compensate for wheel wear? (Reference **18.6.2.3.3.1.**)

6. Are work rests adjusted closely to the wheel with a maximum opening of one-eighth of an inch to prevent the work from being jammed between the wheel and the rest?  
(Reference **18.6.2.3.3.1.**)
7. Are work rests securely clamped after each adjustment? (Reference **18.6.2.3.3.1.**)
8. Are adjustments made only with the wheel out of motion? (Reference **18.6.2.3.3.1.**)
9. Are precautions taken to prevent grinding of stock that is thin enough to be pulled between work rests and the wheel? (Reference **18.6.2.3.3.2.**)
10. Are the abrasive wheel machines only operated within rated speeds?  
(Reference **18.6.2.3.4.**)
11. Are grinding wheels removed from service when any of the following occurs:  
(Reference **18.6.2.3.5.**)
  - a. Cracked - Defective - Out-of-balance?
  - b. When worn to size that would allow the flange assembly to contact the piece being ground on the work rest?
12. Do operators of grinding machines stand to one side when initially turning the machine on, until it has reached its operating speed? (Reference **18.6.2.3.6.**)
13. When the machine chatters or vibrates, do operators stop the machine and inspect it to determine the cause? (Reference **18.6.2.3.7.**)
14. Are all operators prevented from using the abrasive grinding wheels to grind aluminum, brass, copper or other soft metals (unless the wheel is specifically designed for the purpose)? (Reference **18.6.2.3.8.**)
15. Are operators prevented from using the side of the wheel for grinding (other than wheels designed for that purpose)? (Reference **18.6.2.3.9.**)
16. Do all operators ensure that the grinders, buffers and wire brush machines are turned off when work is completed or prior to leaving the vicinity of the machine?  
(Reference **18.6.2.3.10.**)
17. Are operators who wear loose fitting clothing prevented from using these machines?  
(Reference **18.6.2.3.11.**)
18. During any grinding operation, do the operators wear safety glasses or goggles for protection of the eyes, in conjunction with a face shield for protection from wheel breakage, sparks, and other grinding debris? (Reference **18.6.2.3.12.**)

19. Do operators wear shop aprons of heavy construction when grinding operations are performed on a continuing or prolonged basis? (Reference **18.6.2.3.12.**)

20. Do operators wear gloves when the work has burrs, rough edges, or presents other hazards to their hands? (Reference **18.6.2.3.12.**)

21. Do wire brush wheel operators utilize protective shop aprons of heavy construction and a face shield during all operations? (Reference **18.6.2.3.13.**)

22. Do polishing and buffer wheel operators wear a face shield during all operations? (Reference **18.6.2.3.14.**)

### **Inspections:**

1. Do operators inspect the grinding machines prior to each usage for the following?

a. Work rests for security and proper adjustment (i.e., one-eighth of an inch maximum)? (Reference **18.6.2.4.1.**)

b. Wheels for security and condition; i.e., cracks, gouges, chipped edges or uneven wear? (Reference **18.6.2.4.2.**)

c. Wheels for evidence of side grinding, or grinding of soft metals on wheels not designed for these purposes? (Reference **18.6.2.4.3.**)

d. Shatter-resistant transparent shields for cleanliness, scoring and proper placement? (Reference **18.6.2.4.4.**)

e. Machine guards and power transmissions guards for condition, security, and proper alignment? (Reference **18.6.2.4.5.**)

f. Periphery (tongue) guards for security and proper adjustment (i.e., one-fourth of an inch max opening)? (Reference **18.6.2.4.6.**)

g. Proper lighting at point of operation? (Reference **18.6.2.4.7.**)

### **Maintenance and Lubrication:**

1. Prior to performing maintenance on grinding equipment do operators ascertain that the machine power source is turned off and locked out or the power cord is unplugged? (Reference **18.6.2.5.**)

2. Do maintenance personnel refer to and follow the manufacturer's recommendation concerning size and design of mounting flanges and mounting techniques prior to any maintenance? (Reference **18.6.2.5.1.**)
3. Before the wheel is mounted, is the spindle speed of the machine checked to ensure that it does not exceed the maximum operating speed marked on the wheels? (Reference **18.6.2.5.1.1.**)
4. Has the shelf life of the wheels received not been exceeded? (Reference **18.6.2.5.1.2.**)
5. Have all the wheels received a thorough visual inspection and received a ring test prior to use? (Reference **18.6.2.5.1.3.**)
6. Does the grinding wheel fit freely on the spindle and remain free under all grinding conditions? (Reference **18.6.2.5.1.4.**)
7. Are all contact surfaces of wheels, blotters, and flanges flat and free of foreign matter? (Reference **18.6.2.5.1.5.**)
8. If a bushing is used in the wheel hole, is the width of the bushing less than the width of the wheel so that it does not contact the flange? (Reference **18.6.2.5.1.6.**)
9. Are abrasive wheels mounted between flanges, which are not less than one- third, the diameter of the wheel? (Reference **18.6.2.5.1.7.**)
10. Are flanges free of rough surfaces or sharp edges? (Reference **18.6.2.5.1.7.1.**)
11. Are flanges dimensionally accurate and in good balance? (Reference **18.6.2.5.1.7.1.**)
12. Are both flanges of the same diameter and have equal bearing surface? (Reference **18.6.2.5.1.7.1.**)
13. Is the driving flange securely fastened to the spindle and does the bearing surface run true? (Reference **18.6.2.5.1.7.3.**)
14. Where more than one wheel is mounted between a single set of flanges, are the wheels cemented together or separated by specially designed spacers? (Reference **18.6.2.5.1.7.3.**)
15. Are the spacers equal in diameter to the mounting flanges and have equal bearing surfaces? (Reference **18.6.2.5.1.7.3.**)
16. Are blotters prohibited from being used as spacers? (Reference **18.6.2.5.1.7.3.**)
17. When wheels are to be cemented together, are the wheel manufacture's recommendations followed? (Reference **18.6.2.5.1.7.3.**)

18. When the bearing surfaces become worn, warped, sprung, or damaged are they trued and resurfaced? (Reference **18.6.2.5.1.7.4.**)
19. When resurfacing or truing bearing surfaces, is the removal of material prohibited beyond the point that it loses its rigidity? (Reference **18.6.2.5.1.7.4.**)
20. Are blotters always used between flanges and abrasive wheel surfaces to ensure uniform distribution of flange pressure? (Reference **18.6.2.5.1.8.**)
21. When blotters are required, do they cover the entire contact area of wheel flanges per manufacturer's recommendations? (Reference **18.6.2.5.1.8.**)
22. Are the safety guards in place prior to starting the machine? (Reference **18.6.2.5.1.10.**)
23. After the guards are reinstalled, is the wheel rotated several revolutions by hand in insure that it clears both the work rest and the safety guards prior to starting? (Reference **18.6.2.5.1.10.**)
24. Are newly installed wheels run at full operating speed for at least one minute before work is applied? (Reference **18.6.2.5.1.10.**)
25. During the one minute run-in of the wheel are the operator and other personnel standing clear of the machine? (Reference **18.6.2.5.1.10.**)
26. When performing wheel-dressing operation, are wheel dressing tools properly equipped with hood guards over the tops of cutters? (Reference **18.6.2.5.2.**)
27. Is the dresser supported on the work rest and the work rest adjusted away from the wheel so that the heel of the dresser hooks over the work rest? Does the work rest guide the dresser as it moves back and forth across the wheel face? (Reference **18.6.2.5.2.**)
28. Is dressing accomplished only by personnel trained in this task? (Reference **18.6.2.5.2.**)
29. Do personnel wear face shields over safety glasses for face protection, and a respirator if conditions warrant? (Reference **18.6.2.5.2.1.**)
30. Do personnel utilize a dressing tool designed for the task? (Reference **18.6.2.5.2.2.**)
31. Do personnel inspect star dressers for loose shaft and worn discs prior to use? (Reference **18.6.2.5.2.3.**)

32. Do personnel round off wheel edges with a hand stone before and after dressing to prevent the edges from chipping? (Reference **18.6.2.5.2.4.**)
33. Do personnel use work rests to support and guide the tool and use a tool holder if one is available? (Reference **18.6.2.5.2.5.**)
34. Do personnel apply moderate pressure, slowly and evenly? (Reference **18.6.2.5.2.6.**)
35. Do personnel always apply diamond dressers at the center or slightly below the center of the wheel? (Reference **18.6.2.5.2.7.**)
36. Do personnel establish and utilize lubrication intervals for the grinding machine spindle bearings based on the manufacturer's recommendations? (Reference **18.6.2.5.3.**)

### **Guarding:**

1. Are guards used on all grinding machines, except wheels used for internal work where the work offers protection? (Reference **18.6.2.6.**)
2. On wheels requiring guards, does the guard cover the spindle end, nut, and the flange projection? (Reference **18.6.2.6.**)
3. Is the guard mounted so as to maintain proper alignment with the wheel? (Reference **18.6.2.6.**)
4. Do the fasteners used to mount the guard equal or exceed the strength of the guard? (Reference **18.6.2.6.**)
5. Does the angular exposure of the grinding wheel periphery and sides for safety guards not exceed 90 degrees or one-fourth of the periphery? Is the angular exposure of the grinding wheel periphery and sides for safety guards used on bench and floor (pedestal) grinders less than the maximum 90 degrees or less than one-fourth of the periphery? (Reference **18.6.2.6.1.**)
6. When the operator stands in front of the opening of bench and floor stand (pedestal) grinder, is the unit equipped with a peripheral protector (tongue guard) that can be adjusted to the decreasing diameter of the wheel? Is the opening maintained at one-fourth of an inch or less? (Reference **18.6.2.6.1.**)
7. Is the angular exposure of the cylindrical grinding wheel periphery and sides for safety guards maintained at less than 180 degrees? (Reference **18.6.2.6.2.**)

8. When the operator stands in front of the opening of the cylindrical grinder, is the unit equipped with a peripheral protector (tongue guard) that can be adjusted to the decreasing diameter of the wheel? Is the opening maintained at one-fourth of an inch or less? (Reference **18.6.2.6.1.**)

9. Where the work is applied to the wheel above the horizontal center line, is the exposure of the grinding wheel periphery as small as possible and does not exceed 60 degrees? (Reference **18.6.2.6.3.**)

### **Wet Grinding:**

1. Do wet grinding machines meet the same criteria for guarding, work rest, and machine set up as required for other abrasive wheel machinery? (Reference **18.6.2.7.**) Do they include the following requirements?

2. When shutting down a wet grinding operation do personnel shut off the coolant first allowing the wheel to rotate until the coolant has been spun out? (Reference **18.6.2.7.1.**)

3. Are wet process grinding wheels restricted from being left partially submerged in water, preventing a possible unbalanced wheel that may break when rotated? (Reference **18.6.2.7.2.**)

4. Do operators follow the manufacturer's directions to prevent coolant alkalinity from affecting organic bonded wheels? (Reference **18.6.2.7.3.**)

5. Are controls established to reduce slipping hazards on floor surfaces around wet processes, i.e., rough concrete or have non-skid materials or mats applied? (Reference **18.6.2.7.4.**)

### **Wheel Storage:**

1. Are abrasive wheels handled and stored as follows to prevent damage?

a. Are wheels stored only in dry areas that are not subject to extreme temperature changes, or below freezing temperatures? (Reference **18.6.2.8.1.**)

b. Are wheels taken from a cold storage room permitted to warm up to room temperature before work is applied to it? (Reference **18.6.2.8.1.**)

c. Is storage arranged to allow wheel selection and removal without damaging other wheels? (Reference **18.6.2.8.2.**)

d. Are thin organic bonded cutting wheels only stored on a flat horizontal surface away from heat? (Reference **18.6.2.8.3.**)

e. Are straight or tapered wheels only stored supported on edge in racks? (Reference **18.6.2.8.4.**)

f. Are wheels dated when placed in storage so they can be issued oldest first? (Reference **18.6.2.8.5.**)

g. Are heavy wheels moved by hand trucks or powered trucks, and not rolled on the floor? (Reference **18.6.2.8.6.**)

h. Are wheel storage areas as close to the grinding operations as practical? (Reference **18.6.2.8.7.**)

i. Are wheels that are found unsatisfactory, tagged and discarded unless repairs can be performed? (Reference **18.6.2.8.8.**)

### **Polishing and Buffing Wheels:**

1. Are speed controls safeguarded to prevent accidental change, when polishing and buffing wheels are driven by variable speed motors? (Reference **18.6.2.9.2.**)

2. When rouge or Tripoli is applied to a rotating polishing or buffing wheel, is the side of the cake held lightly against the wheel's periphery? If a stick is used, is the side of stick applied so that it will fly away from the wheel? (Reference **18.6.2.9.3.**)

### **Special Grinding Operations:**

1. Do supervisors of operations that use materials such as magnesium, titanium, thorium, and beryllium contact base ground safety, fire department, and BEE personnel for assistance to determine safe work practices and protective equipment needs? (Reference **18.6.2.10.**)