

Safety in the Machine Shop

Machine shop safety can be divided into two broad areas of concern:

1. Protection against personal injury;
2. Prevention of damage to tools, machines, and equipment.

Personal Safety

Working with metals in a machine shop makes personal injury possible. Metals are hard, unyielding materials. They have raggedly sharp edges. Hot, sharp metal chips produced in cutting operations can burn and cut the worker. Grinding wheels can throw abrasive particles into unprotected eyes, Fig. 1.

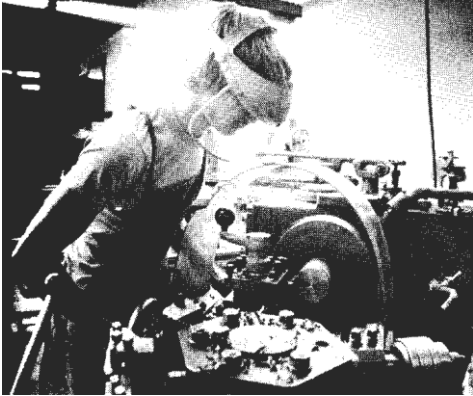


Fig. 1. Workers in a machine shop must be cautious. Protect yourself against hot, sharp chips produced by turning.



Fig. 2. Long, loose hair can get caught in machinery. Confine it in a cap or tie it back securely.

Rotating tools and workpieces can catch loose clothing and hair, Fig. 2. A careless worker can be painfully injured. Workers who **think safety** and **work safely** can avoid these and many other hazards. They must dress properly, follow correct work procedures, and work harmoniously with fellow workers.

How to Dress Safely

1. For maximum eye protection, wear clean, properly fitted, approved safety glasses with side shields, goggles, or a face shield in the machine shop, Fig. 3. An approved type of safety glasses should be worn at all times. Laws in most states require everyone to wear eye protection in school shops, laboratories, and factories. Even if this were not so, **your eyes cannot be replaced. Protect them at all costs.**



Fig. 3. Choose the right equipment to protect your eyes and face.

A. Safety glasses with side shields. B. Goggles. C. Face shield for full-face protection.

2. Wear close fitting clothing made of a hard, smooth finished fabric. Such fabric will not catch easily on sharp edges or be wrapped around drills or other rotating tools. A fuzzy sweater is particularly bad. Wear it only under a hard finished garment like a shop coat.

Wear short sleeved shirts. If long sleeves are worn, they should be close fitting or rolled up past the elbow. A necktie should be removed or tucked into the shirt. Long sleeves on shirts, long hair, neckties, and jewelry are a definite hazard in the shop.

Wear a close fitting apron or shop coat to protect street clothes from the usual grime of metalworking, Fig. 4.

3. Protect your feet against hot, sharp chips and sharp or heavy falling objects. Safety shoes offer the best protection, but ordinary leather shoes also provide considerable protection. **Canvas shoes and open toe sandals offer no protection and should not be worn in the machine shop** - they give no resistance to hard objects dropped on the feet.

4. Rings, wrist watches, bracelets, and necklaces can get caught on equipment and cause serious injury. **Always remove all jewelry before working with tools and equipment.**

5. **Long, loose hair is dangerous around machine tools.** Confine long hair under a close fitting cap or tie it back securely.

6. Gloves should be worn **only** when **handling** sheet metal or large pieces of stock. **Never wear gloves while operating machines.** They are easily caught in moving parts which can cause serious injury to the hand.

Safe Work Practices

1. Before starting a machine, be sure that all its safety devices are in place and working properly.

2. Always be sure that the workpiece and the cutting tool are mounted securely before starting the machine, Fig. 5.

3. Keep your hands away from moving machinery and tools.

4. Handle materials carefully to avoid getting cut, Fig. 6.

5. Remove all burrs from workpieces to avoid cuts.

6. Avoid feeling the machined surface of the workpiece while the machine is running.

7. Never leave a machine while it is running or in motion, even if it is coasting with the power off. Someone else may not notice that it is still in motion and may be injured.

8. Always stop the machine to perform an operation where there is danger of the tool catching as, for example, when using an inside caliper.



Fig. 4. Machine operator dressed properly for working safely at metal lathe or other machine tools.

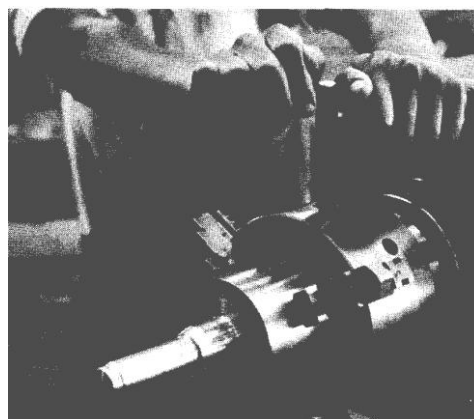


Fig. 5. Tools and workpieces must be rigidly supported for safety.



Fig. 6. Raggedly sharp edges call for care in materials handling.

9. Always stop machines to oil, clean, adjust, or repair them. If extensive repairs are required, disconnect the machine from its power source so that it cannot be accidentally turned on. The National Safety Council recommends that out-of-order equipment be identified with a blue tag or sign, Fig. 7.

10. Never use your hands to stop a machine or a moving part, such as a lathe or drill press chuck.

11. Use a brush, a piece of cardboard, or a thin strip of wood to remove metal chips, Fig. 8. **Do not use your hands!**

12. Whenever you remove guards, change the normal position of a machine, or remove parts to perform a specific operation, be sure that all are properly replaced before leaving the machine.

13. When closing electric switches, always grasp the switch by the insulated handle. **Keep your hands away** from the metal parts of the switch or the switch box itself.

14. If you must change speeds on a cone pulley drive system, wait until the machine comes to a **complete stop** before shifting the belt.

15. Be very cautious when using equipment with projecting setscrews. Where possible, replace them with flush setscrews.

16. Do not use compressed air to blow metal chips from a machine or work station. Be sure that you and others in the area are wearing **safety goggles when working with compressed air for ANY purpose.**

17. Avoid walking through restricted areas designated by floor markings or provided with barriers.

18. Avoid touching metal you suspect is hot. If doubtful, test the piece by sprinkling a few drops of water on it.

19. Return long metal bars to the proper storage rack after cutting off the necessary stock.

20. Keep aisles free of stock, small metal remnants, metal chips, and other waste. These are hazards to safe travel.

21. Clean up oil, grease, or other liquid spilled on the floor. Otherwise, it may cause someone to slip and fall.

22. Ask for help in lifting and handling heavy stock or machine accessories such as milling machine vises. Remember to lift with your legs, not your back, Fig. 9. Also, ask for help in handling long pieces of stock so as to avoid injuring someone or damaging equipment.

23. When working with another person on a machine, agree **beforehand** on who will operate the switches and controls.

24. Make it a habit to **stop, look, and think** in unfamiliar or possibly dangerous situations.

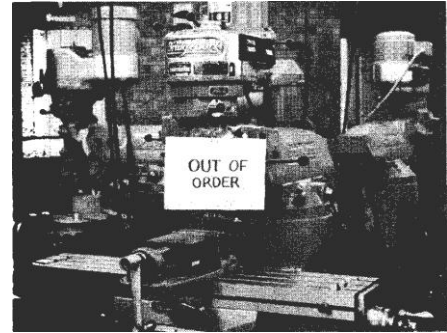


Fig. 7. Out-of-order equipment marked with blue tag or sign.



Fig. 8. Brushing is a safe way to remove chips.



Fig. 9. There is a correct method for lifting heavy workpieces to the machine - lift heavy objects by using the strength in your legs, not your back.

25. Always try to be **alert, patient, courteous, and willing to help**. This is especially necessary in school shops where facilities are often scarce, and you may have to lose precious time waiting for a tool or for your instructor's assistance.

Safety with Hand Tools

1. Always use the **right tool** for the job. Using makeshift tools increases the chance of accident.
2. Keep hands and tools wiped clean and free of dirt, oil, and grease. Dry tools are safer to use than slippery tools, Fig. 10.
3. Keep tools sharp and in good adjustment. Dull or poorly adjusted tools must be forced, causing accidents more easily.
4. Carry sharp-edged tools with the edges or points down. Never carry them in your pockets.
5. When handing a tool to another worker, be sure to offer it handle first, Fig. 11.
6. Check that heads of punches and cold chisels are properly dressed. When they start to mushroom or check, small pieces may break off and cause serious injury.
7. When using chisels, be careful that flying chips do not hit others in the shop.
8. Always use the right wrench for the job. Knuckles or hands are easily injured when a poor fitting wrench slips.
9. Check that handles are securely attached to files.
10. Damaged tools or ones in poor condition are dangerous to use. Always report tool damage to the instructor.



Fig. 10. Keep hands and tools clean and dry.



Fig. 11. A scribe is needle-sharp and hard enough to cut steel. If you are giving it to someone else, offer it handle first.

Fire Prevention

1. Learn the location of the nearest fire alarm in the shop or building as well as the nearest fire exit.
2. Learn the location and proper use of fire protection equipment in the building. Fire extinguishers which use a dry chemical or carbon dioxide should be readily available at all times.
3. Place oily rags or waste in the proper metal containers, Fig. 12. This guards against possible fire from spontaneous combustion.
4. Always close containers of inflammable materials such as paints or oils after use. Return them to the proper metal storage containers.



Fig. 12. Approved metal container for oily rags.

First Aid

1. Always notify the instructor immediately when injured, regardless of how slight the injury may be.

2. Always get first aid treatment for cuts or bruises promptly, Fig. 13. It is good practice to allow slight and moderate cuts to bleed for a few moments before stopping the flow of blood. Free bleeding carries infectious particles out of the wound. **Severe cuts or bruises should receive the immediate attention of a physician.**

3. Always treat burns promptly, according to how severe they are. A first degree burn is one in which the skin is merely reddened. In a second degree burn, the skin is blistered. In a third degree burn, the flesh is seared or charred. Treat first degree burns with applications of cold water. Then apply a sterile dry bandage. **Second and third degree burns should receive a physician's attention immediately.**



Fig. 13. Give cuts or bruises prompt attention.

If you are concerned about either injury or an illness, **get professional help as soon as possible.**

Test Your Knowledge of Safety in the Machine Shop

1. How can you protect your eyes and face in the shop?
2. What type of clothing is considered safest to wear in the machine shop?
3. Next to safety shoes, what kind of shoes offer feet good protection for shop work?
4. What kinds of jewelry should be taken off when working in the shop? Why?
5. What danger is involved in having long, loose hair when working with machines?
6. Why are gloves potentially dangerous to wear when working with machines?
7. Describe how to shift a drive belt safely.
8. What danger is involved in blowing metal chips off a machine with compressed air?
9. Describe how to check whether it is safe to pick up a piece of metal you suspect of being hot.
10. Describe the recommended body posture to use when lifting heavy objects.
11. Why must the workpiece and the cutting tool be mounted securely before starting the machine?
12. What possible dangers are involved if you attempt to operate a machine before you have had instructions on how to use it?
13. List several safety precautions which should be taken when working with hand tools.
14. What precautions should be taken to help prevent fires in the shop?
15. Who should be notified immediately in case you are injured, even if the injury is slight?
16. What types of injuries should receive first aid treatment?
17. Describe the appearance of a first degree burn. What kind of first aid treatment should be given?
18. What type of burn injuries should always receive the immediate attention of a physician?