HAZARDOUS WASTE

Safety Suggestions

- ✓ You must be prepared to handle a spill of hazardous waste or materials BEFORE it happens.
- ✓ Product warning label and MSDS are the best sources of information to prepare you for a spill.
- ✓ No matter how small the spill, the instructor must be informed immediately.
- ✓ It is against the law to pour hazardous materials or wastes down a drain or dump them into a sewer. You could be fined heavily or jailed (in extreme cases) if you do.
- ✓ Hazardous waste generated in general industrial shops can include solvents and solvent waste, batteries (leads) and battery acid, paint waste, and chemical waste.
- ✓ The MSDS can tell you how to dispose of the product.
- ✓ The Resource Conservation Recovery Act requires that a designated person in a facility be responsible for hazardous waste from the time it is generated until it is disposed of.

Hazardous Waste Disposal

To access a *Guide to Environmental Issues* from the U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response go to:

http://www.epa.gov/Epadocs/guide/

The guide offers basic information on numerous environmental topics. Frequently asked questions are answered in plain English, and an extensive glossary gives non-bureaucratic definitions for more than 200 environmental terms. The guide includes synopses of federal environmental laws and six pages of telephone numbers and hotlines.

Eye Protection Information

Phototropic (photochromic) lenses change depth of tint when exposed to varying degrees of ultraviolet light—that is, they darken when exposed to sunlight and fade when removed from the sunlight. These lenses do comply with current American National Standards Institute (ANSI) Z87.1 standards with limitations.

Photochromic lenses have limitations in operations requiring critical visual acuity or fast reaction to visual stimuli, particularly in operations where the wearer passes from outdoors to indoors in the course of his/her work activity. Also, these types of lenses should not be used as a substitute for the proper protection in hazardous optical radiation environments, for example, certain laboratory and shop operations such as welding or foundry work.

If an individual must wear **tinted lenses,** as prescribed by an eye specialist, industrial quality eye and face protection devices appropriate for the hazard involved should also be worn.

Posting of Eye Hazardous Areas

The entrance to all shops, laboratories or other areas that require industrial quality eye protection should be posted with a sign indicating the requirements. In addition, machines, equipment or process areas and laboratories requiring operators to wear specific eye and face protection should be posted with warning signs.

Visitors must wear the protective devices that are required in the area. Extra devices should be available at all times to lend to visitors. Devices called “visitors specs” do not meet ANSI standards.

Fitting and Maintenance

Safety eyewear must be fitted properly. It should be the responsibility of the person in charge of dispensing safety glasses or goggles to see that properly fitted and adjusted eyewear is provided for each individual.

Lenses of eye protectors must be kept clean. Restricted vision due to dirty lenses is sometimes a contributing factor to accidents. Eye protective devices that are shared shall be disinfected between uses.

Cleaning and Disinfecting Procedures

The following cleaning procedures are recommended in the ANSI Z87.1. Products shall be cleaned according to the manufacturer's instructions. If none are available, clean with mild soap and warm water solution by soaking the device in the soap solution maintained at 120°F for 10 minutes. Rinse thoroughly and allow to air dry. Use appropriate glove protection and other personal protective equipment as required of hazardous and combustible standards apply.

To disinfect, completely immerse the protector for 10 minutes in a solution of modified phenol, hypochlorite, quaternary ammonium compound or other disinfections reagent in a strength specified by the manufacturer of the protective equipment at room temperature of 20°C (68°F).

Remove protector from solution and suspend in a clean, dry place for air-drying at room temperature or with heated air. Do not rinse because this will remove the residual effect of the disinfectant.

Spray type disinfectant solutions and bactericides may be utilized when such pressurized spray solutions can be demonstrated to provide comparable disinfections with the immersion procedure outlined above. Store dry devices in a clean, dustproof container or area.

Protectors showing the need for extensive cleaning should be disassembled to the extent possible without tools prior to the washing and disinfections procedure.

We recommend each student have their own pair of safety glasses and goggles to reduce spread of eye disease.

Inspection of Protectors

Instructors and students should make a visual inspection of their eye protectors prior to use. Protective devices with broken parts, heat distortion, or excessive scratches on the lens are unsuitable for use and should not be worn. Pitted and scratched lenses may reduce vision and also, along with worn-out headbands, seriously reduce protection. Replace defective parts with new ones.

Eye Protective Devices

**The illustrations shown are only representative of protective devices commonly available at the time of the writing of this standard. Protective devices do not need to take the forms shown, but they must meet the requirements of the standard.

NOTES

1. Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards must be provided.
2. Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.
3. Face shields shall only be worn over primary eye protection.
4. Filter lenses shall meet the requirements for shade designations.

5. Persons whose vision requires the use of prescription (Rx) lenses shall wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear.
6. Wearers of contact lenses shall also be required to wear appropriate covering eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments might represent an additional hazard to contact lens wearers.
7. Caution should be exercised in the use of metal frame protective devices in electrical hazard areas.
8. Welding helmets or hand shields shall be used only over primary eye protection.
9. Nonsided shield spectacles are available for frontal protection only.

American National Standard Institute Z87.1

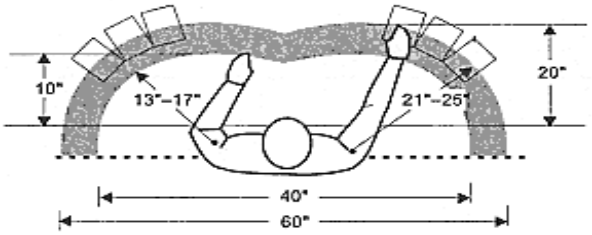
Reprinted from *American National Standards Practice for Occupational and Educational Eye and Face Protection,* ANSI Z87.1.

ERGONOMICS

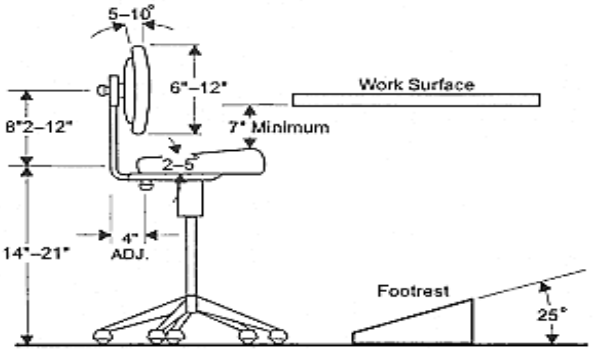
For more information about ergonomics visit WISHA Services at

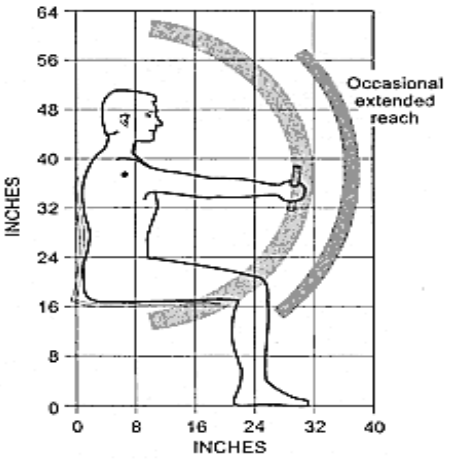
www.lni.wa.gov/wisha/ergo/default.htm

Tray 6–A. Recommended Workstation Measurements*

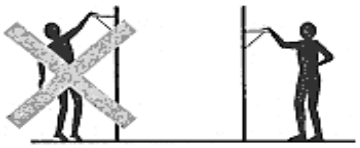


SEATED WORK:
Primary ☐ and secondary ▩ areas for table top work.
Optimal work surface height varies with the work performed:
Precision work = 31–37 in.
Reading/writing = 28–31 in.
Typing/light assembly = 21–28 in.
Seat and back rest heights should be adjustable as noted in chair requirements below.



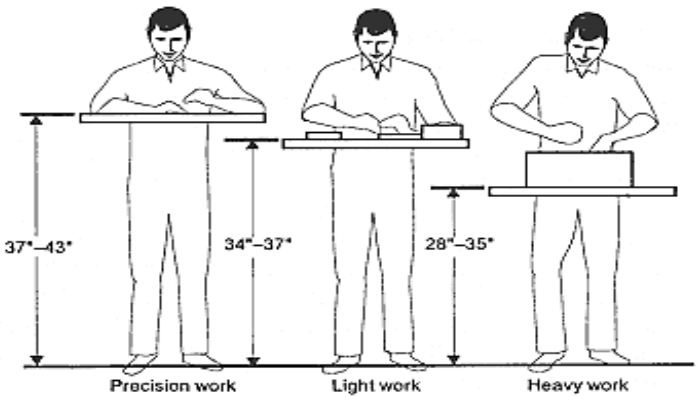


SEATED WORK:
Boundaries for vertical reaches for grasping objects.



STANDING WORK:
Shelf heights to which a free-standing person can reach and place a hand flat on a shelf should not exceed 60 in.

STANDING WORK:
Workbench heights should be
—above elbow height for *precision work*,
—just below elbow height for *light work*, and
—4–6 in. below elbow height for *heavy work*.



*Adapted in part from Grandjean E [1982] (*Fitting the Task to the Man: An Ergonomic Approach*. London: Taylor & Francis Ltd.) and UAW-GM [1990] (*UAW-GM Ergonomics Handbook*. Madison Heights, Michigan: Center for Health & Safety).

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MATERIALS SAFETY DATA SHEETS (MSDS)

AND WASTE DISPOSAL

Hazardous Communication

"Right-to-Know"—MSDS

Whenever chemicals are handled, used or stored on the school premises, the administration, instructors, and students should be familiar with the Federal Hazard Communication Standard. Reference should be made to WISHA Hazard Communication Standard. The purpose of this set of regulations was to "protect" employees from the potentially adverse effects of hazardous chemicals that they might come into contact with in their workplace. Initially, this regulation affected only manufacturers of potentially hazardous chemicals and the companies that used them. Since that time the law has been amended and the state has adopted laws to cover additional types of facilities and operations. It is imperative that CTE educators become familiar with these laws and how they affect them. MSDS must be reviewed with all on how to use the chemicals.

The intent of all the "Right-to-Know" regulations is basically the same "to protect employees from possible adverse effects of any potentially hazardous chemicals that they may encounter in their workplace." This "intent" weaves its way through all aspects of the laws and regulations and is especially important when students are in contact with various chemicals.

Materials Safety Data Sheets (MSDS)

Every lab or shop is required to have a readily accessible file containing materials safety data sheets (MSDS) for all hazardous chemicals and materials used in the facility.

MSDS can be obtained from the supplier or manufacturer. There are also several websites with comprehensive lists that you can download. For a list of Internet sites just type:

http://www.ilpi.com/msds/index.html

Examples:

RUST-OLEUM—PAINT THINNER
MATERIALS SAFETY DATA SHEET
NSN: 801000F003789
Manufacturer's CAGE: 08882
Part No. Indicator: B
Part Number/Trade Name: PAINT THINNER

Flammable and Combustible Liquids

- Read the manufacturer's label information and MSDS before using a product.
- Withdraw only as much material as you will need to complete the immediate operation.
- Always wear proper eye protection.
- Dispose of waste materials in approved containers.
- Use a funnel when pouring into a smaller container.
- Follow instructions for handling and mixing catalysts with resins and finishes.
- Never pour catalyst back into the container.
- Always add catalyst to resin, not resin to catalyst. Add acid to water, not water to acid.
- Do not apply resin, paint, or other finishing material near areas used for flame cutting, welding, grinding, soldering, or other high temperature operations.
- Store materials in original containers or approved containers that are properly labeled.
- Wear rubber gloves to minimize chances of skin irritation.
- Wash hands and other exposed skin areas before leaving the classroom.
- Store volatile materials in approved fireproof cabinets or specially designed areas.
- Remove clothing that may have become accidentally soaked with epoxy, polyester resins, and other potentially dangerous substances.
- Be certain the fire extinguisher located in work area is suited for application to a fire caused by the materials being used in the work area.
- If you are unsure of materials or procedures to complete an operation, ask the instructor for help.

Some of the more hazardous flammable liquids are listed below in approximate order of hazard.

- Starting fluid
- Gasoline
- Aerosol cans
- Catalysts
- Carburetor cleaner
- Acetone
- Lacquer thinner
- Adhering liquid
- Alcohol
- Shellac
- Japan dryer
- Kerosene
- Paint, oil
- Resin (polyester)
- Stain/varnish
- Danish oil

(printing)

- Paint thinner

Chemical Safety

Today's CTE educators must be conscious of potential chemical hazards. New concerns are being raised daily about the potential long-term effect chemicals might have on students, instructors, and the environment. Unless handled and used with rigorous care, all chemicals have the potential to cause injury and illness. For safe, effective use of chemicals, the following guidelines are suggested:

- Become familiar with every chemical before you use it. Know what it does and how it does it. Find out about the specific safety precautions, what protective equipment to wear, signs of illness associated with use, and what to do with empty containers and leftovers. Advise students of these facts. The label on the chemical container will provide most of the information you need. Your dealer is a good source of information.
- Use the least toxic chemical that will still be effective.
- Make sure that nonworkers are out of the work area.
- When using a chemical that could harm you if it came in contact with your body, wear personal protective equipment—unlined liquid-proof gloves, liquid-proof hat with brim, boots, clothing, chemical goggles, face shields, and an appropriate respirator for the chemical being used.
- To protect ground water, be careful of spills when mixing and loading. If a spill occurs, clean it up and report it promptly.
- Dry chemical dust can irritate your lungs and throat. Also, handling dry chemicals can dry out and irritate your hands.
- Consult the Washington State Department of Ecology for steps on how to safely dispose of empty containers and leftover chemicals. Don't dump them into any unapproved places where they could pollute ground water, wells, streams, or harm people and animals.
- With lower toxicity chemicals, less stringent measures will usually suffice, but they must still be adequate. Follow label recommendations, and limit exposure to any chemical you're using. If possible, avoid breathing dust, vapors, or spray. Avoid splashes and spills when handling. Don't eat until you've washed thoroughly.
- If someone is splashed or doused with a toxic chemical or inhales or ingests a toxic chemical use water to flush immediately, then call the poison control center immediately. Be ready to tell them what the chemical was and the suspected level of exposure the victim suffered.
- Store chemicals in their original labeled containers and in their proper storage location.

ELECTRICAL PROTECTION

Understanding the electrical resistance of the body

Current is forced through the resistance of a circuit by voltage, which is electrical pressure or force. A lower resistance in the circuit allows more current to pass through the circuit for a given amount of voltage. If the human body is thought of as a circuit, then the amount of current that can flow between any two points of the body depends on the resistance between those two points at that time and the amount of voltage or electrical pressure applied. Normally, skin resistance is high. This high resistance tends to impede the current flowing into and out of the body. However, there are several conditions that can lower skin resistance drastically and which permit a larger amount of current to pass through the body with the same voltage applied.

The average body resistance is over 100,000 ohms. However, if the skin is wet from perspiration or other moisture, or if the pulse rate is high, the body's resistance can be as low as a few hundred ohms. Also, if the skin is broken with a cut or an abrasion, a lesser voltage is required at that point to force the same amount of current through the body.

Precautions to be used when working with electronic circuits

1. Practice a precaution used by experienced technicians. Try to keep one hand in your pocket or behind you when you are making voltage and current measurements. If two hands are in contact with the circuit or if one hand is in contact with the circuit and the other hand is in contact with ground (such as a metal panel or the case of a piece of test equipment), the current path is across the chest where the heart and lungs are located. THIS IS EXTREMELY DANGEROUS.

2. Do not work on electronic circuits when the power is on.

3. Electrolytic and other large capacitors can hold a voltage charge for several hours after the power is removed. Make it a habit to check if they are fully discharged by shorting them with a screwdriver with an insulated handle or clip lead before working on a circuit.

4. Do not work on electronic equipment while standing on a damp floor or when leaning on any metal object.

5. Certain components, such as resistors and vacuum tubes, get quite hot. Give them time to cool off before removing them.

6. Know the location of and how to use an available fire extinguisher.

7. Be sure equipment is in proper working order before using it.

Electrical equipment

Electrical equipment is found in nearly every vocational subject area. Students shall be taught the dangers present in electrical equipment and wiring and learn how to protect themselves and others from injury.

Points to remember:

1. All electrical wiring needs to be in compliance with the National Electrical Code.

2. Never use temporary wiring. All extension cords for tools and appliances must be three-wire parallel ground with grounding lug plugs. Do not overload the circuit.

3. Treat all electrical equipment as if it is “live.”

4. Never bypass safety interlocks (i.e., circuit breakers, fuses, etc).

5. Never work on electrical equipment alone; always have someone else nearby.

6. While working on electrical equipment, stand on rubber mats or wooden floors. Wear protective gloves and hat.

7. Use safety light in closed or fume-laden areas. When working in a closed area, or in a place where fumes could collect, one should use only approved, sealed safety lights and explosion-proof equipment. Some explosions in the past haven’t killed anyone, but the bare wires whipping around as a result of the big boom electrocuted those present.

8. Make sure that grounding is proper and complete. Most electrical industrial equipment comes with carefully designed grounding provisions. Most cords use three or four-wire cable to ensure one’s safety by providing a built-in low-resistance path to ground in case of a short circuit. Don’t guess about this. If there is any doubt about the condition or function of any electrical equipment one may have to use, get help from authorized and trained personnel instead of taking a chance.

9. Touching a bare wire, an exposed socket, or a faulty electrical tool or appliance may give a person an electrical shock. Shock hazards also exist inside various types of electronic equipment and around power lines. The possibility of shock is greatly increased if the person is also in contact with a ground surface or if the floor or his/her body is wet.

In attempting to rescue someone who is in contact with an electrical source, one should:

1. Shut off the current quickly.

2. Attempt to move the victim away from the conductor using some sort of insulating material if the current cannot be shut off quickly.

3. Not touch the victim until electrical contact is broken. Use a wooden pole, such as a broom handle, to separate the victim and the conductor. A large cloth, such as a coat, may be used.

4. Move the victim quite a distance from the conductor as a line conductor may cling to the victim.

5. Apply CPR immediately if the victim is not breathing. Speed is essential. In 600 cases studied, 70 percent recovered when artificial respiration was applied within three minutes. Another minute of delay reduced the figure to 58 percent. Five minutes is too long—the chances are slim.

Sure death

Two hundred thirty milliamperes of current flowing through one's body in the region of the heart is well within the band of current flows labeled "SURE DEATH." This is the area where the heart stops pumping and just trembles ineffectually (ventricular fibrillation). Naturally, the effect of current flow on the body varies not only with its intensity, but also with the path it follows.

Effects of electric shock

To get an idea of the effects of so-called "low voltage" shock, let's see what happens when a sixty-cycle alternating current at 110 volts passes through a person from hand-to-hand or hand-to-foot. As the current flow gradually increases, the following effects become apparent:

1. 1 to 8 MILLIAMPERES—a sensation of shock; not very painful. A person can still let go because muscle control is not lost.

2. 8 to 15 MILLIAMPERES—painful shock, but still one can let go. The hazard up through this amount of current flow often comes from the so-called "fright reaction" or recoil when the shock occurs. People have fallen from ladders and other high locations or have bumped their heads hard enough to cause unconsciousness, increasing the possibility of continued current flow; thus prolonging the exposure.

3. 15 to 20 MILLIAMPERES—loss of muscle control begins, and the person cannot let go in spite of the painful shock. At 25 MILLIAMPERES one will be "frozen" to the point of contact. At 20 to 50 MILLIAMPERES—severe muscle contractions include those muscles controlling breathing. In addition to the difficulty in breathing, the victim may be "knocked out."

4. 50 to 75 MILLIAMPERES—almost certain unconsciousness.

5. 75 to 100 MILLIAMPERES—as the current nears 100 MA, the person is almost certain to die. Ventricular fibrillation sets in and the heart no longer circulates blood in the body. Even after the current is cut off, no pulse can be detected. Artificial respiration should be attempted. However, unless a trained physician can restore the natural rhythmic action of the heart by massage or controlled electrical shock treatment, using special equipment usually found only in hospitals, it's almost impossible to save the victim's life. Usually, the maximum time limit for resumption of natural heart function under these circumstances is about six minutes. (Closed heart massage is taught in many first aid courses. This technique, applied by a person trained in its use, may save a life if used prior to the arrival of medical personnel.)

6. 0.20 to 2 AMPERES—this intensity of flow will paralyze the nerves near the diaphragm or the nerve centers at the base of the brain. Breathing will be cut off.

7. 2 AMPERRES and over—the person will suffer severe burns due to "frying" of the body fluids and to external arcing at the point of contact. In addition, internal burns of the slow-healing type will also occur. This latter fact might seem academic under the circumstances, but a peculiar thing sometimes happens when flows of above 10 AMPs occur for very short periods. The severe muscle contractions the person experiences may prevent ventricular fibrillation. After release, if the proper first aid is administered soon enough, he/she might survive if the heart picks up its regular pumping rhythm again.

The tabulation above is a general guide only. Naturally there will be variations due to individual circumstances. The physical condition of the victim may be a factor. But an important thing to remember is that fewer low-voltage victims can be revived than those receiving 1,000 volts or more.

What one must know about electricity

1. If the body becomes part of a circuit, either as the load or as the conductor and the load, a person will get an electrical shock.

2. The body will become part of the circuit if one comes in contact with both a source of potential and a ground while one's total resistance is low enough to allow a flow of current.

3. Current flow is what kills or injures—the voltage only pushes the current through body resistance.

4. Direct current (DC) is generally considered to carry less shock hazard than alternating current (AC) for a given voltage, but it is likely to burn more severely since the arcs from DC are more persistent than those from AC.

5. Body resistance is highly variable, principally because of the changes in skin resistance from one body area to another due to the thickness and amount of moisture on the surface.

6. Electrical energy sources (AC or DC)—operating with an open circuit potential of 30 volts or more, with a capability of delivering 2.5 milliamperes or more into a short circuit—are hazardous to a person.

7. Low voltage (less than 600 volts) can be more dangerous than high voltage. Statistics show that 62 percent of victims recovered after being knocked out by potentials over 1,000 volts; for lower voltages, only 39 percent recovered.

8. The seriousness of electrical shock depends on the balance between several factors: the voltage, the body resistance, the amount of current flow and its path through the body, the duration of contact, and the condition of the body organs in the current path.

9. The most hazardous currents are those in the frequency range from 20 to 100 cycles per second (cps). Currents of higher frequencies are less hazardous because they tend to flow on the surface of conductors rather than through the conductors themselves. High-frequency current will cause electrical shock but to a lesser extent.

10. The current required to operate just one 100-watt light bulb is eight to ten times the amount that is needed to kill a person.

PORTABLE LADDER SAFETY

CONSTRUCTION TRADES
PORTABLE LADDERS (OSHA/NIOSH)

PORTABLE WOOD LADDERS

This section is intended to prescribe rules and establish minimum requirements for the construction, care, and use of the common types of portable wood ladders in order to ensure safety under normal conditions of usage.

Ladder standards—Standards have been established by the American National Standards Institute (ANSI) that covers wood stepladders and extension ladders. Any stepladder or extension ladder with ANSI seal conforms to the standards for wood ladders.

Materials—The following requirements are applicable to all wood parts. They shall be free from sharp edges and splinters and they shall be sound and free (by accepted visual inspection) from shake, wane, compression failures, decay, or other irregularities. Low-density wood shall not be used.

PORTABLE STEPLADDERS

Stepladders longer than 20 feet shall not be supplied. Stepladders as hereinafter specified shall be of three types.

1. TYPE IA—Extra heavy-duty professional—duty rating of 300 pounds.

2. TYPE I—Industrial stepladder, 3 to 20 feet for heavy duty (such as those used by utilities, contractors, and industry)—duty rating of 250 pounds.

3. TYPE II—Commercial stepladder, 3 to 12 feet for medium duty (such as those used by painters, offices, and light industry)—duty rating of 225 pounds.

4. TYPE III—Household stepladder, 3 to 6 feet for light duty (such as light household use)—duty rating of 200 pounds.

The weight of the user—including clothing, tools, and materials—must not exceed the duty rating.

GENERAL REQUIREMENTS

1. A uniform step spacing shall be employed which shall be not more than 12 inches. The steps shall be parallel and level when the ladder is in a position for use.

2. The minimum width between side rails at the top, inside to inside, shall be not less than 11 ½ inches. From top to bottom, the side rails shall be spread at least 1 inch for each foot of length of the stepladder.

3. A metal spreader or locking device of sufficient size and strength to securely hold the front and back sections in open positions shall be a component of each stepladder. The spreader shall have all its sharp points covered or removed to protect the user. For a Type III ladder, the pail shelf and spreader may be combined in one unit.

TYPE IA, I, II, III LADDERS

SINGLE LADDER—Single ladders longer than 3 feet shall not be supplied.

TWO-SECTION LADDER—Two-section extension ladders longer than 60 feet shall not be supplied. All ladders of this type shall consist of two sections; one to fit within the side rails of the other, and both arranged in such a manner that the upper section can be raised and lowered.

SECTIONAL LADDER—Assembled combinations of sectional ladders longer than the lengths specified in this subdivision shall not be used.

TRESTLE AND EXTENSION TRESTLE LADDER—Trestle ladders extension sections, or base sections of extension trestle ladders longer than 20 feet, shall not be supplied.

PAINTER'S STEPLADDER—Painter's stepladders longer than 12 feet shall not be supplied.

MASON'S LADDER—A mason's ladder is a special type of single ladder intended for use in heavy construction work. Mason's ladders longer than 40 feet shall not be supplied.

TROLLEY AND SIDE-ROLLING LADDERS—Trolley ladders and side-rolling ladders longer than 20 feet shall not be supplied.

CARE OF LADDERS

1. Ladders shall be maintained in good condition at all times. The joint between the steps and side rails shall be tight, all hardware and fittings shall be securely attached, and the moveable parts shall operate freely without binding or undue play.
2. Metal bearings of locks, wheels, pulleys, etc., shall be frequently lubricated.
3. Frayed or badly worn rope shall be replaced.
4. Safety feet and other auxiliary equipments shall be kept in good condition to ensure proper performance.
5. Ladders shall be inspected frequently and those which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "DANGEROUS—DO NOT USE."
6. Rungs should be kept free of grease or oil.

USE OF LADDERS

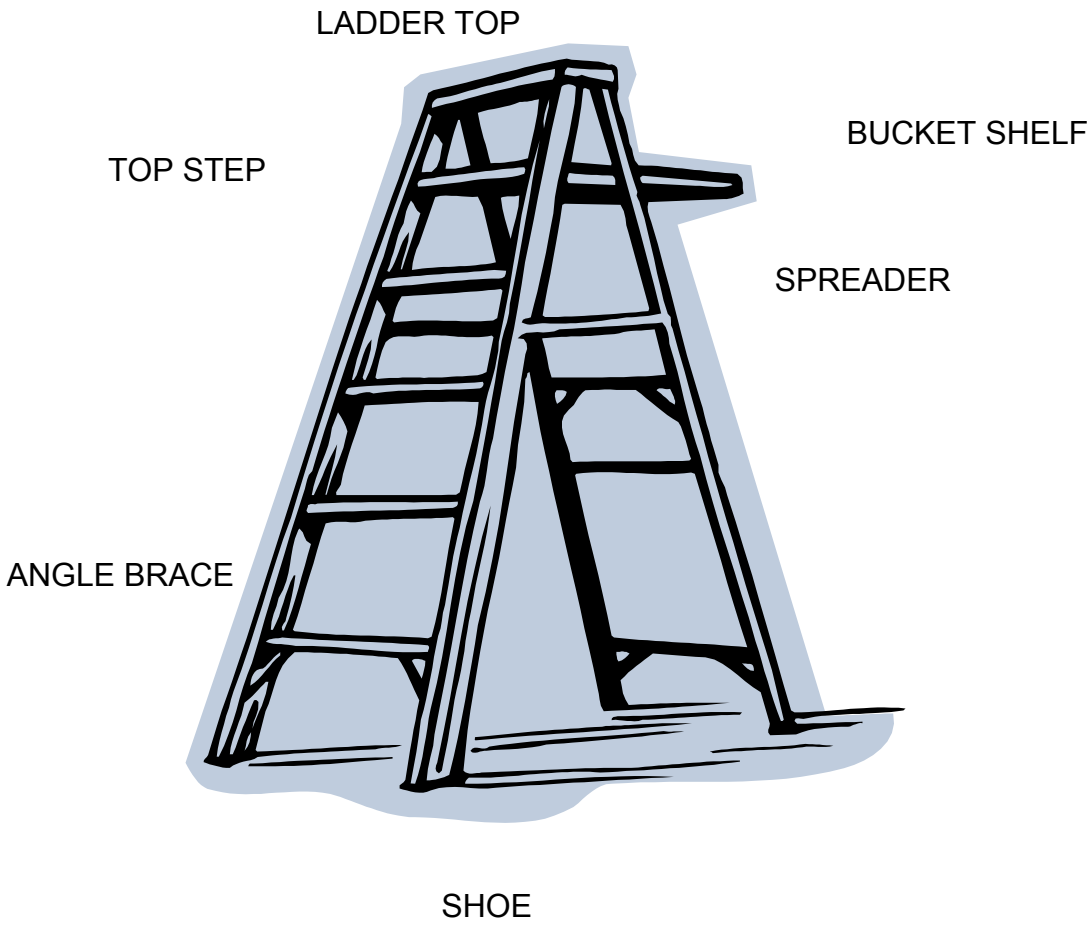
1. Portable rung and cleat ladders shall, where possible, be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one quarter of the working length of the ladder (the length along the ladder between the foot and top support). The ladder shall be so placed as to prevent slipping, or it shall be lashed or held in position. Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds.
2. More than one person shall not use ladders for which dimensions are specified at a time, nor with ladder jacks and scaffold planks where use by more than one person is anticipated. In such cases, specially designed ladders with larger dimensions of the parts should be procured.
3. Portable ladders shall be placed so that the side rails have a secure footing. The top rest for portable rung and cleat ladders shall be reasonably rigid and shall have ample strength to support the applied load.
4. Ladders shall not be placed in front of doors opening toward the ladder unless the door is blocked open, locked, or guarded.
5. Ladders shall not be placed on boxes, barrels, or other unstable bases in order to obtain additional height.
6. To support the top of the ladder at a window opening, a board shall be attached across the back of the ladder, extending across the window and providing firm support against the building walls or window frames.
7. When ascending or descending, the user shall face the ladder.
8. Ladders with broken or missing steps, rungs, or cleats; broken side rails; or other faulty equipment shall not be used. Improvised repairs shall not be made.
9. Short ladders shall not be spliced together to provide long sections.
10. Ladders made by fastening cleats across a single rail shall not be used.
11. Ladders shall not be used as guys, braces, or skids or for other than their intended purposes.
12. The tops of the ordinary types of stepladders shall not be used as steps.
13. On two-section extension ladders, the minimum overlap for the two sections in use shall be as follows:

Size of ladder (feet)	Overlap feet
Up to and including 36	3
Over 36 up to and including 48	4
Over 48 up to and including 60	5

14. Portable rung ladders with reinforced rails shall be used only with the metal reinforcement on the underside. Ladders of this type should be used with great care near electrical conductors, since the reinforcing itself is a good conductor.
15. No ladder shall be used to gain access to a roof unless the top of the ladder shall extend at least 3 feet above the point of support at the eave, gutter, or roofline.
16. Only the user shall make adjustment of extension ladders. This is to be done when standing at the base of the ladder, so that the user may see that the locks are properly engaged. Adjustment of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and should not be attempted. Adjustment should not be made while the user is standing on the ladder.
17. The middle and top sections of sectional or window cleaner's ladders shall not be used for the bottom section unless the user equips them with safety shoes.
18. Extension ladders shall always be erected so that the upper section is resting on the bottom section.
19. The user should equip all portable rung ladders with nonsolid bases when there is a hazard of slipping. Nonsolid bases are not intended as a substitute for care in the safe placing, lashing, or holding of a ladder that is being used upon oily, metal, concrete, or slippery surfaces.
20. The bracing on the back legs of stepladders is designed solely for increasing stability and not for climbing.
21. Hangers should be used for storing ladders horizontally in order to prevent sag and permanent set. At least three should be used for each ladder.

PORTABLE METAL LADDERS (OSHA/NIOSH)

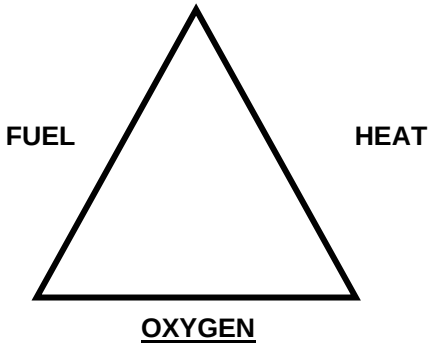
1. Requirements are not part of this section because of the wide variety of metals and design possibilities. However, the design shall be such as to produce a ladder without structural defects or accident hazards—such as sharp edges, burrs, etc. The metal selected shall be of sufficient strength to meet the test requirements and shall be protected against corrosion unless it's inherently corrosion-resistant.
2. The spacing of rungs or steps shall be on 12-inch centers.
3. Rungs and steps shall be corrugated, knurled, dimpled, or coated with skid-resistant material or shall be otherwise treated to minimize the possibility of slipping.


LADDER TOP
BUCKET SHELF
TOP STEP
SPREADER
ANGLE BRACE
SHOE

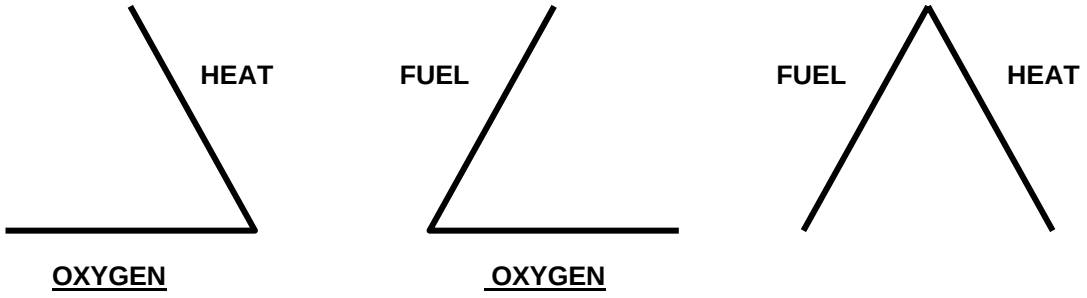
FIRE SAFETY

The Fire Triangle

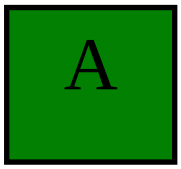
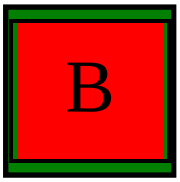
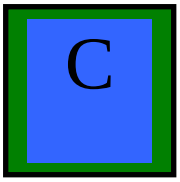
To produce fire, three things must be present at the same time.



If any one of the three is missing, a fire cannot be started; or with the removal of any one element, the fire will be extinguished.



Standard Letter Symbols for Fire Extinguishers

GREEN	RED	BLUE	YELLOW
			
ORDINARY COMBUSTIBLES	**FLAMMABLE LIQUIDS**	**ELECTRICAL EQUIPMENT**	**COMBUSTIBLE METALS**

Distinctive letters, shapes, and colors mark extinguishers according to the classes of fires on which they should be used.

Types of Fire Extinguishers

Dry Chemical extinguishers are usually rated for multipurpose use. They contain an extinguishing agent and use a compressed, nonflammable gas propellant.

Halon or halatron extinguishers contain a gas that interrupts the chemical reaction that takes place when fuels burn. These types of extinguishers are often used to protect valuable electrical equipment since they leave no residue to clean up.

Water extinguishers contain water and compressed gas and should be used on Class A (ordinary combustibles) fires.

Carbon Dioxide ($C0^2$) extinguishers are most effective on Class B and C (liquids and electrical) fires. Since the gas disperses quickly, these extinguishers are only effective from 3 to 8 feet. The carbon dioxide is stored as a compressed liquid in the extinguisher.

This Is Your New ABCDs of Portable Fire Extinguishers

A fire extinguisher is a storage container for an extinguishing agent such as water or chemicals. It is designed to put out a small fire, not a big one.

An extinguisher is labeled according to whether the fire on which it is to be used occurs in wood or cloth, flammable liquids, electrical, or metal sources. Using one type extinguisher on another type fire can make the fire much worse. So learn how extinguishers are labeled and used.

Traditionally the labels A, B, C, or D have been used to indicate the type of fire on which an extinguisher is to be used.

Recently pictograms have come into use. These picture in blue the type of fire on which an extinguisher is to be used. Shown in black with a red slash are pictures of fires on which the extinguisher is not to be used. For example, on a class “A” type, the following symbols would appear:

NFPA 10, Standard for Portable Fire Extinguishers, recommends that extinguishers be labeled with pictograms. However, the user may find the traditional A, B, C, D labels or both the pictograms and the A, B, C, D labels on an extinguisher.

You need an extinguisher at home.

If you plan to buy one extinguisher, a multipurpose dry chemical labeled ABC puts out most types of fires—wood, paper, and cloth, flammable liquid, or electrical fires.

If you buy more than one, you might want to get a BC for the kitchen, an A for the living room, and an ABC for the basement or garage.

Fire extinguishers where you work.

It is *management’s* job to have extinguishers available for use and *your* job to know how they work.

Buying and maintaining an extinguisher.

1. Extinguishers come in dry chemical, foam, carbon dioxide, water or halon types. Whatever type you buy, a testing laboratory should label it.

2. The higher the number rating on the extinguisher, the more fire it puts out. High-rated ones are often (not always) the heavier models. Make sure you can hold and operate the one you buy for home use or be required to use at work.
3. Ask your dealer how to have your extinguisher serviced and inspected. Recharge it after ANY use. A partially used extinguisher might as well be empty.
4. Extinguishers should be installed away from potential fire hazards and near an escape route.

ABCDs

Class A—Extinguish ordinary combustibles by cooling the material below its ignition temperature and soaking the fibers to prevent re-ignition.

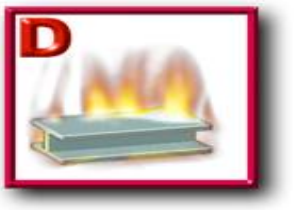
Fires in paper, cloth, wood, rubber, and many plastics require a water-type extinguisher labeled A.

Class B—Extinguish flammable liquids, greases or gases by removing the oxygen, preventing the vapors from reaching the ignition source or inhibiting the chemical chain reaction.

Fires in oils, gasoline, some paints, lacquers, grease in a frying pan or in the oven, solvents, and other flammable liquids require an extinguisher labeled B.

Class C—Extinguish energized electrical equipment by using an extinguishing agent that is not capable of conducting electrical currents.

Fires in wiring, fuse boxes, energized electrical equipment, and other electrical sources require an extinguisher labeled C.



Class D—Extinguish combustible metals such as magnesium, titanium, potassium, and sodium with dry powder extinguishing agents specially designated for the material involved.

Combustible metals such as magnesium and sodium require special extinguishants labeled D.

FIRST AID

Accidents and First Aid

INSIST THAT ACCIDENTS, NO MATTER HOW SMALL,
BE REPORTED TO YOU.

Always fill out a report form and submit it through the proper channels in your district.

1. **WASH OFF AREA**—Wash with water any area that might have something spilled on it.
2. **FLOOD ANY BURNED AREA WITH *COLD WATER***—This will draw the heat away from the burn. Continue to do this until further help can be obtained. You should NOT apply any ointments.
3. **COMPRESS THE WOUND**—All first aid kits should have large sterile pads. After removing any foreign material from a cut, compress it to stop the bleeding. You should NOT apply any ointment or tourniquets.
4. **WASH SPILLS TO THE EYES AND SKIN FOR 15 FULL MINUTES**—Use an eye wash bottle or station and hold the eyes wide open. If eye washes are unavailable then splash water from your hands. If there is any danger from caustics then eye safety glasses should be worn.
5. **DO NOT TREAT MAJOR INJURIES YOURSELF, CALL FOR ASSISTANCE OR 911**—All certificated career and technical education employees maintain a valid CPR and First Aide Card and the records of this requirement be maintained at the local level.
6. **POISON CONTROL CENTER—1-800-456-7707.**

First Aide Certification for the instructors of CTE programs is the local districts responsibility and is a condition of local employment.

GENERAL SAFETY PRACTICES

1.1-1.13 Washington

GENERAL SAFETY PRACTICES

BODY MECHANICS

1. Use proper muscle groups and distribute the workload.
2. Both hands are used to pick up heavier objects.
3. Lifting heavy objects alone is avoided. Help is requested.
4. Pushing is preferred to pulling.
5. Leg muscles are used to lift heavy objects rather than back muscles.
6. Bending and unnecessary twisting of the body for any length of time is avoided.
7. Work is done at the proper level.
8. Two people carry long pieces of materials.
9. Do not lift heavy loads above shoulder level.

PERSONAL PROTECTION

1. Confine long hair so that it is not exposed to machinery and does not interfere with vision.
2. Require the wearing of safety goggles, glasses, or other eye protection when there is a danger of eye injury.
3. Provide respirators for use where harmful dusts or fumes exist (see WISHA rules). ** Respirator use requires appropriate certification, fit testing, and supervision to insure that there is proper fit, training, and inspection are all taking place.
4. Determine the physical defects and limitations of all students so that they will not be assigned tasks detrimental to their health or physical condition.
5. Prohibit the wearing of loose clothing in the laboratory and shop areas.
6. Require students to remove rings and other jewelry while working in the laboratory and shop areas.
7. Where noise levels are excessive over long periods of time, ear protection should be worn.
8. Protective apparel, including safety shoes, aprons, shields, and gloves, are worn properly as required by the nature of the task.
9. Provisions are made for cleaning and sterilizing respirators, masks, and goggles.
10. Head protection is worn in all areas where there is danger of falling and/or flying objects.

FACILITY CONDITION

1. Aisles, machines, benches, and other equipment are arranged to conform to good safety practices.
2. Stairways, aisles, and floors are maintained, clean, dry, and unobstructed with no protruding objects.
3. Walls, windows, and ceilings are clean, maintained in good repair, and free of protrusions.
4. Illumination is safe, sufficient, and well placed.
5. Ventilation and temperature controls are proper for conditions.
6. Fire extinguishers and other necessary fire equipment are properly selected, adequately supplied, properly located, inspected, and periodically recharged as required.
7. Exits are properly identified and illuminated.
8. Lockers and drawers are clean, free of hazards, and doors kept closed.
9. Personnel know the procedures for notification of fire and evaluation of premises.
10. Laboratories and workplaces are free from excessive dust, smoke, and airborne toxic materials.
11. Utility lines and shutoffs are properly identified.
12. Stairways, floor openings, and overhead storage areas are properly guarded with rails and toe boards and have the proper clearances.

HOUSEKEEPING PRACTICES

1. Provide for the storage and daily removal of all sawdust, metal cuttings, rags, and other waste materials.
2. Provide properly marked boxes, bins, or containers for various kinds of scrap stock and rags.
3. Utilize sturdy racks and bins for material storage, arranged to keep material from falling on students and to avoid injuries from protruding objects.
4. Employ a standard procedure to keep floors free of oil, water, and foreign material.
5. Provide for the cleaning of equipment and facilities after each use.
6. Provide regular custodial service in addition to end of class cleanup.
7. Prohibit the use of compressed air to clean clothing, equipment, and work areas.
8. Keep walkways and work areas free of all obstructions.
9. Floor surfaces must be maintained in a “nonskid” condition.
10. Tools and materials are stored orderly and safely.
11. File cabinets and other tall cabinets are required to be anchored.

EQUIPMENT

1. All equipment should be operated in accordance with specifications as stated in the owner's manual.
2. Machines and apparatus are arranged so that operators are protected from hazards of other machines or passing individuals.
3. Point of operation zones are properly identified and guarded.
4. Permanent enclosure guards properly protect pulleys, gears, and belts.
5. Guards are removed only for repair purposes and then replaced immediately.
6. Equipment control switches for each machine are easily available to the operator.
7. Machines are turned off when the instructor is out of the room and/or if the machine is unattended.
8. Proper cleaning equipment is used (avoid air for cleaning purposes).
9. Nonskid areas are maintained around dangerous equipment.
10. A preventive maintenance program is established for all equipment.
11. Machines are guarded to comply with WISHA code.
12. Cutting tools are kept sharp, clean, and in safe working order.
13. All hoisting devices are maintained in a safe operating condition and specified load ratings are easily identified.
14. Machines that are defective or being repaired are clearly marked and made inoperable by locking out the machine power switch.
15. Machines and apparatus are marked with proper color code.
16. Equipment cords and adapters are maintained in a safe working condition.
17. Adjustment and repair of any machine is restricted to experienced persons.
18. Ladders are maintained and stored properly.
19. Machines designated for fixed location are securely anchored.

RECORDKEEPING

1. Always keep an adequate record of accidents and report it through proper channels in your district.
2. An analysis of accidents is made for the purpose of corrective action.

HAND TOOLS

1. Instruct students to select the right tools for each job.
2. Establish regular tool inspection procedures to ensure tools are maintained in safe condition.
3. Instruct students in the correct use of tools for each job.
4. Provide proper storage facilities.
5. Do not lay tools on operating machinery or equipment.
6. Keep tools out of aisles and working spaces where they may become tripping hazards.
7. Do not put sharp objects or tools in pockets. This could result in cuts or being stabbed.

SCAFFOLDS

1. The footing or anchorage for scaffolding is sound, rigid, and capable of carrying the maximum intended load without settling or displacement.
2. Unstable objects such as barrels, boxes, loose bricks, or concrete blocks cannot be used to support scaffold or planks.
3. No scaffold will be erected, moved, dismantled, or altered except under the supervision of the instructor.
4. Guard rails and toe boards will be installed on all open sides of platforms more than 10 feet above the ground or floor.
5. Scaffolds 4–10 feet, having a minimum horizontal of less than 45 inches in either direction, will have standard guardrails installed on all open sides and ends of the platform.
6. Scaffolds and their components will be capable of supporting without failure four times the maximum intended load.
7. All planking of platforms will be overlapped a minimum of 12 inches or secured from movement.
8. An access ladder or equivalent safe access will be provided.
9. Scaffold planking will extend over their end supports not less than 6 inches or more than 12 inches.
10. The use of shore or lean-to scaffolds is prohibited.
11. The poles, legs, or uprights of a scaffold will be plumb and securely and rigidly braced to prevent swaying and displacement.

COLOR CODING

1. **RED**

   Fire. Red shall be used as the basic color for the identification of fire protection equipment and apparatus.

   Stop: Emergency stop bars, buttons, or electrical switches on hazardous machines shall be red.

   Danger: Safety cans and safety signs shall be painted red.

2. **ORANGE**

   Orange shall be used as the basic color for designating dangerous parts of machines or energized equipment. Orange shall be used to emphasize hazards when enclosure doors are open or when gear bolts or other guards around moving equipment are open or removed, exposing unguarded hazards.

3. **YELLOW**

   Yellow shall be the basic color for designating caution and for marking physical hazards. Solid yellow, yellow and black stripes, or checkers (or yellow with suitable contrasting background) should be used interchangeably using the combination that will attract the most attention.

4. **GREEN**

   Green shall be used to designate safety and the location of first aid equipment (other than firefighting equipment).

5. **BLUE**

   Blue shall be the basic color for designation of caution, limited to warning against the starting, use of, or the movement of equipment under repair or being worked upon.

6. **PURPLE**

   Purple shall designate radiation hazards.

7. **BLACK AND WHITE**

   Black, white, or a combination of these two shall be the basic colors for designation of traffic and housekeeping markings.

NOISE CONTROL

The ability to hear is a precious gift. Without it, it is difficult to lead a fully productive life either on or off the job. Noise can destroy hearing, create physical and psychological stress, and thereby contribute to accidents in addition to the obvious cause by making it impossible to hear warning signals. Practical arts and vocational education laboratories and shops are not exempt from noise pollution considerations, particularly if maximization of learning and safety are the goal!

Noise is an unwanted sound. It is a form of energy or vibration that is conducted through the atmosphere. There are four variables that can affect the intensity of noise and its potential danger.

1. The level of the sound, as measured in decibels (dB).
2. The length of time to which one is exposed to the sound.
3. The numbers and lengths of quiet (recovery) periods between periods of sound.
4. Individual sensitivity to or tolerance for sound.

Table 1.1 indicates that workers cannot be exposed to a sound level that exceeds 90dB on the average for an eight-hour day. It should be noted that the standards in this table apply only to work; i.e., day-to-day environments, and schools are typically different. In some cases, however, vocational courses approximate the work situation and, hence, these standards might well apply. Furthermore, it also deserves noting that instructor exposure is often the equivalent of industry despite the fact that student exposure is not. Since hearing is affected by the totality of the noise that one is exposed to, any precautions are appropriate.

Fortunately, noise exposure can be controlled. No matter what noise problems occur in the laboratory and workplace, the technology exists to reduce the hazard. The responsibility to correct noise problems rests on the individuals, i.e., supervisors, teachers, etc., involved. In general, there are three basic ways to control noise.

1. **Source Control**

   The best and most effective approach to control noise is to control it at its source since in this way no further hearing danger is posed and, therefore, other control methods are probably not needed. Techniques of noise source control include:

   a. Reduction of impact noise.
   b. Reduction of the speed of moving and rotating parts.
   c. Reduction of pressures and flow velocities in circulating systems.
   d. Reduction of flow resistance in circulation systems.
   e. Balancing of rotating parts.
   f. Reduction of friction in rotating, sliding, and moving parts.
   g. Isolation of vibration within equipment.
   h. Reduction of the size of the surface radiation areas.
   i. Application of vibration-damping materials to vibrating parts and surfaces.

2. **Path Control**

If source control is not possible, the next best approach is to control the noise along its path. Although such controls limit the number of persons exposed to the noise, they do not always eliminate the noise problem for all persons affected. In path control, noise is blocked or reduced before it is heard. This can be accomplished by:

a. Containing or enclosing the noise.

b. Absorbing the noise along its path.

c. Deflecting the noise away from our ears.

d. Separating the noise from the hearer.

3. **Hearing Protection**

Finally, ear protection equipment is available. This is not as desirable as either source or path control because it affords protection only to those wearing the equipment. Students must be willing to wear hearing protectors whenever they are exposed to potentially dangerous noise. Certain conditions and activities can reduce the effectiveness of the hearing protectors themselves.

TABLE 1.1 PERMISSIBLE NOISE EXPOSURES

Duration per Day in Hours	Sound Level—DBA—Slow Response
8	85
6.2	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

Free safety and health consulting and education services are available from the state of Washington Department of Labor and Industries, Division of Industrial Safety and Health. To contact the Voluntary Services section nearest you, call 1-800-LISTENS.

HEARING PROTECTION

Cotton should not be used as protection against abrasive sound. While a wad of cotton may minimize waves of certain frequencies, it fails to alter the intensity thus providing a false sense of security.

Sound is measured by two fundamental characteristics: frequency (related to pitch) or number of waves per second and intensity level (related to loudness). The human ear reacts to frequencies ranging from 20 cycles per second to about 20,000. Sound at a level of 85 db. begins to lead to a loss of hearing, depending on (1) the intensity, (2) the frequency, (3) the duration of exposure, and (4) individual sensitivity. The following are examples of noise and the approximate db for each.

Busy street traffic at about 100 feet	60 db.
Office tabulating machines (electric typewriter, etc.)	80 db.
20 feet from subway	90 db.
Pneumatic diesel shovel (idling)	90 db.
Diesel shovel (idling)	90 db.
Automatic screw machines	95 to 105 db.
Wire rope stranding machine	102 to 108 db.
Header	103 to 108 db.
Circular saw	105 to 115 db.
Between two compressors	110 db.
Drop hammer (depending on size)	110 to 135 db.
Punch press	112 db.
Between two drills, 20 feet apart	117 db.
Five feet from pneumatic press	130 db.
40 feet from jet engine	138 db.
59 feet from rocket engine	150 db.

EMERGENCY ACTION

Emergency Communications

It is recommended that the following be implemented to ensure proper channels of communication during an emergency:

1. Procedures should be reviewed with the administration and employees to set methods of communication in the event an emergency occurs.
2. Order of notification under the following conditions:
   a. If serious injury (uncontrollable situation)
      —school nurse
      —ambulance
      —principal
      —parents
   b. If serious injury (controlled situation)
      —school nurse
      —principal
      —parents
3. Telephone
   a. Each department should have communication with the building office.
   b. Emergency telephone numbers should be conspicuously posted and the procedure posted for dialing “outside.”
4. A card file should be maintained in each school for all students. This card should include the names and telephone numbers of parents or guardians to be notified in the case of injury.

First Aid

General

All certificated career and technical education employees maintain a valid CPR and First Aide Card and the records of this requirement be maintained at the local level.

Administering

1. Qualified personnel should administer first aid.
2. Do not diagnose illness or prescribe or administer medication of any sort.
3. Disperse crowds if accident is serious and keep the area as quiet as possible.
4. Stick to basic procedures:
   a. Call for aid.
   b. Stop bleeding.
   c. Treat for shock.
   d. Mouth-to-mouth resuscitation (if breathing has stopped).
   e. Cardiopulmonary resuscitation (CPR) (if required).

Transportation

1. Parents shall be notified immediately of all cases of illness or injury. If the student is to be sent home or elsewhere, the parents should arrange for the transportation. The principal should take appropriate action for the best interest of the student.
2. When the injury is serious, do not attempt to move the student except for first aid procedures until professional medical help arrives.
3. If a school is uniquely located where special transportation may be required, procedures should be established at the beginning of the school year.