SAFETY INSTRUCTION HANDBOOK

INDUSTRIAL EDUCATION - ELECTRONICS
ADULT SCHOOL

Table of Contents:

I. GENERAL

1. You are permitted to work with machines and equipment only after you have been given safety instructions. Every machine is dangerous if operated incorrectly. You must be instructed in safe operation.

2. You are not permitted to work with any machine or equipment before, during, or after class hours unless you have received permission and there is an instructor in the shop. Should you be injured, a qualified instructor would be near to assist you immediately.

3. Never remove guards of safety devices from any machine. They always must be used. If, for any reason, a safety guard is removed, or if the machine is defective in any way, the machine must not be used until corrections are made (by proper authorities). Tag the defective machine so other students will not use it.

4. Obtain your instructor's permission before starting any job or operating any power equipment. He may make suggestions that will prevent an accident.

5. Before turning on the power, pick up loose tools and make certain that all other students are clear of the machines or equipment.

6. Clean, oil, or adjust machinery only when it is stopped. Otherwise, some part of your body, clothes, or equipment may become caught in the moving parts, causing injury to yourself or others.

7. Only you, as the operator, may start and stop a machine. Once the machine starts, one person must assume control of it and decide exactly what is to be done.

8. Only the operator and the instructor are permitted within the defined safety zone around any machine. Crowding around a machine distracts the operator's attention and may cause him to be injured.

9. Start your machine and stay with it until you have turned it off. Use caution approaching any power machine to be aware of any part of the machine that is in motion.

10. Do not distract the attention of any student operating a machine. In the event anyone wishes to speak with you, discontinue your work and stop the machine while you are talking. Safe operation of a machine requires concentration.

11. Remove all tools and other objects from the machine and check all adjustments before turning on the power. Unless all adjustments on the machine are securely locked in place before it is started, the vibration may cause these items to slip or change position. Vibration also may cause tools or other loose objects to be drawn into the moving parts, causing personal injury and damaging equipment.

12. Stop any machine before wiping it with rags or waste, in order to prevent catching these items in the moving parts.

13. Never stand in direct line with the "throw" of any machine. If a saw should break or a machine become overloaded, if the stock were not held securely, or if a knot or large sliver should come loose, these objects would be thrown out with terrific force.

14. If you are engaged in any activity in which eye hazards, such as flying particles, corrosive substances, or blinding light exist, you must use suitable eye protection, such as goggles or a face shield. Don't gamble with your eyesight.

15. Before starting to work, tuck in loose clothing and dangling neckties. Use a cap for long hair. These items could be caught in moving parts and draw your hand or body along with them.

16. Become thoroughly familiar with the school's fire signal, fire drill procedures, and fire exits. In case of a fire alarm, turn off all power and flames, walk quietly to the nearest exit, and follow your instructor's directions.

17. To prevent spontaneous combustion, keep all rags containing oil, gasoline, paint, solvents, or any other combustibles in covered metal containers.

18. Never use gasoline near flames, potential sparks, or radiators.

19. Keep the floor, aisles, and passageways clear of stock, materials, scraps, tools, and equipment. Place all scrap material or cuttings in the scrap box provided. Good housekeeping helps prevent accidents.

20. Clean up immediately any liquids or grease spilled on the floor, in order to reduce fire danger and to prevent slip and falls.

21. Do not place articles on windowsills, stepladders, or other high places where there is danger of them falling on someone.

22. Safety procedures prohibit playing, clowning, running, and participating in non-productive activities. "Horseplay" is extremely dangerous. A playful push may cause a fall, resulting in injury from contact with the edge of a bench or part of the machine or other equipment.

23. Consider it your duty to call your instructor's attention to anyone you see violating a safety rule or good safety practice. You may prevent serious injury to yourself or your classmates. In addition, report any defective tool, equipment, or unsafe condition.

24. Inform your instructor at once in case of an accident, however slight. Infection may result from any uncared-for cuts and scratches.

25. If you do not feel well, check with the instructor before using any equipment.

26. Always keep your mind on your work. Inattention may result in a serious accident and years of regret.

27. To lift heavy objects from the floor, squat down and keep your back nearly vertical; use the leg muscles in lifting. This procedure will help prevent an injury. Do not attempt to lift any object heavier than you can handle easily.

28. Carry long pieces of material very carefully. Good safety practice requires that long pieces of material (six feet or more) must be carried with students at each end. Short pieces may be carried by one student if he keeps the front end high enough to avoid striking anyone.

29. Do not move any equipment or material unless you can see clearly there are no obstacles in your path.

II. HAND TOOLS AND BENCH WORK

1. Always pass tools or materials directly to another student, with handles extended. Eyes, hands, or body easily could be injured by thrown articles.

2. Do not leave tools or materials projecting from a vise or workbench where another student may stumble against them.

3. Keep tool handles free from oil or grease in order to prevent them from slipping from your grasp.

4. Avoid using wrenches with cracked, sprung, or worn jaws. A wrench that slips usually causes a painful hand injury.

5. Do not carry sharp-edged tools in your pockets. Your hand may be cut, or you may slip or fall against them.

6. Keep sharp-edged tools sharp. A dull tool is more dangerous than a sharp one because it will slip over and away form the work. A dull tool requires more pressure and is difficult to control, increasing the danger of slips and resultant injuries.

7. Cut away from your body and use sharp-edged tools. A tool facing you could slip, and you could be cut.

8. Do not hold small articles in the palm of the hand while tightening screws with a screwdriver. A slip may cause a painful hand injury.

9. Avoid using files without handles. The tang, or pointed end of the file, is sharp and, if not protected by a handle, may puncture your hand. A puncture is a dangerous wound because it is difficult to clean thoroughly.

10. Grind off mushroomed heads on chisels, hammers, punches, and similar tools before using them. Sharp pieces from a mushroomed tool head may break off.

11. When using a chisel or gouge, hold it with both hands, unless one hand is used to drive the tool with a mallet. Always cut away from the body. Be sure no other person is standing near.

12. Don't lacerate your hand by sliding your fingers along the edges of sheet metal. Sheet metal has razor-sharp edges, burrs, and fish hooks.

13. Do not strike two hardened surfaces together, such as hammer heads or a hammer and anvil face. When hard steel strikes hard steel, a sharp piece of one of the surfaces may fly off like a bullet.

14. Never point an air nozzle at anyone, nor attempt practical jokes with it. You may break an ear drum, blow foreign matter into an eye, or cause other injuries. Do not direct air on any skin cuts.

15. Make certain the guard is installed on the air nozzle so that the nozzle cannot be placed directly against an object or person.

III. SHOP PRACTICE

1. Never work on any electrical conductors or equipment unless supervised by the instructor.

2. Do not increase any fuse capacity or make an illegal connection on electrical equipment. Do not pull fuses while current is turned on.

3. Be sure that interlock systems are in working condition. Never by-pass any safety interlock switches while working on electrical equipment.

4. Never work on wires that are carrying electrical current.

5. Make certain that hands are dry while working on electrical equipment.

6. Do not use cords with defective plugs or worn insulation.

7. Never enter a transformer cage.

8. Wear suitable clothes. Clothes should fit snugly. Anything, such as neckties, jewelry, and gloves that can catch in machinery is prohibited. Keep sleeves rolled up.

IV. ELECTRONIC COMPONENTS

1. Complete the connections to any apparatus before plugging the cord into the power outlet and always turn off the power before changing the connections on any equipment.

2. Keep fingers away from the live metal parts of the test leads.

3. Check the condition of the wire insulation in high voltage circuits. If it is necessary to change the wire, use insulated wire rated for the voltage to be applied.

4. Determine with a voltmeter or other testing devices which side of the live receptacle is at ground potential. Always use polarized plugs on test equipment and test benches.

5. Do not remove the amplifier dust pans or the grills while the current is applied to the amplifier.

6. Turn off the power before working on electronic circuits; then, discharge the high voltage capacitor.
7. When using portable spot welder, always wear approved safety goggles.
8. Never replace resistors and capacitors while the current is turned on.
9. Connect clip leads to high voltage circuits before connecting equipment to the power source.
10. Never make any connections on transformers while the power is turned on.

V. CATHODE-RAY TUBES

1. Do not handle electrically charged or physically hot tubes.

2. Do not pick up a cathode-ray tube by its neck.

3. Dispose of a cathode-ray or fluorescent tube by first sealing it in a carton; then driving a heavy tool, such as a wrecking bar, through the side and at the neck end of the case, knocking off the neck. This precaution will prevent the tube from being intact if it comes into possession of children or curious adults. Playing with the bulb or inhaling the dangerous fumes can cause injuries.

4. Report to the instructor immediately if you receive an injury when a tube breaks, even if the injury appears to be minor. Carefully wash all cuts to remove dirt and particles; some coating materials used on the tubes are poisonous.

5. Store all cathode-ray tubes in closed shipping cartons when not in use. Spare tubes left on a work bench may be damaged.

6. Check the type of tube. Some large cathode-ray tubes have both internal and external bulb coatings which form a capacitor similar to the old Leyden jars. If the tube is removed without discharging it, a shock can result; and the student may then drop the tube, which would implode.

7. Gloves and face shield or goggles should be worn for maximum protection in the event that a tube should implode. Cathode-ray tubes are highly evacuated. Under atmospheric pressure, any mishandling of the tube

may cause it to break or implode, causing sharp particles of glass to scatter with considerable force.

VI. WIRING

1. Do not close a switch on any circuit without authorization from the instructor.

2. Hang "MAN AT WORK" signs on circuits on which work is being done. No one but the person who placed these signs is allowed to remove them.

3. Make changes in the wiring of any circuit only after the power has been shut off.

4. Consider all electric wires live until they have been proved otherwise by some safe method of testing.

5. Use caution in handling live wires of any voltage. Wires carrying as little as 50 volts can cause death under certain conditions.

6. Never test an electric circuit with a knife, metal tool, key, wire, or the fingers. Use test equipment.

7. Never assume that an electric current is off or on. Go to the primary source of power to determine the electrical condition before starting work.

8. Use caution when a circuit breaker opens or a fuse is blown because of a short circuit. Do not close the circuit again until the fault has been located and corrected.

9. Be sure that all equipment is grounded.

10. Be certain that all distribution (power) transformers are grounded in the approved manner before the circuit is energized. Keep ground wires secure.

11. Be sure that all metallic or grounded wiring systems have an equipment ground attached.

12. Use wooden or plastic rulers on switchboard work and with electrical conductors or equipment.

13. Do not remove brushes from running motors or generators.

14. Be sure that all splices and bare wires, which are part of any electrical circuit, have been made electrically and mechanically secure.

15. Do not wear jewelry or metal objects while working on electrical circuits.

16. Use special care while working on or near an open switchboard.

17. Be certain that the ground terminal of the oscilloscope is connected to the ground side of the circuit being investigated. If the ground lead cannot be connected to the oscilloscope, the part of the circuit having the lowest potential above ground should be used.

18. Keep your head and body away from the stock handles while threading pipe or conduit. Use a pan to catch the oil and chips.

19. Stand to the side of your partner while he is bending conduit.

20. Never grasp conduit by the thread.

21. Carry lengths of conduit with their front ends up.

22. Be sure that handles of bending tools are tight.

23. Do not move any permanently placed equipment nor lift equipment without the instructor's permission.

24. Secure all control box covers properly before leaving the job.

25. Do not operate series motors, except ¼ horsepower or less, unless the motor is attached to a load. A series motor will "run way" if it loses its load.

VII. MOTORS, GENERATORS, AND TRANSFORMERS

1. Obtain permission of the instructor before starting or stopping a motor generator set.

2. Be sure that all circuits are properly fused before turning on the power.

3. Be ready to turn off the motor instantly when starting it the first time after a setup.

4. Verify that all breakers, interlocks, fuses, and other safety devices are in operating condition.

5. Adjust the generator to the lowest voltage output before starting a motor.

6. Recheck all wiring before energizing a circuit.

7. Make certain that all distribution (power) transformers are grounded in the approved manner before the unit is energized.

8. Use wire large enough for maximum current flow.

VIII. BLOWTORCH AND PRESTOLITE TORCHES

1. To avoid fires and explosions, be sure that the blowtorch filler cap is tight and that there are no leaks.

2. Turn the valve off tightly when finishing work. Do not breathe the dangerous vapors.

IX. BATTERIES, STORAGE

1. Handle battery or acid with care. Wash immediately with a solution of baking soda and water any part of your skin or clothing that comes in contact with acid. Battery acid will burn skin and destroy clothing.

2. Use a battery lifter to pick up or carry a battery to prevent spilling acid or dropping the battery.

3. Never leave tools lying on top of a battery. They may cause a short circuit and a fire.

4. The gas given off by a battery is explosive; keep open flames and sparks away from the battery.

5. Use proper instruments to test a battery. A battery shorted with pliers or wire may explode.

6. Before connecting or disconnecting lead wires from charger to storage battery, you should turn off the charger to prevent explosion.

7. Keep your face a safe distance away from the battery when testing with a high rate discharge tester, or when removing or installing it. Batteries are subject to explosion at all times.

X. ELECTRIC HAND DRILL

1. Make certain that the drill will not be turned on accidentally while the chuck is being tightened. Otherwise, it may become entangled in your clothing or gouge you. The switch should be in the "OFF" position.

2. Be sure that the electric drill is in the "OFF" position when it is plugged into an electric outlet, in order to prevent anything from being caught by the rotating drill.

3. Use extension cords carefully. Drop the lead wire directly from the wall plug to the floor to avoid hazards of tripping. Inspect the condition of the cord, cap, and body to be sure that the insulation and covering are not broken or worn.

4. Be sure your hands are dry before touching switches or receptacles. Wet hands invite shocks and burns. Do not use the drill while standing on a wet or damp floor.

5. Always hold the switch when operating the drill. Be ready to stop the drill instantly.

6. When using a heavy-duty drill, hold the drill with both hands and brace your body well to avoid injury.

7. Keep your face away from the portable electric drill. If the drill grabs, the handle is likely to swing around.

8. Exercise care when using an extension drill. Support it just above the flutes to keep it from whipping and breaking.

9. Discontinue drilling if electric sparks jump from the point of the drill to the work. This may indicate a problem with electrical grounding.

XI. DRILL PRESS

1. Use the drill press vise, pliers or a clamp to hold the work being drilled to prevent the drill from catching into and throwing the work.

2. Grip the vise firmly while drilling to prevent the drill from breaking or the work and vise from revolving.

3. Lessen the feed pressure as the drill cuts through the work. This will decrease the danger of the drill catching the work and causing it to revolve.

4. Stop the machine immediately if the drill catches in a piece of work, causing it to revolve. Do not touch the work while it is in motion.

5. Always use a sharp drill that has been ground appropriately for the material to be cut. Drills that have been improperly ground may dig into the work and throw it.

6. Operate the drill at the correct speed for the size of the drill and the kind of material. If too much speed is used, or if the drill is forced too rapidly into the material, the drill will break.

7. Remove the chuck key from the chuck and the drift from the spindle before turning on the power to prevent them from flying.

8. Stop the machine before removing work, chips or cuttings. Avoid deep, painful cuts by using a brush to remove chips.

XII. GRINDER AND BUFFER

1. Adjust work rests on grinders and emery wheels as close to the wheel as possible to prevent the work from catching between the rest and the wheel. The gap should not exceed 1/64 inch. Clamp the work rests securely after each adjustment.

2. When grinding work is held in the hands, use special caution to prevent the work form slipping and causing finger injuries.

3. Grind the face of the wheel only, unless the wheel is designed for side grinding. Grinding on the side of the wheel may cause the wheel to break from side tension.

4. Do not hold the tool downward between the wheel and the rest when grinding. Dangerous jamming of the tool and wheel may result.

5. Buff work below the horizontal axis of the wheel in order that the wheel may not throw the work.

6. Stand to one side while the grinding wheel is being faced or started. There is always a possibility that a wheel may break or that particles may fly.

7. Hold small pieces of material with vise grips or a small vise to prevent the work from slipping and becoming jammed in the wheel. Never use pliers.

8. Wear goggles, or a face shield, or look through the safety window while using the grinder.

9. Be sure that the grinding wheel fits the arbor and is tightened securely.

XIII. LATHE

1. Use caution when turning long stock, which extends beyond the end of the lathe. Support it in a manner that will prevent the material from whipping, and tie a piece of cloth to the end of the stock to warn other students.

2. Exercise care while setting up work between centers on a lathe. Make certain that the tail stock is securely clamped before turning on the lathe to prevent the work from flying out.

3. Use chuck blocks or some other form of support while mounting the chuck or removing it from the spindle so as to keep the chuck from dropping on the fingers or feet.

4. When the lathe is in operation, do not touch the work with the hands, wipe it with a rag, encircle it with a piece of emery cloth, or measure it with a micrometer. The work may have dangerous particles.

5. Keep the gear cover closed while operating the lathe to prevent hands or clothing from being caught in the moving parts.

6. Turn the chuck or face plate one complete circle before turning on the power to determine if there is proper clearance of the lathe bed.

7. Remove the cutting tool from the tool holder and move the compound rest toward the tail stock before filing and polishing to prevent injury to hand and arms.

8. Remove the chuck key or wrench immediately after using it to prevent its flying out when the machine is started.

9. Stop the power feed before the tool reaches the jaws of the chuck. This procedure will prevent the tool bit from digging into the work and causing breakage or flying particles.

10. Do not handle the curling chips of metal while the lathe is in motion. The jagged edges of the metal chips may lacerate the fingers, or they may catch the hand and draw it into the work. Use a brush to remove small chips and use a small bar for long, curled chips.

XIV. SQUARING SHEARS

1. Operate the machine alone. If two students are allowed to work on the shears, one might step on the treadle while the other has his foot in the way or his fingers under the knife.

2. Do not use the squaring shears to cut wire, rods, bars, or other stock. The shears are designed to cut sheet metal, and the manufacturer's specifications should be followed as to the gauge of sheet metal that can be cut safely.

3. Apply foot pressure evenly and with necessary force on the treadle of the shears. Jumping on the treadle is dangerous.

4. Return the foot treadle slowly to normal position after finishing a cut. If it is allowed to snap back, the treadle spring may fly off.

5. Be sure that the foot is clear before pushing down on the treadle. When the shears cut through the metal, the treadle comes down to the floor with sufficient force to cause serious injury.

6. Operate squaring shears only from the front or side.

7. Keep your hands in front of the machine; do not reach behind it. There is no guard in the back of the machine.

8. Allow metal stock cut by the squaring shears to drop to a table or the work area behind the shears. It is dangerous to attempt to catch small pieces as they are cut.

9. Keep your fingers away from the blade and all other moving parts.

10. Be sure that pieces of sheet metal to be cut are large enough so that they can be held easily and securely.

11. There is no safe way to cut narrow strips of metal lengthwise; do not attempt it.

12. Cut only one thickness of sheet metal at a time.

XV. SOLDERING

1. Use caution in lighting the gas soldering furnace. Tilt the hood back and stand to one side. Hold the lighted match inside the furnace before turning on the gas.

2. Shut off the gas in the soldering furnace when work is completed.

3. Pass a soldering iron indirectly to another student by placing it on a rest or on the surface of the furnace so that he can pick it up. Never pick up a soldering iron or gun by any part other than the handle.

4. Place the soldering copper in the rack when it is not in use.

5. Secure the soldering copper in a vise when it is necessary to file the tip.

6. Do not allow soldering fluxes to come in contact with the skin, eyes, or clothing. They usually contain harmful chemicals.

7. Report to the instructor immediately in the event of an acid burn.

8. Wipe up promptly any spilled soldering flux.

9. Use liquid fluxes sparingly to avoid spatters.

10. Stand in a position protected from fumes while soldering or tinning a copper.

11. Avoid inhaling the dangerous vapors when using a Prestolite or propane gas for soldering. Turn off the valve tightly when you are finished.

12. Do not strike freshly soldered seams with a hammer or mallet. A pocket of hot liquid solder may spatter.

13. Be careful to not drop molten solder on yourself.

14. If you are soldering above floor or ground level make certain that no one is underneath.

15. To avoid spattering, use caution when wiping off excessive solder.

16. Determine heat of a soldering copper by testing it on a piece of solder. Do not hold it near your face.

17. Do not inhale fumes of fluxes or cleaners.

18. Clean metals only in appropriate acid solutions. Contact with the wrong type of acid may cause spattering and fuming.

19. Keep flammable materials away from any area in which open-flame torches are used.

20. Keep soldering irons away from lacquered insulation.

21. Be sure to test the proper adjustment of air and gas before use of the soldering equipment.

22. Be sure that no gas is escaping while you are using low-pressure gas in a container. The gas can collect in another part of the room and ignite.

23. Turn off the valve when soldering is completed or in case of an accident.

24. Do not knock over or drop a gas container; a dropped container may explode.

25. Do not allow molten metals to come in contact with water or moisture. Such contact may cause an explosion. Do not apply solder to a damp surface.

26. Handle heated metal with care. Hold it firmly with pliers or tongs. Do not pick up metal from the bench with your fingers.

27. Place heated articles on sheets of asbestos, transite, or other insulating materiel.

XVI. SPOT WELDING

1. Wear a face shield or goggles as protection from flying sparks and molten metal.

2. Be sure that other persons nearby are protected from flying sparks.

3. Wear suitable leather gloves while operating a spot welder.

4. Prevent excessive sparks by proper preparation of work and correct setup and operation of the spot welder.

5. Do not rub your fingers across completed spot welds. The welds may be hot or jagged.

6. Prevent burns by not touching the work or the part of the machine that has become heated during the welding operation.

7. Do not bring the electrodes together unless a piece of stock is between them.

8. Shut off the spot welder as soon as all work is completed.

XVII. ETCHING

1. When etching printed circuits, a person must be very careful not to get the etchant on the skin, the clothing, or in the eyes. Protective clothing must be worn.

2. If ultraviolet light is used to expose the chemical resist when making a printed circuit, a person must be very careful not to stare at the ultraviolet light. Staring into the ultra violet light could damage your eyes.

3. Some etching solutions are dangerous because they are acidic. Correct eye protection must be worn when using etching solutions.

4. During the etching process, a person must avoid inhaling the fumes. Never use etchant without proper ventilation.

5. Never pour etchant down the sink or drain. Used etchant should go into a hazardous waste container.

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