OSHA Standard29 CFR 1910.211-.247, Subpart O, Machinery and Machine Guarding, and Subpart P, Hand and Portable-Powered Tools and other Hand-Held Equipment.

Hand Power and Stationary Tool Safety

Preparation

1. Read Applicable Background information and related Company Policy Chapter.
2. Make _____ Copies of this Lesson Plan for Personnel
3. Make Transparency, procure transparency pens, etc.
4. Coffee, tea, snacks

Other:

Material

1. Tools and Personal Protective Equipment the employee is expected to operate

Objective

By the end of this session, personnel shall be able to:

- Identify General Tool Safety Procedures
- Identify hazards associated with portable power tools and stationary power tools.
- Identify different types of portable power tools.
- Explain safety tips that should be utilized when using hand and power tools.
- Describe general safety practices to be used when setting up a work area, selection of personal protective equipment, and utilizing tools at the work site.
- Identify hazards and state precautions taken when using electric powered tools, pneumatic powered tools, and fuel powered tools.
- Identify hazards and state precautions taken when using hand tools, portable power tools, and stationary power tools.
- Perform a “Ring Test” on abrasive grinding wheels

Notes

Background

Tools are such a common part of our lives that it is difficult to remember that they may pose hazards. All tools are manufactured with safety in mind, but a serious accident often occurs before steps are taken to search out and avoid or eliminate tool-related hazards. Workers must learn to recognize the hazard associated with the different tools they use and the safety precautions necessary to prevent those hazards

The misuse of power tools is a source of injury to workers. In many cases injury results because it is assumed that the worker knows how to use the tool or the worker does not pay attention to what he/ she is doing.

Lesson

General Safety Rules

General safety rules apply to both stationary and portable power tools. The following shop safety rules apply to many of the tools which you use:

The Work Area

· Your work area shall be kept clean! Oily rags, dust, and paper are fire hazards and can damage your tools. Place scrap materials in appropriate containers.
· Keep your work area well lit. If you can't see your work, then you can't see a hazard.
· Keep your area dry. Wet floors and work surfaces can cause slips. Water serves as an excellent electric conductor between the ground, you, and your tool!
· Before working with tools that can produce sparks, make sure that the surrounding area is free from ignitable materials.
· Know the locations of fire extinguishers. They shall be the correct type (e.g., A, B, C, D) for the potential fires which could occur in your shop. Also, know where the fire alarm is located and the proper exit route(s) for your work area.

Personal Protective Equipment

· Use protective equipment when necessary. Safety glasses and safety shoes must always be worn in the Machine Shop. Other PPE includes gloves, hard hats, hearing protection, respiratory protection, special protective clothing, and welding masks.

Notes

Personal Protective Equipment (continued)

· Discuss proper safety equipment with your supervisor and the Company Safety Department.
· When operating the overhead crane, hardhats, gloves, safety shoes, and safety glasses must be worn.
· Noise produced by power tools can drown out other sounds in the shop... like a person shouting “STOP!” or “HELP!” Stay alert to your surroundings.
· When cutting certain materials like plastics or epoxies, fumes can be released. Dust is produced when using most every shop tool. To address these potential hazards, discuss the appropriate controls and respiratory protection with your supervisor or Safety Department.

Clothing

· Never wear loose clothing or jewelry that can entangle in power tools. Hand jewelry can serve as a conductor of electricity.
· Tie back long hair.
· Do not wear neckties while working around machinery.

Tools

· Always use the right tool for the job! Forcing a small tool to do a big job causes the tool to strain. A strained tool can kickback or break, causing injury.
· Never use a tool that you are unfamiliar with. Get proper training from your supervisor, the Safety Department, or the tool manufacturer. Read the tool manual for proper use procedures and safety precautions.
· Before each use, inspect your tools. Check the alignment of moving parts, breakage of parts, and cracks.
· When you’re tired, you’re attention span is reduced. Attention to your work is very important when working in the shop. Make sure you’re fit to do the job!
· Disconnect the power source when performing maintenance, cleaning, or changing blades and bits.
· Be wary of dropping tools. Don’t rest a tool on the edge of the workstation. Secure tools when working at heights.
· When using both portable and stationary tools, grip the tool or material being worked-on firmly. Hold tools only by insulated grasping surfaces. The material being worked-on should be well secured.

Notes

Tools (continued)

· Make sure that you are well balanced when operating a tool. Sometimes, a "kickback" from a tool can throw the operator off balance, causing injury.

"Kickback" means an uncontrolled grabbing and throwing of the workpiece toward the front of the saw. Kickbacks can cause severe injury.

· Don't work in an awkward position. You may not have complete control of the tool or the material you are working on.

· Never lock a tool in the ON position if you are working under conditions that require you to stop the tool quickly.

· Guarding is one of the best ways to minimize a hazard. Make sure that machine guards are in place on large and small equipment.

· When cutting materials, try to cut along the grain. This will reduce the chance of kickback or shattering of the material.

Maintaining and Repairing Tools

· Install or repair equipment only if you are qualified. A faulty job could cause serious injuries from mechanical failure, fire, or shock.

· Maintain tools in proper working condition. Regularly inspect tools, cords and accessories. Repair or replace problem equipment immediately. Keep tools sharp, well oiled and stored in a dry place.

· Never alter a tool in a manner that reduces its effectiveness or safety.

Hand Power Tools

Because of the mobility of portable power tools, they can easily come in contact with the operator's body. In addition, the source of power (electric, compressed air, liquid fuel, or explosive cartridge) is in close proximity to the operator, thus creating additional hazards. Typical injuries caused by portable power tools include burns, cuts, eye injury, and sprains. Sources of injury include electric shock, flying objects and particles, fires, falling tools, and explosion of gases. Here are safety precautions to follow when using power tools:

Powered Hand Saws

The main hazard associated with all saws is being cut by the blade. Protection from a rotating or reciprocating blade can be achieved by following these rules:

· Inspect blades regularly. Make sure blades are sharp.

· Keep the saw blades clean. Buildup of material on the blade increases blade friction. This increases the chance of kickback.

Notes

· Make sure that blade guard works properly. Inspect guards frequently to make sure they rotate freely and cover the saw blade when not cutting.
· For circular saws, set the blade depth no more than 1/8 to 1/4 inch greater than the thickness of the material.
· A circular saw shall be started and stopped outside the work. Extra care should be taken at the beginning and end of the sawing stroke to keep the body and cord away from the blade.
· Don't overload the motor by pushing too hard or cutting a heavy material with an inadequate saw.
· Never cut wet wood. Kickback may occur.
· Inspect the material to be cut before cutting. Look for nails, staples, or other foreign objects that could bind the blade or fly off during cutting.

Hand Drills

The rotating drill bit can serve as a hazard in many ways:
· It can break and fly off.
· It can catch the material being worked on, causing the material to rotate freely and hit something or someone.
· The drill can slip and the user can be punctured by the bit. To protect from these drill hazards, employ the following when using drills:
· Use the correct bit for the material. There are special bits for metal, wood, masonry, plastic and other materials.
· Make sure that drill bits are sharp. A dull bit causes the user to press harder on the drill and increases the chance of tool slippage or bit breakage.
· Old bits can get metal fatigue. Replace bits according to the manufacturer's guidelines.

Routers

The shaft and bit of a router can turn very fast and cut very quickly. The hazards are similar to drills but can be more severe. The safety rules listed below should be followed when using routers:
· Always start the router with the cutting edge in contact with the material to be cut.
· When the cutting is complete, turn off the router. Do not lift the router until it has come to a stop.
· The base of the router shall always be kept flat on the work surface.

Notes

Router (continued):

· If available use a chip shield to protect from flying objects.

· Always allow the router to come to full speed before beginning to cut.

Routers operate at speeds of 20,000 RPM, which is 25 times faster than most hand drills.

Soldering Irons

The main hazards associated with soldering irons include burns and toxic fumes. Follow these safety rules when using soldering irons:

· Resting the iron on wood or metal over wood can cause fires. The use of insulated soldering iron holders reduces the fire hazard and chance of burns from accidental contact. The holders should prevent accidental touching of the iron tip.

· Make sure that there is adequate ventilation to remove soldering fumes.

· Lead is harmful if ingested. If lead solder is allowed to accumulate on floors and work surface, it can be tracked home. Keep these areas clean.

Glue Guns

Glue guns can heat glue to very high temperatures. Avoid contact with the tip of the glue gun and the glue itself.

Electric Powered Tools- General Safety

Tools are powered by a variety of sources. Unique hazards exist depending on a tool's power source. This section describes these hazards and safety precautions for electric, fuel, and air (pneumatic) powered tools. Electric shock is the primary hazard from electric powered tools. Most electric shocks from tools have been caused by the failure of insulation between the current-carrying parts and the metal frames of tools.

Double Insulation

Double insulated tools provide reliable shock protection without third-wire grounding. Conventional electric tools have a single layer of functional insulation and are metal encased. Double insulation can be provided by encasing the entire tool, or at least the part of the tool which is handled, in a nonconductive material, such as plastic, which is also shatterproof. The National Electric Code permits double insulation on portable tools and appliances. Double-insulated tools that have been tested by Underwriter's Laboratories carry the square-in-square UL mark.

Notes

Grounding and Ground Fault Circuit Interrupters (GFCIs)

The Ground Fault Circuit Interrupter (GFCI) is a fast-acting device which monitors the flow of current. It monitors for any leakage of current and shuts the power down quickly. When a GFCI is used the current is shut off before a serious shock can occur. Remember, a GFCI shall always be used with electric tools. The third-wire ground of the tool will not totally protect the worker from shock.

To ensure that grounding and GFCI protection is working properly, practice these safety procedures:

· Check all grounding connections regularly for tightness.
· For a good connection, make sure that grounding connections are free of dirt and oil.
· Most GFCIs have a TEST feature. Test the GFCI regularly.
· If you have any doubts about the electrical safety of a tool, contact your supervisor and request an electrician to evaluate the equipment.

If you ever get shocked by a tool DO NOTcontinue to use it!
Repair or replace the tool.

Extension Cords

Faulty or misused extension cords can present serious hazards. Here are some extension cord safety practices:

· Inspect cords regularly. Look for signs of stretching, insulation damage, and kinking.
· Keep cords and cables clean and free from kinks. Kinking can damage both the cord's insulation and internal wire.
· **Never carry a tool by its cord!**
· When using tools which require a third wire ground use only three wire extension cords with three-pronged, grounding plugs and three hole electric outlets.

Never cut off the grounding plug from a cord!

If you see a cord with the grounding plug missing, remove the cord from service.

· Pulling on electric cords can damage the cord insulation and cause electric sparks. Always remove the cord at the plug.
· Extension cords may present a tripping hazard. Make sure that cords are not located in walking paths or a non-trip cover is placed over cords.

Notes

Pneumatic Tools

Pneumatic tools are tools powered by compressed air at pressures of up to 90 psi. Pneumatic impact tools include riveting guns, nail guns, chipping hammers, and jackhammers. Here are some important safety rules to remember when using pneumatic-powered tools:

· The air hose presents hazards similar to electrical cords. The hose can be a tripping hazard so it must be kept out of the way or protected. The hose must be kept clear from the work to prevent damage from the tool. If a hose gets cut and is pressurized, it can whip around and cause injury. A short length of chain attached to the tool and hose can prevent this if the hose coupling breaks.

· Care must be taken to always use hose built for the pressure involved. There have been instances where workmen have put a hand over a pinhole leak and had air forced into a finger by the high pressure.

· Before disconnecting the air hose from the air line, make sure that the air pressure is off and any air pressure inside the line has been released. A safety check valve shall be installed in the air line at the manifold to shut-off the air pressure if a fracture occurs in the hose.

· Pneumatic percussion tools such as air hammers, riveting guns and jackhammers operate by producing heavy impacts or by rapid pulsating motion. This causes a great deal of vibration. Rubber hand grips, air cushion devices, and vibration dampers shall be used where possible.

· Air operated staplers and nailers can cause injury by the accidental firing of the fastener. The fastener can travel at very high velocity and can easily puncture tissue from a good distance. Never point a nailer or stapler at another person. Always be aware of where the fastener is going when you activate the tool.

· In the use of pneumatic chipping tools there is a hazard from flying chips. Operators should wear safety goggles, and, if other employees must be in the vicinity, they be similarly protected. If two employees are chipping in the same area, they shall work back to back so they are chipping away from each other.

· Noise levels from pneumatic tools are usually elevated and should be evaluated to determine if hearing protection is required. OSHA says; at 85 decibels, hearing protection should be offered to the employees, and at 90 decibels, hearing protection is required.

Notes

Fuel Powered Tools

These types of tools can be powered by fuels such as propane or gasoline. The main hazards associated with fuel are flammability and combustion. Certain tools like a propane torch produce a flame, which can burn and serve as an ignition source. The following safety guidelines should be remembered when using fuel powered tools:

· Never work near a source of ignition such as a heating element, fire, or sparks.

· The Safety Committee will determine if fuel powered machinery can be allowed to be used at the Company and a Hot Work Permit may have to be issued. Contact the Safety Office in advance if planning to use any type of fuel powered equipment.

· Avoid working near flammable materials and fuel storage areas like paper boxes, gas and propane tanks, and flammable chemical storage areas.

· Always store fuels in a cool, protected location.

· Fuels like gasoline contain harmful chemicals like benzene. Avoid breathing gasoline vapors. Use respiratory protection if needed.

Stationary Power Tools

Company Stationary Power Tools Include:

Sheet Metal Benders	***Table Saws***
Metal Radial Arm Saws	***Belt Grinders***
Wheel Grinders	***Drill Presses***
Welders	***Band Saws***
Milling Machines	***Lathes***
Sheet Metal Shears	

Many of the safety practices used for portable tools apply to stationary power tools. However, stationary tools tend to be larger, more powerful, and more complex. These factors can lead to serious injuries. Some of the safe practices which we learned in previous sections apply to stationary tools. These are reviewed below, followed by specific safety measures for a variety of stationary power tools:

· Safety devices and guards must always be in place. These devices were designed by the manufacturer to be used with the tool.

· Always keep blades and cutting edges sharp!

· Perform maintenance, accessory changes, and adjustments only when the tool is off and unplugged.

Notes

Safety Measures (continued)

· Don't wear loose fitting clothing. High powered stationary tools can catch clothing and draw the operators body into the tool.
· When using any type of stationary saw, never use gloves. They can get caught in the saw.
· Never put your fingers and hands in front of saw blades and other cutting tools.
· Never turn or feed the material or workpiece at excessive speed. This increases stress on both the workpiece and the machine.
· Because stationary tools tend to be complex, tools from different manufacturer's can vary in safety and operation procedures and precautions. Read the owners manual and safety precautions before using.
· Many stationary tools are equipped with emergency-off switches. Know the location of these switches and the tool power switch.
· Make sure that blades, bits, and accessories are properly mounted. In addition, make sure all locking handles and clamps are tight before using a tool.
· Watch for flying objects. Keep unnecessary personnel away from machines when in use.

Table Saw (Circular Saw)

The circular blade of a table saw moves at very high speed. Employ the following precautions when using this tool:
· Use the saw guard at all times. No operation shall be done with the guards removed.
· Never reach over the saw blade to remove scraps, or to provide support to the workpiece. If you are off-balance, you could fall into the saw.
· Always stand to the side of the saw, and never directly in line with the blade. If the saw catches the material you are working on, the saw will throw it in line with the blade.
· To prevent kickback never use a dull blade and never cut without the guide and splitter guard in place. In addition, don't drop wood on top of the saw blade.
· When cutting, NEVER PULL the workpiece through the saw. Start and finish the cut from the front of the saw.
· Never feed the workpiece from the back of the saw.
· When crosscutting, hold the workpiece firmly against the miter gauge. Make sure that the miter gage works freely in the slot and that it will clear both sides of the blade when tilted. Note that on some saws the miter gage can be used *only on one side* when the blade is tilted.

Notes

Employ the following precautions when the Table Saw: (continued)

· Use a push stick according to the manufacturer's guidelines. In general, when using a push stick or push block, the trailing end of the board must be square. A push stick against an uneven end could slip off or push the work away from the fence. The fence is the stop plate or barrier used to guide the workpiece.

A "Crosscut" is a cutting or shaping operation made across the grain of the wood. A "Rip Cut" (or "Ripping") is a cutting operation along the grain of the wood.

Radial Arm Saw

The radial arm-saw is a very versatile tool and is one of the most used tools in the shop. Because of its ability to cut a variety of ways, it presents a variety of hazards. However, if used properly it can be one of the safest tools in the shop.

Follow these precautions when using this tool:

· Never stand directly behind or in-line with the saw. Stand to either side of the saw.

· The motor/saw assembly must be returned to the rear of the table (against the column) after each cut. Never remove the workpiece from the table until the saw has been returned to the rear.

· When crosscutting, make sure the workpiece is held against the guide fence. This will virtually eliminate kickback.

· It's easy to overload the motor of a radial arm saw. If the motor overloads, check the motor and blades. Don't feed the workpiece too quickly.

· To minimize vibration, the saw should be maintained in good alignment and adjustment.

· When lowering the blade, keep your hands and arms out of the way of the blade!

· When ripping, make sure that the blade rotates toward you and always feed the workpiece under the safety guard from the side opposite to the anti-kickback fingers. When ripping narrow stock, use a push stick to complete the cut.

Band Saw And Jig Saw (Reciprocating Saw)

A main safety concern with the band saw is the breakage of the blade. In addition, because both the band saw and jig saw allow for intricate cuts, the fingers can come close to the saw blade.

Notes

The following rules can minimize injuries from these hazards:

Band Saw

· Always stand to the left of the band saw. In the event of a broken blade, the blade will fly off to the right. If the blade breaks, shut-off the power and stay away from the saw until it stops.
· Care should be taken in uncoiling, removing, and installing the band saw blade. Use gloves. The blade shall be adjusted and tensioned properly.
· The blade guard is very important when using the band saw and jig saw. Keep your fingers away from exposed parts of the blade.
· Follow the manufacturer's guidelines for adjustment of the sliding bar or post. If the guide is too high, the blade will not have the proper support.
· Avoid backing out of the cut. This could push the blade off the wheels.
· Never cut a small radius with a wide blade unless you make relief cuts first.

Jig Saw

· Always install the blade with the teeth pointing down. Adjust the tension according to the manufacturer's guidelines. Turn the pulley over by hand to make sure that the blade operates properly before turning on the power.
· Do not place excess force on the jigsaw blade. It can easily break and fly off.
· Adjust the blade guide and hold down properly.

Wheel Grinders

The chief hazards from wheel grinders are flying pieces of a shattered grinding wheel and being cut by the grinding wheel. Follow these precautions to avoid these hazards:
· Before each use, inspect the grinder to ensure that the grinding wheels are firmly attached and that the work rests are tight.
· Because some grinders can be converted to buffers, guards are often removed. When using the unit as a grinder, always have a guard in-place.
· Always inspect the grinding wheel before use. The wheel should be free of cracks. Grinding wheels shall be ring tested prior to installation.
· Too much pressure on the wheel can cause it to fracture. Spend more time at lighter pressure.
· Always use grinding discs that are marked with a rating speed above the maximum speed of the grinder. Never use an unmarked grinding wheel. Check the spindle speed before mounting the wheel.

Notes

Drill Press

Many of the safety rules of the portable drill apply to the drill press. In addition, follow these rules:

· Always secure the material being drilled.
· When lowering the press, keep hands out of the way of the bit.
· Never use a hand or auger bit. Use bits designed only for the drill press.
· Never try to stop the machine by taking hold of the chuck after the power is off.
· Check to make sure the chuck is secured before turning the drill press on.

Lathes

The lathe is different from the tools presented so far. While most tools rotate or move a blade or bit to cut, the lathe moves the workpiece being cut. If the workpiece is not fastened to the lathe properly or is defective, it can fly off or beak apart, causing injury. To minimize this and others, follow these safety rules:

· Stand to the side of the lathe. This will also minimize the chance of being hit by a tool if it catches.
· The workpiece (especially wood) should be free of cracks, knots, and other defects. Check for weak glue joints.
· Watch out for flying chips and shavings. Always wear safety glasses with side shields. Make sure that anyone in close proximity to the lathe is doing the same.
· Adjust the tool rest as close as possible to the workpiece. Then revolve the stock by hand to make sure that it clears the rest.
· Avoid long nods projecting from the rear of the headstock at high speeds. The whipping action can cause serious injuries.
· Always run the lathe at low speed until the workpiece is rounded.
· Check to make sure that the chuck is secured before turning the lathe on.

Bending Machine ("Brake")

Though the bender is powered by human force alone, the long push arm, counterweight can generate a great deal of force. If body parts get caught in the brake, they can be easily broken or cut-off. It's easy to prevent this and other injuries from occurring. Follow these safety rules when using the brake:

· Never place any body part in the blade area.
· Always check the work area around the brake. Be sure that the area is free from people.

Notes

Follow these safety rules when using the brake: (continued)
· Before using the brake, check the counterweight rods and counterweights to make sure they are secure.
· Never place material in the brake which is too rigid for the capacity of the brake. Overstraining the brake can cause the arm and other parts to break and possibly cause injury.

Welding Machine

CAUTION

Looking at a welding arc can cause "welder's flash". This is caused by ultraviolet light generated by the welding. You will feel like you have sand in your eyes several hours after exposure.

Severe burns can be caused by the high-energy arc of even the smallest of welding machines. When welding, the following precautions must be observed:
· Ideally, welding should be performed in a separate, well ventilated room with a fire-resistant flooring material. If welding is to be conducted in other areas, the area must be free of flammable materials.
· Non-flammable clothing, eye, and hand protection must be worn to protect from molten metal and hot sparks. Eye protection must provide appropriate shading according to the guidelines of the American National Standards Institute (ANSI). Consult the Safety Department for help in determining the correct shade for your operation.

Sheet Metals Shears

When using shears, follow these precautions:
· Keep fingers away from the cutting blade.
· Wear leather gloves when handling sheet metal to avoid cuts from sharp edges.
· Keep objects, other than the piece being cut, away from the blade.

Milling Machine

Milling machines present similar hazards as drill presses and lathes. Follow these general safety rules when using the milling machine:
· Secure the workpiece in a vice or clamp to the table.
· Prevent coolant from getting on the floor.
· Keep fingers from rotating cutters.
· Use appropriate feeds and speeds for the material machined.

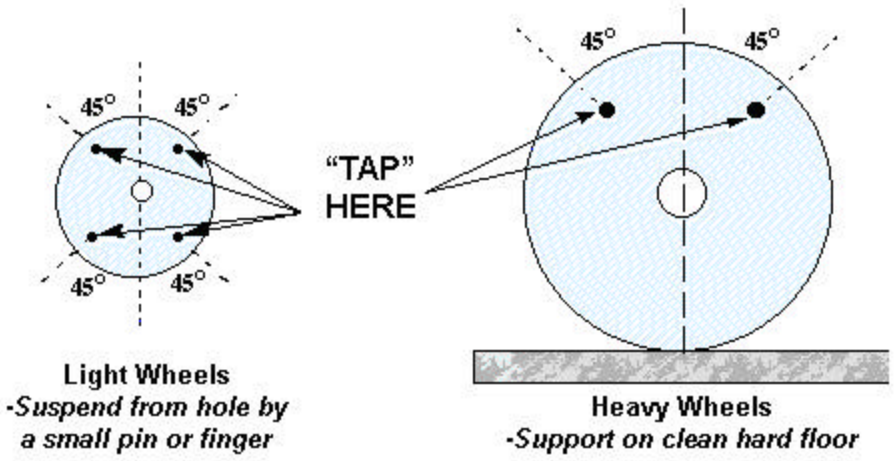
Notes

The "Ring Test" For Abrasive Wheel Grinders

One of the most common and useful tools used both at work and at home is the bench or pedestal grinder. Never take this tool for granted. People have been killed and hundreds seriously injured when a cracked or defective grinding wheel has "exploded."

In addition to a visual inspection of grinding wheels, a "ring test" must be performed to identify any damage that may have taken place during storage or transport. The ring test helps identify defective grinding wheels.

A ring test is conducted by tapping the wheel gently with a light, nonmetallic implement, such as the handle of a screwdriver for light wheels or a wooden mallet for heavier wheels. The wheels should be "tapped" about 45 degrees on each side of the vertical centerline, and about 1or 2 inches from the outer edge of the wheel. Rotate the wheel 45-degrees and repeat the test. An undamaged wheel will give a clear metallic tone. If it is cracked, there will be a hollow, "dead" sound and you will not hear a clear "ring." In this case do not use the wheel!



Notes

Closure

Remember these important points when working in the shop:
· Make sure that equipment is maintained properly. A mis-adjusted tool or a tool in poor condition can be hazardous.
· Don't be afraid to admit that you don't know how to use a tool. To learn about tool use talk to your coworkers and your supervisor, read the tool manual and craftsmen literature, and attend the Company or manufacturer's courses on tool use.
· Respect the tool power source. Whether the power source is electric, pneumatic, or fuel driven.
· Always keep your shop in good "working order".

What questions do you have?

Notes