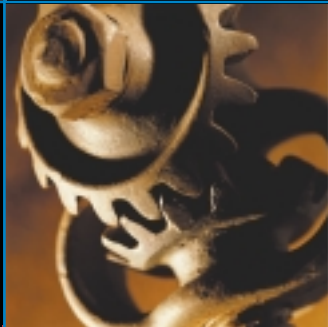


# Safety Manual for **Machine Shops**



**Safety**  
**works!**  
**FOR YOU**

The Ohio Bureau of Workers' Compensation

# Table of Contents

<b>Chapter</b>	<b>Subject</b>	<b>Page No.</b>
	<b>Introduction to the machine shop industry</b>	<b>2</b>
<b>1</b>	<b>Hand tools</b>	<b>3</b>
<b>2</b>	<b>Ladders</b>	<b>4</b>
<b>3</b>	<b>Power tools</b>	<b>6</b>
<b>4</b>	<b>Flammable and combustible liquids</b>	<b>10</b>
<b>5</b>	<b>Welding and cutting</b>	<b>12</b>
<b>6</b>	<b>Compressed gas cylinders</b>	<b>14</b>
<b>7</b>	<b>Personal Protective Equipment (PPE)</b>	<b>15</b>
<b>8</b>	<b>Emergency action plans</b>	<b>18</b>
<b>9</b>	<b>Powered industrial trucks</b>	<b>21</b>
<b>10</b>	<b>Overhead and gantry cranes</b>	<b>27</b>
<b>11</b>	<b>Slings</b>	<b>30</b>
<b>12</b>	<b>Hazard communication standard (HAZCOM)</b>	<b>35</b>
<b>13</b>	<b>Machinery and machine guarding</b>	<b>38</b>
<b>14</b>	<b>Lockout/tagout</b>	<b>43</b>
<b>15</b>	<b>Electrical safety</b>	<b>45</b>
<b>16</b>	<b>BWC Division of Safety &amp; Hygiene services</b>	<b>46</b>

Dear Employer:

Safety Works for You and your employees. After all, the most valuable asset your organization has is its employees. By improving safety and preventing accidents, you can protect your work force while at the same time reducing your workers' compensation costs. And, the Ohio Bureau of Workers' Compensation's (BWC's) Division of Safety & Hygiene is here to help.

BWC published this safety manual to help you improve your workplace safety. Because you have unique safety issues, this manual addresses specific safety needs that you may have. It identifies specific safety issues and highlights solutions you can implement.

However, safety isn't the only thing you can do to reduce your workers' compensation costs. You also can lower your costs by proactively managing your workers' compensation claims. This includes incident investigation, early reporting of injuries and working with your employer services specialist and claims service specialist.

By combining proactive safety strategies with hands-on claims management, you will reduce injuries and lower your workers' compensation costs. Safety works, and it can work for you and your employees.



# Safety Works for Machine Shops

## Introduction to the machine shop industry

Machine shop work generally includes all cold-metal work by which an operator, using either power-driven equipment or hand tools, removes a portion of the metal and shapes it to a specified form or size. Machine tools are power-driven equipment designed to drill, bore, grind, or cut metal or other material.

In addition, according to the National Council on Compensation Insurance's (NCCI's) Scopes of Basic Manual Classifications July 2000, a machine shop is a place of employment that manufactures or repairs machines, as well as general job machining. It may use metal castings, forgings, rods, flats, tubing, angles, pipe and pipe fittings, chains, sockets, gears, shafting, pulleys, hardware, sheet metal and some lumber and paint.

A variety of processes may be involved, including boring, turning, planing, shaping, milling, drilling, punching, grinding, tapping, threading, shearing, bending, forming, riveting, welding, painting, inspecting and testing. Typical machine shop operations consist of sawing, centering, turning, boring, facing, reaming, shaping the nose, heat-treating, thread milling, application of copper bands, washing, painting and packing.

In 1999, the Ohio Bureau of Workers' Compensation's (BWC's) Division of Safety & Hygiene identified machine shops as one of the most hazardous industries in Ohio. This industry now represents one of our top four preferred customers in our effort to reduce and eliminate injuries, illnesses and their resulting costs.

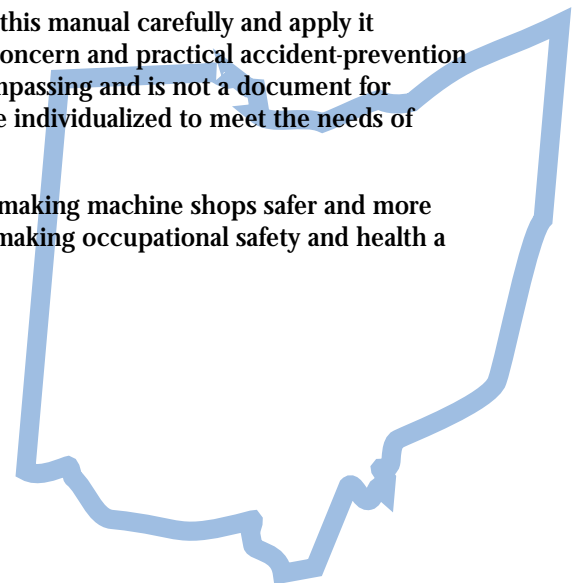
### **BWC's preferred customer plan for machine shops**

The Division of Safety & Hygiene has developed a collaborative-action work team to address high-priority, machine shop concerns. Team members represent a variety of safety and health expertises, particularly in the fields of ergonomics and industrial hygiene.

In our attack on hazards in machine shops, we have developed an operations manual for machine shops. This manual identifies and explains hazardous safety and health workplace concerns, summarizes effective accident-prevention principles and techniques, provides management and employers with information to help them work safely, and enables safety teams to meet their goals and obligations.

We urge employers to consider the contents of this manual carefully and apply it thoroughly. Each chapter addresses a different concern and practical accident-prevention measures. This manual, however, is not all-encompassing and is not a document for compliance. Safety and health programs must be individualized to meet the needs of each workplace.

Our collaborative-action team looks forward to making machine shops safer and more healthful throughout Ohio. Please join BWC in making occupational safety and health a way of life at your machine shop.



## Chapter 1 Hand tools

Hand tools are non-powered tools, including wrenches, hammers, chisels and screwdrivers. While hand-tool injuries tend to be less severe than power-tool injuries, hand-tool injuries are more common.

The most common hand-tool accidents are caused by:

- Failure to use the right tool;
- Failure to use a tool correctly;
- Failure to keep edged tools sharp;
- Failure to replace or repair a defective tool;
- Failure to store tools safely.

### Safety guidelines

- Wear safety glasses whenever you hammer or cut, especially when working with surfaces that chip or splinter.
- Do not use a screwdriver as a chisel. The tool can slip and cause a deep puncture wound.
- Do not use a chisel as a screwdriver. The tip of the chisel may break and cause an injury.
- Do not use a knife as a screwdriver. The blade can snap and injure an eye.
- Never carry a screwdriver or chisel in your pocket. If you fall, the tool can cause a serious injury. Instead, use a tool belt holder.
- Replace loose, splintered, or cracked handles. Loose hammer, axe or maul heads can fly off defective handles.
- Use the proper wrench to tighten or loosen nuts. Pliers can chew the corners off a nut.
- Always chip or cut away from yourself when using a chisel. Use a soft-headed hammer or mallet to strike a wooden chisel handle. A metal hammer or mallet may cause the handle to split.
- Do not use a wrench if the jaws are sprung.
- Do not use impact tools, such as chisels, wedges or drift pins, if their heads are mushroom shaped. The heads may shatter upon impact.
- Direct saw blades, knives, and other tools away from aisle areas and other employees.
- Keep knives and scissors sharp. Dull tools are more dangerous than sharp tools.
- Iron or steel hand tools may cause sparks and be hazardous around flammable substances. Use spark-resistant tools made from brass, plastic, aluminum or wood when working around flammable hazards.

Improper tool storage is responsible for many shop accidents, so:

- Have a specific place for each tool;
- Do not place unguarded cutting tools in a drawer;
- Store knives or chisels in their scabbards;
- Hang saws with the blades away from someone's reach;
- Provide sturdy hooks to hang (or storage area for tools) most tools on;
- Rack heavy tools, such as axes and sledges, with the heavy end down.

# Safety Works for Machine Shops

## Chapter 2 Ladders

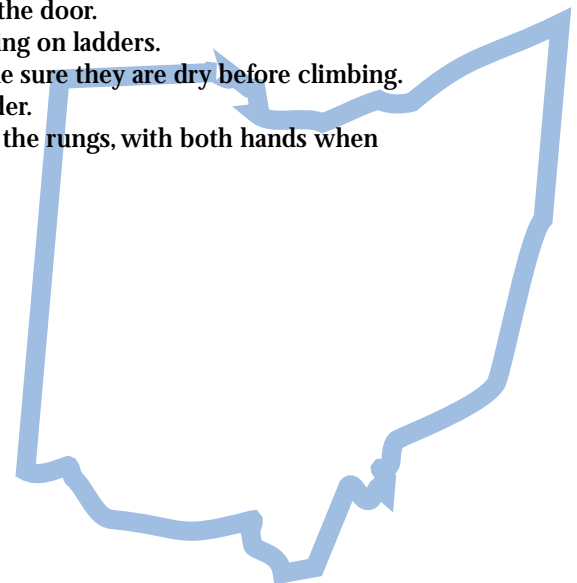
Ladders come in different styles, including step, straight and extension, and they also vary in construction and may consist of wood, aluminum or fiberglass. Choose the correct type and size ladder for the job. Type I or IA ladders are required in the work environment.

All ladders sold within the U.S. are rated as:

- Type I or IA: Heavy-duty industrial ladder rated to hold up to 250 or 300 pounds, respectively;
- Type II: Medium-duty commercial ladder rated to hold up to 225 pounds;
- Type III: Light-duty household ladder rated to hold up to 200 pounds.

### Safety guidelines

- Always inspect a ladder before you climb it. Make sure the steps are sturdy and the locking mechanisms are functional.
- Carry ladders horizontally with the front end slightly higher than the back end.
- To open a stepladder, make sure the spreader is locked and the pail shelf is in position. To open an extension ladder, brace the bottom end and push the rungs or rails out.
- Place ladders on a solid, level surface to ensure safety.
- Watch for overhead obstructions and power lines.
- To prevent ladders from sinking into soft ground, use a large board under the feet of the ladder.
- Position a straight or extension ladder so that the base of the ladder is one foot away from the vertical support for every four feet of working ladder height (e.g., if you are working with eight feet of ladder, place the base of the ladder two feet from the wall).
- Do not place the top of a ladder against a window or an uneven surface.
- Tie the top of a straight or extension ladder to supports when possible. Stake and tie the feet of the ladder.
- An extension ladder used for access to a roof must extend at least three feet beyond the support point.
- Use a wooden or fiberglass ladder if you must work near electrical sources.
- Do not place a ladder in front of a door unless you lock and barricade the door, and post a warning sign on the opposite side of the door.
- Use good judgment when climbing or working on ladders.
- Wear shoes with slip-resistant soles and make sure they are dry before climbing.
- Never allow more than one person on a ladder.
- Face the ladder and firmly grip the rails, not the rungs, with both hands when climbing or descending.



- Keep your body between the rails at all times. Do not shift your weight to one side.
- Have somebody steady the ladder if it cannot be secured otherwise.
- Do not stand on the top four rungs of an extension ladder or the top two rungs of a step ladder.
- Keep two feet and one hand on the ladder at all times when working on a ladder.
- Do not stand on the bucket shelf of a ladder.
- Carry small tools on a tool belt when working on a ladder. Use a rope to raise and lower heavy tools.
- Never leave a raised or open ladder unattended.
- Store ladders away from heat and moisture. Destroy damaged or unsafe ladders.

# Safety Works for Machine Shops

# Safety Works for Machine Shops

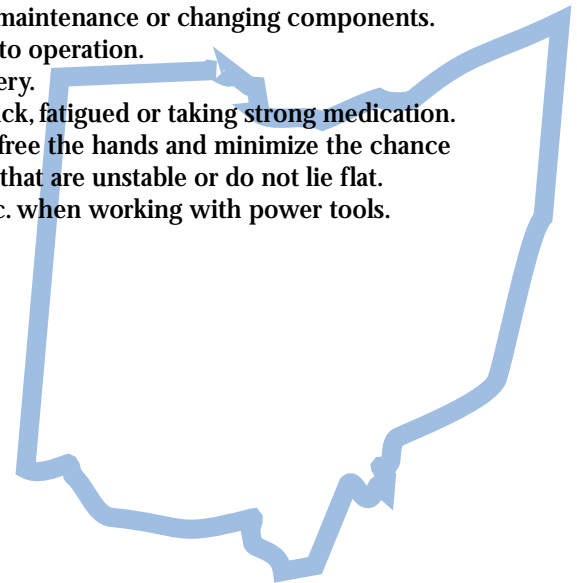
## Chapter 3 Power tools

Common accidents associated with power tools include abrasions, cuts, lacerations, amputations, burns, electrocution and broken bones. These accidents are often caused by:

- Touching the cutting, drilling or grinding components;
- Getting caught in moving parts;
- Suffering electrical shock due to improper grounding, equipment defects or operator misuse;
- Being struck by particles that normally eject during operation;
- Touching hot tools or work pieces;
- Falling in the work area;
- Being struck by falling tools.

### Safety guidelines

- Use the correct tool for the job. Do not use a tool or attachment for something it was not designed to do.
- Select the correct bit, blade, cutter or grinder wheel for the material at hand. This precaution will reduce the chance for an accident and improve the quality of your work.
- Keep all guards in place. Cover exposed belts, pulleys, gears and shafts that can cause injury.
- Always operate tools at the correct speed for the job at hand. Working too slowly can cause an accident just as easily as working too fast.
- Watch your work when operating power tools. Stop working if something distracts you.
- Do not rely on strength to perform an operation. The correct tool, blade and method should not require excessive strength. If you have to use undue force, you may be using the wrong tool or have a dull blade.
- Disconnect from power source before clearing jams or blockages on power tools. Do not use your hand to clear jams or blockages, use an appropriate tool.
- Never reach over equipment while it is running.
- Never disable or tamper with safety releases or other automatic switches.
- Use a push stick to move material through a machine when the chance for operator injury is great.
- Disconnect power tools before performing maintenance or changing components.
- Remove chuck keys or adjusting tools prior to operation.
- Keep bystanders away from moving machinery.
- Do not operate power tools when you are sick, fatigued or taking strong medication.
- Secure work pieces with a clamp or vise to free the hands and minimize the chance of injury when possible. Use a jig for pieces that are unstable or do not lie flat.
- Never wear gloves, loose clothing, jewelry, etc. when working with power tools.





## **Drill presses**

- Securely fasten work materials to prevent spinning. Never use your hands to secure work materials.
- Use a center punch to score the material before drilling.
- Run the drill at the correct speed. Forcing or feeding too fast can break drill bits.
- Never attempt to loosen the chuck unless the power is off.
- Lower the spindle before removing a chuck.
- Never use a regular auger bit in a drill press.
- Frequently back the drill out of deep cuts to clean and cool the bit.
- Secure or anchor portable drills.
- Never wear gloves, loose clothing, jewelry, etc. when working with a drill press.
- Guard the point of operations on all drill presses. This includes the spindle, chuck, and belt and pulley system.

## **Grinders**

- Ensure that no combustible or flammable materials are nearby that sparks from the grinder wheel can ignite.
- Ensure that a guard covers at least 270° of the grinding wheel on bench-mounted machines.
- Place the upper peripheral guard (tongue guard) one-fourth inch above the grinding wheel for bench or pedestal grinders.
- Place the grinder tool rest one-eighth inch from the wheel and slightly above the center line.
- Allow the grinder to reach full speed before stepping into the grinding position. Faulty wheels usually break at the start of an operation.
- Grind on the face of the wheel, unless otherwise designed.
- Use a vise-grip plier or clamp to hold small pieces.
- Slowly move work pieces across the face of wheel in a uniform manner. This will keep the wheel sound.
- Do not grind non-ferrous materials.
- Periodically check grinder wheels for soundness. Suspend the wheel on a string and tap it. If the wheel rings, it is probably sound.
- Replace wheels that are badly worn or cracked.
- Never use a wheel that has been dropped or received a heavy blow, even if there is no apparent damage.
- Before using a new wheel, let it run a few seconds at full speed to make sure it is balanced.
- Secure or anchor in place, pedestal or bench grinders.
- Never wear gloves, loose clothing, jewelry, etc. when working with grinders.
- Use a faceshield in addition to eye protection when using a grinder for any operation.

# Safety Works for Machine Shops

## Lathes

- Examine wood for knots and other defects before placing it in the lathe.
- Ensure that glued materials are set before placing them in the lathe.
- Assure that appropriate chuck guards and chip guards are in place prior to starting the machine.
- Slowly turn rough materials a few times to ensure they will clear the tool rest before turning the lathe on.
- Keep hands off the chuck rim when the lathe is moving.
- Hold all wood cutting tools firmly with two hands. (Not necessarily true in all cases.)
- Start all jobs at the lowest speed. Ensure that materials are in a cylindrical form before advancing to higher speeds. Never turn large diameter materials at a high speed.
- Firmly screw faceplate work to the faceplate. Take care to avoid cutting too deep and hitting the screws.
- Do not cut too deep or scrape too long.
- Remove the “T” rest when sanding or polishing.

## Safety guidelines for metal lathes

- Make sure that all gear and belt guards are in place.
- Never leave a chuck wrench in a chuck.
- Keep your hands off chuck rims when a lathe is in operation.
- Do not attempt to screw the chuck onto the lathe spindle with the power on, as it may get cross-threaded and cause injury. Stop the machine, place a board under the chuck, and then screw on by hand.
- Properly adjust steady rests to conform with the material being worked on.
- Always face the head stock and chuck when filing work in a lathe.
- See that tailstock, toolholder and work are properly clamped before turning on power.
- Never attempt to adjust a tool while the lathe is running.
- Never apply a wrench to revolving work or parts.
- Always use a brush to remove chips; never your hands.
- Use pipe sleeves to cover work protruding from the end of the lathe when possible.
- Remove the tool bit before you remove your work from the lathe.



## **Pneumatic fastening tools**

Nail guns and air guns are powered by compressed air. The main danger associated with pneumatic fastening tools is injury from one of the tool's attachments or fasteners.

- Ensure that pneumatic tools that shoot nails, rivets or staples are equipped with a device that keeps fasteners from ejecting unless the muzzle is pressed against a firm surface.
- Never point a tool at items you do not want to fasten.
- Keep your finger off the trigger until you are ready to begin work. Most pneumatic tools have a hair-trigger that requires little pressure to activate the gun.
- Treat air hoses with the same care as an electrical cord.
- Do not drive fasteners into hard, brittle surfaces or areas where the fastener may pass through the material and protrude on the other side.
- Train all operators of pneumatic fastening tools according to the manufacturers' guidelines prior to operation of the equipment.

## **Forging machines**

Once punchers, shears and benders are activated, it is impossible to stop them until the end of a cycle. Use extreme care when working with these tools.

- Maintain all forge shop equipment in a condition that will ensure continued safe operation.
- Position or install all hammers so they remain on or are anchored to foundations sufficient to support them according to applicable engineering standards.
- Make die keys and shims from a grade of material that will not unduly crack or splinter.
- Clearly identify and make readily accessible all manually operated valves and switches.
- Make sure every steam or air hammer has a safety cylinder head to act as a cushion if the rod breaks or pulls out of the ram.
- Air-lift hammers must have a safety cylinder head.

When dies are being changed or maintenance is being performed on the press, ensure that the:

- Power to the press is locked out and tagged out;
- Verify that all energy sources are at a zero energy state;
- Flywheel is at rest;
- Ram is blocked with a material of the appropriate strength;
- Upsetters are installed so they remain on their supporting foundations.

# Safety Works for Machine Shops

## Chapter 4 Flammable and combustible liquids

Statistics indicate that more than 21 percent of industrial fires and 15 percent of office fires start with the ignition of a flammable or combustible liquid. Contributing factors include:

- Lack of a fire prevention program;
- Improper container storage;
- No storage limits;
- Inadequate employee training;
- Inadequate bonding and grounding procedures;
- Lack of interaction with local emergency management agencies;
- No preventive-maintenance program for emergency equipment and devices;
- No procedures to control ignition sources during maintenance and contractor activities;
- No established hot work procedures, and a no-smoking policy.

Flammable and/or combustible liquids are substances that catch fire and burn easily. Flammable liquids continue to burn even after ignition sources are removed from the source.

The flammability of a combustible liquid is determined by the following factors:

- Flash point — the lowest temperature at which vapors or gases will ignite;
- Fire point — the temperature at which a combustible liquid gives off vapors that will ignite;
- Minimum concentration of extinguishing agents needed to extinguish the fire;
- Combustion rate;
- Temperature increase during combustion.

Employees need to know the various sources that might ignite flammable liquid vapors. They include, but are not limited to the following:

- Open flames;
- Electrical switches;
- Open motors;
- Static electricity;
- Smoking;
- Friction and mechanical sparks;
- Heat guns;
- Cutting and welding;
- Radiant heat.



Standard operating procedures should limit the amounts of any given flammable liquids stored on-site and in the work area. Develop storage strategies by considering daily usage requirements, storage capacity and delivery time. Permit only a limited amount of flammable liquids outside approved storage areas or containers. Limit the amount of flammable liquids outside an approved storage container or room to the following: 25 gallons of Class IA, 120 gallons of Class IB, IC, Class II, or Class III. Permit no more than one day's supply of combustible/flammable liquids in spraying areas.

Only trained and authorized employees should handle and dispense flammable materials. Containers must be properly labeled, designed for flammable liquids and equipped with flame arrestors. When flammable liquids are dispensed from containers, the containers will be effectively bonded and grounded. No smoking signs should be in place where flammable liquids are stored or being used for operations.

Incorporate general exhaust ventilation for storage locations housed inside facilities. The ventilation system should include low-level venting, approximately 12 inches above the floor level. Federal safety standards require six room-air changes per hour.

### **Hazard communication standard**

According to the Occupational Safety and Health Administration's (OSHA's) hazard communication, employers will conduct an inventory of all chemicals in their facility and obtain material safety data sheets (MSDS) for each chemical identified. In addition, employers should develop a written plan that identifies specific standard procedures for handling chemicals, storage of chemicals and required protective equipment. Employers and employees should verify that all containers are labeled properly. Employers also are required to provide training for each employee regarding the safety handling of the chemicals in their work environment.

- Follow the instructions on the label and in the MSDS for each chemical product used in your workplace.
- Use personal protective clothing or equipment, such as neoprene gloves, rubber boots, shoe covers, rubber aprons and protective eyewear, when using chemicals labeled flammable, corrosive, caustic or poisonous.
- Do not use protective clothing or equipment that has split seams, pin holes, cuts, tears or other signs of visible damage.
- Always wash your hands with soap and water after using cutting fluids or solvents.
- Each time you use your gloves, wash your gloves before removing them, using cold tap water and normal hand washing motion. Always wash your hands after removing your gloves.
- Only dispense liquid labeled flammable from its bulk container located in areas posted flammable liquid storage.
- Do not use chemicals from unlabeled containers.

Do not perform hot work, such as metal cutting or other spark producing operations, within 50 feet of containers labeled flammable or combustible.

# Safety Works for Machine Shops

## Chapter 5 Welding and cutting

Welding and cutting are two forms of hot work that require special safety considerations. Unless they are done in a designated shop area, welding and cutting are strictly prohibited without proper authorization.

Before conducting welding or cutting operations, make sure:

- Welding leads are completely insulated and in good condition;
- Cutting tools are leak-free and equipped with proper fittings, gauges, regulators and flow and flashback devices;
- Oxygen and acetylene tanks are secured in a safe place.

In addition:

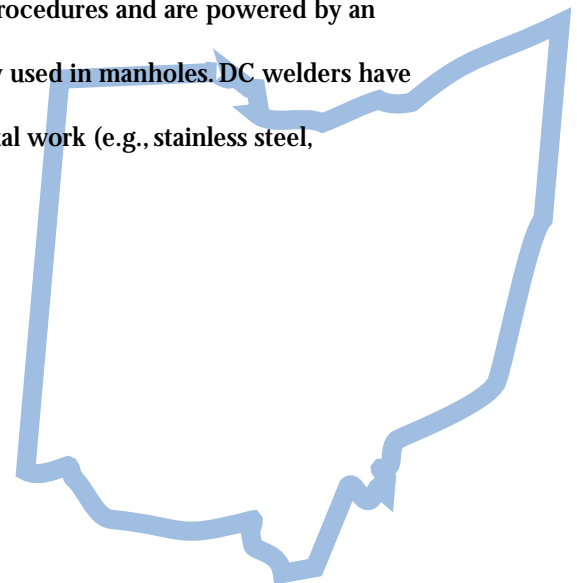
- Conduct welding and cutting operations in a designated area free from flammable materials. When welding or cutting is necessary in an undesignated or hazardous area, obtain a hot work permit from management and have someone nearby act as a fire attendant. The permit should include a review and inspection of work area by supervisor, ensure a fire extinguisher is in the vicinity, a 30-minute fire watch should be in place during and after work is completed. All combustible/flammable liquids removed or covered;
- Periodically check welding and cutting areas for combustible atmospheres;
- Take care to prevent sparks from starting a fire;
- Remove unused gas cylinders from the welding and cutting area;
- Keep hoses out of doorways and away from other people. A flattened hose can cause a flashback;
- Mark hot metal with a sign or other warning when welding or cutting operations are complete.

### Welding guidelines

Proper selection of personal protective equipment (PPE) is important when welding. Make sure the welding helmet visor is dark enough to provide adequate protection. Wear fireproof apron and gloves. In addition, protect other people from the hazards of welding. For example, use a welding curtain to protect other employees from UV radiation.

There are three types of welders:

- AC welders are used for standard welding procedures and are powered by an electrical cord;
- DC welders are portable welders commonly used in manholes. DC welders have their own power supply;
- Wire-feed welders use inert gas for light metal work (e.g., stainless steel, aluminum, etc.).



Common hazards associated with welding include:

- Electrocutation;
- Burns;
- UV radiation exposure;
- Oxygen depletion;
- Sparking.

In addition to the general guidelines for welding and cutting:

- Make sure the welding area has a nonreflective, noncombustible surface;
- Ensure that adequate ventilation and exhaust are available;
- Be aware of electrocution hazards, particularly in damp conditions. Be sure that electrical cords are properly grounded. Use cords that pull down from an overhead pulley;
- Use welding curtains or welding screens to protect and shield other workers, and visitors from UV rays.

### **Cutting guidelines**

Oxygen or acetylene gas cylinders usually power gas welding and cutting tools.

These tanks require special safety precautions to prevent explosions and serious injuries.

- Ensure that acetylene/oxygen systems are equipped with flame or flashback arrestors.
- Store acetylene bottles upright and secured.
- Keep cylinder fittings and hoses free from oil and grease.
- Repair or replace defective hoses by splicing. Do not use tape.
- Do not tamper or attempt to repair cylinders, valves or regulators.
- Do not interchange regulators or pressure gauges with other gas cylinders.
- Carefully purge hoses and torches before connecting a cylinder.
- Set acetylene pressure at or below 15 psig. Always use the minimum acceptable flow rate.
- Never use a match to light a torch. Use an approved lighter.
- Do not store oxygen and fuel gas together. Safety standards require oxygen and fuel gas to be separated by at least 20 feet or by a noncombustible barrier at least five-feet high having a fire resistance of at least one-half hour.
- According to the American National Standards Institute (ANSI) Z49.1:1999, cylinder storage refers to cylinders of compressed gas standing by on the site (not those in use or attached ready for use).
- Cylinder in use — refers to cylinders connected for use, a single cylinder for each gas to be used, in the use location, ready to be connected, or a one-day supply of cylinders, in the use location, ready to be connected.
- Cylinders in storage will be separated from flammable and combustible liquids, and from easily ignited materials, such as wood, paper, packaging materials, oil and grease.

# Safety Works for Machine Shops

## Chapter 6 Compressed gas cylinders

The in-plant handling, storage and use of all compressed gases in cylinders, portable tanks, rail tank cars or motor vehicle cargo tanks will be in accordance with the Compressed Gas Association Pamphlet P-1-1965.

- Do not handle oxygen cylinders if your gloves are greasy or oily.
- Store all compressed gas cylinders in the upright position.
- Place valve-protection caps on compressed gas cylinders that are in storage or are not being used.
- Do not lift compressed gas cylinders by the valve-protection cap.
- Do not store compressed gas cylinders in areas where they can come in contact with chemicals labeled corrosive.
- Hoist compressed gas cylinders on the cradle, slingboard, pallet or compressed gas cylinder basket.
- Do not place compressed gas cylinders against electrical panels or live electrical cords where the cylinder can become part of the circuit.

### Compressed air used for cleaning

Do not use compressed air for cleaning equipment unless the pressure for the equipment is reduced to 30 psi or less and proper protective equipment is in place.

Employees should never use compressed air to clean or blow debris from their person.





## Chapter 7

### Personal protective equipment (PPE)

Engineering controls that eliminate the hazard at the source offer the best and most reliable means of safeguarding. But whenever engineering controls are not available or fully capable of protecting employees, they must wear protective clothing or PPE. Employers are required to perform a PPE hazard assessment for their workplace and determine if PPE is required. If PPE is required, employers will identify each type of PPE required and the specific task or operations that requires the use of PPE. The employer will certify and date the assessment. In addition, the employer must provide training to each employee on the specific type of PPE required in the work environment.

To provide adequate protection, protective clothing and equipment must always be:

- Appropriate for the particular hazards;
- Maintained in good condition;
- Properly stored when not in use, to prevent damage or loss;
- Kept clean, fully functional, and sanitary.

#### Eye protection

Make sure that employees use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.

Ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) meeting the pertinent requirements are acceptable.

Employees who wear prescription lenses while engaged in operations involving eye hazards should wear eye protection that incorporates the prescription in its design, or wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses. Protective eye and face devices purchased after July 5, 1994, will comply with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection."

#### Hearing protection

Administer a continuing, effective hearing conservation program whenever employee noise exposures equal or exceed an eight-hour time-weighted average sound level (TWA) of 85 decibels measured on the A scale (slow response) or, equivalently, a dose of 50 percent. For purposes of the hearing conservation program, compute employee noise exposures in accordance with appropriate references, and without regard to any attenuation provided by the use of personal protective equipment.

Make hearing protectors available to all employees exposed to an eight-hour time-weighted average of 85 decibels or greater at no cost to the employees. Replace hearing protectors as necessary.

# Safety Works for Machine Shops

## **Respiratory protection**

The primary objective in controlling occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smoke, sprays or vapors is to prevent atmospheric contamination. This should be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, use appropriate respirators.

Develop and implement a written respiratory protection program with required work site-specific procedures and elements for required respirator use. A suitably trained program administrator must administer the program. In addition, certain program elements are required for voluntary use of respirators to prevent hazards associated with respirator use. Requirements include fit-testing, employee training, including maintenance, cleaning and care, respirator limitations, and verification that the respirator will protect against contaminant of concern.

## **Head protection**

Ensure that affected employees wear protective helmets when working in areas where there is a potential for injury to the head from falling objects. Make sure the helmet is designed to reduce electrical shock hazard when exposed to electrical conductors that could contact the head.

## **Foot protection**

Make sure affected employees use protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. Protective footwear should be marked to indicate that they meet ANSI Z41.1 standard for protective footwear.

## **Hand and finger protection**

Select and require employees to use appropriate hand protection when their hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns and harmful temperature extremes.



# Safety Works for Machine Shops

## **Housekeeping**

Keep all places of employment, passageways, storerooms, and service rooms clean and orderly and in a sanitary condition.

Maintain every workroom floor in a clean and, so far as possible, a dry condition. Where wet processes are used, maintain drainage and provide false floors, platforms, mats, or other dry standing places where practicable.

To facilitate cleaning, keep every floor, working place and passageway free from protruding nails, splinters, holes or loose boards.

Where mechanical handling equipment is used, allow sufficient safe clearances (a minimum of three feet) for aisles, at loading docks, through doorways and wherever turns or passage must be made. Keep aisles and passageways clear and in good repairs, with no obstruction across or in aisles that could create a hazard. Appropriately mark permanent aisles and passageways.

Provide covers and/or guardrails to protect personnel from the hazards of open pits, tanks, vats, ditches, etc.

# Safety Works for Machine Shops

## Chapter 8 Emergency action plans

The emergency action plan should be in writing and cover designated actions employers and employees must take to ensure employee safety from fire and other emergencies. Employers with 10 or fewer employees, can communicate the plan orally to employees.

Include these elements, at a minimum, in the plan:

- Emergency escape procedures and emergency escape route assignments;
- Procedures to be followed by employees who remain to operate critical plant operations before they evacuate;
- Procedures to account for all employees after emergency evacuation has been completed;
- Rescue and medical duties for those employees who are to perform them;
- The preferred means of reporting fires and other emergencies;
- Names or regular job titles of persons or departments who can be contacted for further information or explanation of duties under the plan.

Establish an employee alarm system that complies with appropriate regulations. If the employee alarm system is used for alerting fire brigade members, or for other purposes, use a distinctive signal for each purpose.

Establish in the emergency action plan the types of evacuation to be used in emergency circumstances. Before implementing the emergency action plan, designate and train a sufficient number of persons to assist in the safe and orderly emergency evacuation of employees.

Review the plan with each employee covered by the plan under the following circumstances:

- When the plan is developed;
- Whenever the employee's responsibilities or designated actions under the plan change;
- Whenever the plan is changed.

Review with employees upon initial assignment those parts of the plan that they must know to protect themselves in an emergency. Keep the written plan at the workplace, and make it available for employee review. Employers with 10 or fewer employees may orally communicate the plan to employees.



## **Fire prevention plan**

Maintain a written fire prevention plan, except for employers with 10 or fewer employees, who may orally communicate the plan to employees.

Include these elements, at a minimum, in the fire prevention plan:

- A list of the major workplace fire hazards and their proper handling and storage procedures, potential ignition sources (such as welding, smoking and others) and their control procedures, and the type of fire protection equipment or systems which can control a fire involving them;
- Names or regular job titles of those personnel responsible for maintenance of equipment and systems installed to prevent or control ignitions or fires;
- Names or regular job titles of those personnel responsible for control of fuel source hazards.

Control accumulations of flammable and combustible waste materials and residues so they do not contribute to a fire emergency. Include housekeeping procedures in the written fire prevention plan.

Apprise employees of the fire hazards of the materials and processes to which they are exposed. Review with employees upon initial assignment those parts of the fire prevention plan they must know to protect themselves in an emergency. Keep the written plan in the workplace, and make it available for employee review. Employers with 10 or fewer employees may communicate the plan orally to employees.

Regularly and properly maintain, according to established procedures, equipment and systems installed on heat-producing equipment to prevent accidental ignition of combustible materials. Include maintenance procedures in the written fire prevention plan. Identify fire extinguishers and free them from obstruction. Inspect extinguishers visually in-house on a monthly basis and annually by an outside service company. Train any employee designated to use a fire extinguisher on an annual basis.

## **Exhaust ventilation system**

Make sure the system for removing contaminated air from a space comprises two or more of the following elements: enclosure or hood, duct work, dust-collecting equipment, exhauster and discharge stack. The construction, installation, inspection and maintenance of exhaust systems must conform to the principles and requirements in American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960, and ANSI Z33.1-1961.

# Safety Works for *Machine Shops*

## **Materials handling and storage**

If using mechanical handling equipment, allow sufficient safe clearances for aisles, at loading docks, through doorways and wherever turns or passage must be made. Keep aisles and passageways clear and in good repair, with no obstruction across or in aisles that could create a hazard. Mark permanent aisles and passageways appropriately.

Do not allow storage of material to create a hazard. If bags, bundles and other containers are stocked, stack, block and interlock in tiers with limited height so that they are stable and secure against sliding or collapse.

Keep storage areas free from accumulation of materials that constitute hazards from tripping, fire, explosion or pest refuge. Control vegetation when necessary.

Provide signs to warn of clearance limits.

Provide derail and/or bumper blocks on spur railroad tracks where a rolling car can contact other cars being worked, enter a building, work or traffic area.

Provide covers and/or guardrails to protect personnel from the hazards of open pits, tanks, vats, ditches and other hazards.



## **Chapter 9 Powered industrial trucks**

All new powered industrial trucks must meet the design and construction requirements for powered industrial trucks established in the American National Standard for Powered Industrial Trucks, Part II, ANSI B56.1-1969. A label or other identifying mark on approved trucks must indicate approval by the testing laboratory.

Any modifications and additions that affect capacity and safe operation performed by the customer or user must have the manufacturer's prior written approval. Change capacity, operation, and maintenance instruction plates, tags or decals accordingly.

Do not use power-operated industrial trucks in atmospheres containing hazardous concentration of chemicals or dusts. Refer to appropriate standards for a specific list of hazards and for the types (designations) of powered industrial trucks that can be used.

Store and handle liquid fuels, such as gasoline and diesel fuel, in accordance with National Fire Protection Association Flammable and Combustible Liquids Code (NFPA No. 30-1969), and liquefied petroleum gas fuel in accordance with NFPA Storage and Handling of Liquefied Petroleum Gases (NFPA No. 58-1969).

Designate battery charging installations in areas designed for that purpose. Provide facilities for flushing and neutralizing spilled electrolyte for fire protection, for protecting charging apparatus from damage by trucks and for adequate ventilation for dispersal of fumes from gassing batteries. Provide a conveyor, overhead hoist or equivalent material handling equipment for handling batteries. Properly position and secure reinstalled batteries in the truck. Provide a carboy tilter or siphon for handling electrolyte. When charging batteries, pour acid into water, not water into acid.

Properly position trucks and apply brakes before attempting to change or charge batteries. Take care to ensure that vent caps are functioning. Open the battery (or compartment) cover(s) to dissipate heat. There is no smoking in the charging area.

Take precautions to prevent open flames, sparks or electric arcs in battery-charging areas. Keep tools and other metallic objects away from the top of uncovered batteries.

Provide adequate lighting on the truck.

Make sure concentration levels of carbon monoxide gas created by powered industrial truck operations do not exceed the specified levels.

Set the brakes of highway trucks and place wheel chocks under the rear wheels to prevent the trucks from rolling during the loading of powered industrial trucks. Fixed jacks may be necessary to support a semi-trailer and prevent unloading during the loading or unloading when the trailer is not coupled to a tractor.

Provide wheel stops or other recognized positive protection to prevent railroad cars from moving during loading or unloading operations. Provide protection to prevent railroad cars from being moved while dock boards or bridge plates are in position.

# Safety Works for Machine Shops

Operators must be competent to operate a powered industrial truck safely, as demonstrated by completion of training and evaluations.

Trainees may operate a powered industrial truck only:

- Under the direct supervision of persons who have the knowledge, training and experience to train operators and evaluate their competence;
- Where such operation does not endanger the trainee or other employees.

Training consists of a combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material), practical training (demonstrations the trainer performs and practical exercises trainees perform), and evaluation of the operator's performance in the workplace. All operator training and evaluation is conducted by persons who have the knowledge, training and experience to train powered industrial truck operators and evaluate their competence.

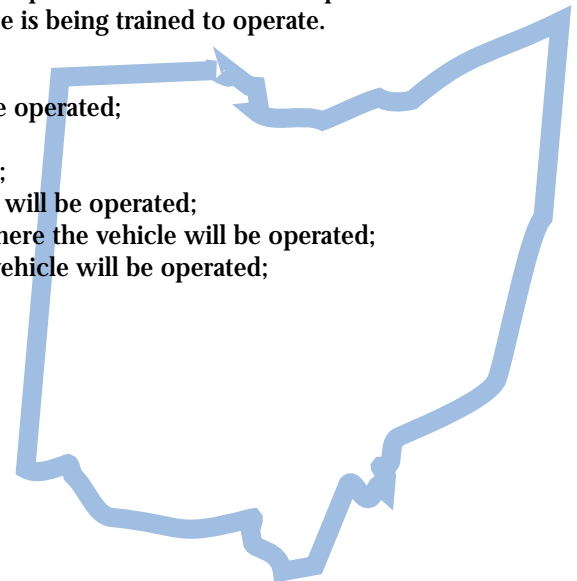
Powered industrial truck operators receive initial training in truck-related topics and workplace-related topics, except in topics the employer can demonstrate are not applicable to safe truck operation in the employer's workplace.

Truck-related topics include:

- Operating instructions, warnings and precautions for the truck types the operator will be authorized to operate;
- Differences between the truck and the automobile;
- Where truck controls and instrumentation are located, what they do, and how they work;
- Engine or motor operation;
- Steering and maneuvering;
- Visibility (including restrictions due to loading);
- Fork and attachment adaptation, operation, and use limitations;
- Vehicle capacity and stability;
- Any vehicle inspection and maintenance that the operator will be required to perform;
- Refueling and/or charging and recharging of batteries;
- Operating limitations;
- Any other operating instructions, warnings, or precautions listed in the operator's manual for the types of vehicle the employee is being trained to operate.

Workplace-related topics include:

- Surface conditions where the vehicle will be operated;
- Load composition and load stability;
- Load manipulation, stacking, and unstacking;
- Pedestrian traffic in areas where the vehicle will be operated;
- Narrow aisles and other restricted places where the vehicle will be operated;
- Hazardous (classified) locations where the vehicle will be operated;





- Ramps and other sloped surfaces that could affect the vehicle's stability;
- Closed environments and other areas where insufficient ventilation or poor vehicle maintenance can cause a buildup of carbon monoxide or diesel exhaust;
- Other unique or potentially hazardous environmental conditions in the workplace that might affect safe operation.

Conduct refresher training, including an evaluation of the effectiveness of that training to ensure that the operator has the knowledge and skills needed to operate the powered industrial truck safely.

Provide refresher training in relevant topics when:

- The operator is observed operating the vehicle in an unsafe manner;
- The operator is involved in an accident or near-miss incident;
- The operator receives an evaluation that reveals he or she is not operating the truck safely;
- The operator is assigned to drive a different type of truck;
- A workplace condition changes in a manner that could affect safe operation of the truck.

Conduct an evaluation of each powered industrial truck operator's performance at least once every three years or if an employee is involved in an accident or a near-miss.

If an operator has already received training in a topic previously specified, and the training is appropriate to the truck and working conditions encountered, no additional training in that topic is required if the operator is evaluated and is competent to operate the truck safely.

Employers certify that each operator has been trained and evaluated as required. The certification includes the name of the operator, the date of the training, the date of the evaluation and the identity of the person(s) performing the training or evaluation.

### General rules

- Do not drive trucks up to anyone standing in front of a bench or other fixed object.
- Do not allow anyone to stand or pass under the elevated portion of any truck, whether loaded or empty.
- Do not permit unauthorized personnel to ride on powered industrial trucks; provide a safe place to ride where riding of trucks is authorized.
- Keep arms or legs from between the uprights of the mast or outside the running lines of the truck.

When a powered industrial truck is left unattended, fully lower load-engaging means, neutralize controls, shut off power and set brakes. Block the wheels if the truck is parked on an incline. A powered industrial truck is unattended when the operator is more than 25 feet away from the vehicle but remains in his view, or whenever the operator leaves the vehicle and it is not in his or her view.

# Safety Works for Machine Shops

Maintain a safe distance from the edge of ramps or platforms while on any elevated dock, or platform or freight car. Do not use trucks for opening or closing freight doors.

Set brakes and put wheel blocks in place to prevent movement of trucks, trailers or railroad cars while loading or unloading. Fixed jacks may be necessary to support a semi-trailer during loading or unloading when the trailer is not coupled to a tractor. Check the flooring of trucks, trailers, and railroad cars for breaks and weakness before they are driven onto.

Ensure that there is sufficient headroom under overhead installations, lights, pipes, sprinkler system and other overhead obstructions.

Use an overhead guard as protection against falling objects; this guard offers protection from the impact of small packages, boxes, bagged material, and other objects the operator might encounter, but not the impact of a falling capacity load.

Use a load backrest extension whenever necessary to minimize the possibility of the load or part of it from falling rearward.

Use only approved industrial trucks in hazardous locations.

Whenever a truck is equipped with vertical only, or vertical and horizontal controls that can be elevated with the lifting carriage or forks for lifting personnel, take the following additional precautions for the protection of personnel being elevated:

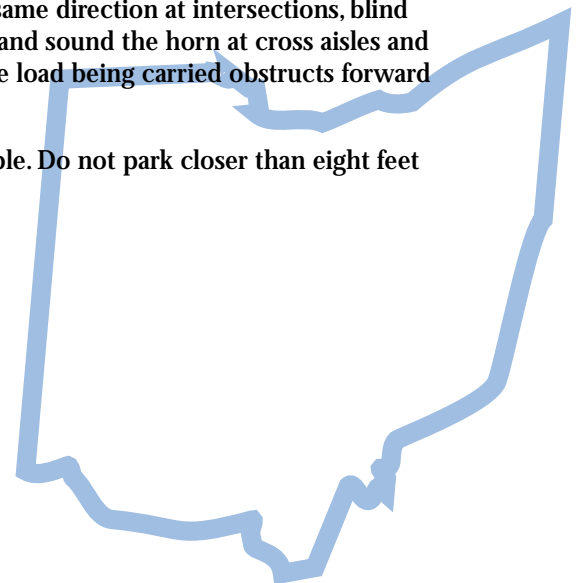
- Use a safety platform firmly secured to the lifting carriage and/or forks;
- Provide means to allow personnel on the platform to shut off power to the truck;
- Provide protection from falling objects as indicated necessary by the operating conditions.

Keep fire aisles, access to stairways and fire equipment clear.

Observe all traffic regulations, including authorized plant speed limits. Maintain a safe distance, approximately three truck lengths from the truck ahead, and keep the truck under control at all times.

Yield the right of way to ambulances, fire trucks or other vehicles in emergency situations. Do not pass other trucks traveling in the same direction at intersections, blind spots or other dangerous locations. Slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, travel with the load trailing.

Cross railroad tracks diagonally wherever possible. Do not park closer than eight feet from the center of railroad tracks.



Look in the direction of and keep a clear view of the path of travel. Ascend or descend grades slowly. When ascending or descending grades in excess of 10 percent, drive loaded trucks with the load upgrade. Tilt back the load and load-engaging means on all grades if applicable, and raise the load only as far as necessary to clear the road surface.

Under all travel conditions, operate the truck at a speed that will permit it to be brought to a stop safely. Stunt driving and horseplay is not permitted. Slow down for wet and slippery floors.

Properly secure dock boards or bridge plates before they are driven over. Drive over dock boards and bridge plates carefully and slowly and do not exceed their rated capacity. Approach elevators slowly, and then enter squarely after the elevator car is properly leveled. Once on the elevator, neutralize the controls, shut off the power, and set the brakes. Enter elevators or other confined areas with motorized hand trucks with load end forward. Avoid running over loose objects on the roadway surface.

Reduce speed to a safe level while negotiating turns by turning the hand steering wheel in a smooth, sweeping motion. Except when maneuvering at a very low speed, turn the hand steering wheel at a moderate, even rate. Handle only stable or safely arranged loads. Exercise caution when handling off-center loads that cannot be centered. Handle only loads within the truck's rated capacity. Adjust the long or high (including multiple-tiered) loads that may affect capacity. Operate trucks equipped with attachments as partially loaded trucks when not handling a load.

Place a load engaging means under the load as far as possible; carefully tilt the mast backward to stabilize the load.

Use extreme care when tilting the load forward or backward, particularly when high tiering. Do not tilt forward with load engaging means elevated except to pick up a load. Do not tilt an elevated load forward except when the load is in a deposit position over a rack or stack. When stacking or tiering, use only enough backward tilt to stabilize the load.

If a powered industrial truck needs repair, is defective or in any way unsafe, take it out of service until it has been restored to safe operating condition.

Turn the engine off while filling fuel tanks. Avoid spillage, but if any fuel or oil is spilled, carefully wash it away or make sure it has completely evaporated, and the fuel tank cap is replaced before restarting engine. Do not operate a truck until any leaks in the fuel system have been repaired. Do not use open flames to check the electrolyte level in storage batteries or gasoline level in fuel tanks.

# Safety Works for *Machine Shops*

Remove from service any power-operated industrial truck in unsafe operating condition. Have authorized personnel make all repairs. Repair problems with the fuel and ignition systems of industrial trucks that involve fire hazards only in locations designated for such repairs. If a truck needs repairs to the electrical system, disconnect the battery prior to such repairs.

Replace all parts of any industrial truck requiring replacement only with parts equivalent to those used in the original design. Do not alter industrial trucks so the relative positions of various parts are different from when originally received from the manufacturer; do not add extra parts not provided by the manufacturer or eliminate parts, except as provided in the appropriate standard. Do not add counterweights to fork trucks unless approved by the truck manufacturer.

Examine industrial trucks before placing them in service; if the examination shows any condition affecting the vehicle's safety, keep the vehicle out of service. Make these examinations at least daily. If industrial trucks are used on a round-the-clock basis, examine them after each shift. Immediately report and correct any defects found.



## **Chapter 10** **Overhead and gantry cranes**

A crane is a machine for lifting and lowering a load, and moving it horizontally, with the hoisting mechanism an integral part of the machine. Cranes, whether fixed or mobile, are driven manually or by power. An overhead crane has a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure. A hoist is an apparatus that may be a part of a crane, exerting a force for lifting or lowering. Rope refers to wire rope, unless otherwise specified.

All new overhead and gantry cranes constructed and installed on or after Aug. 31, 1971, have to meet the design specifications of the American National Standard Safety Code for Overhead and Gantry Cranes, ANSI B30.2.0-1967.

Cranes may be modified and re-rated if a qualified engineer or the equipment manufacturer checks the modifications and the supporting structure thoroughly for the new rated load. Test the crane in accordance with appropriate standards. Typically, the crane must be load tested at 125 percent of designed capacity after modifications are completed on the equipment.

Mark the crane's rated load plainly on each side of the crane, and if the crane has more than one hoisting unit, have its rated load marked on each hoist or its load block. Make sure this marking is clearly legible from the ground or floor.

Maintain a minimum clearance of three inches overhead and two inches laterally between crane and obstructions in conformity with Crane Manufacturers Association of America Inc.'s, Specification No. 61.

Inspect all cranes on a regular basis. Prior to initial use, inspect all new and altered cranes to insure compliance with provisions of federal and state safety requirements. Primarily, there are two types of inspections: frequent and periodic.

Perform frequent inspections on daily to monthly intervals. Inspect the following items for defects. Carefully examine all deficiencies and determine whether they constitute a safety hazard:

- Inspect all functional operating mechanisms for maladjustments interfering with proper operation daily.
- Inspect deterioration or leakage in lines, tanks, valves, drain pumps and other parts of air or hydraulic systems daily.
- Inspect hooks with deformation or cracks visually on a daily basis. Perform a documented monthly inspection.
- Inspect hoist chains and wire ropes visually on a daily basis. Perform a documented monthly inspection.

# Safety Works for Machine Shops

Conduct periodic inspections on one-to-12 month intervals. The periodic inspection should include all items identified in the frequent inspection and also include the following:

- Deformed, cracked or corroded members;
- Loose bolts or rivets;
- Cracked or worn sheaves and drums;
- Worn, cracked or distorted parts, such as pins, bearings, shafts, gears, locking and clamping devices;
- Excessive wear on brake system parts, linings, pawls and ratchets;
- Load, wind and other indicators over their full range for any significant inaccuracies;
- Gasoline, diesel, electrical or other power plants for improper performance or noncompliance with applicable safety requirements;
- Excessive wear of chain-drive sprockets and excessive chain stretch.

Allow only designated personnel to operate a crane. Locate all operating handles within convenient reach of the operator when he or she is facing the area to be served by the load hook, or while facing the direction of travel of the cab. The operator needs a full view of the load hook in all positions and should see clearly enough to perform his or her work with light within the cab. Locate the cab to afford a minimum of three inches clearance from all fixed structures within its area of possible movement.

Use a conveniently placed fixed ladder, stairs or platform requiring no step over any gap exceeding 12 inches to access the cab and/or bridge walkway. Make sure fixed ladders conform to the American National Standard Safety Code for Fixed Ladders, ANSI A14.3-1956.

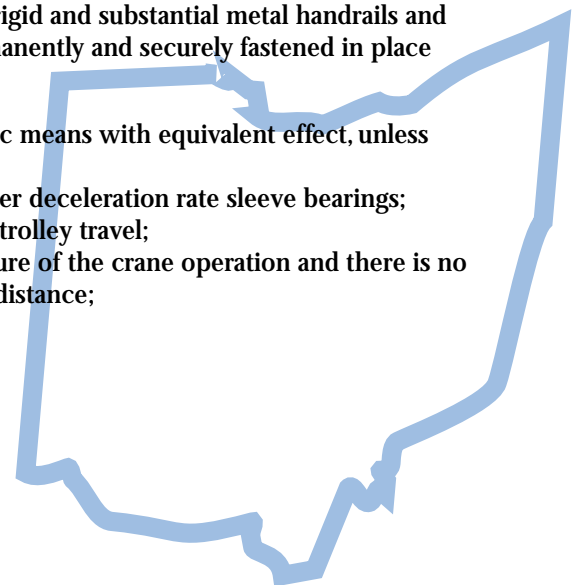
If sufficient headroom (a minimum of 48 inches) is available on cab-operated cranes, provide a foot walk on the drive side along the entire length of the bridge of all cranes having the trolley running on the top of the girders.

Make sure foot walks are designed to sustain a distributed load of at least 50 pounds per square foot and have an antislip walking surface, toeboards and handrails in compliance with appropriate standards.

Gantry cranes require ladders or stairways extending from the ground to the foot walk or cab platform, with stairways equipped with rigid and substantial metal handrails and antislip walking surfaces. Ladders must be permanently and securely fastened in place and comply with standards.

Provide cranes with bumpers or other automatic means with equivalent effect, unless the crane:

- Travels at a slow rate of speed and has a faster deceleration rate sleeve bearings;
- Is not operated near the ends of bridge and trolley travel;
- Is restricted to a limited distance by the nature of the crane operation and there is no hazard of striking any object in this limited distance;
- Is used in similar operating conditions.



Mount the bumper so there is no direct shear on bolts, and design and install the bumpers to minimize parts falling from the crane in case of breakage.

Provide trolleys with bumpers or other automatic means of equivalent effect, unless the trolley:

- Travels at a slow rate of speed;
- Is not operated near the ends of bridge and trolley travel;
- Is restricted to a limited distance of the runway and there is no hazard of striking any object in this limited distance;
- Is used in similar operating conditions.

When operating more than one trolley on the same bridge, equip each with bumpers or equivalent on their adjacent ends. Design and install bumpers or equivalent to minimize parts falling from the trolley in case of age.

Equip bridge trucks with sweeps extending below the top of the rail and project in front of the truck wheels.

If hoisting ropes run near enough to other parts to make fouling or chafing possible, install guards to prevent this condition. Provide a guard to prevent contact between bridge conductors and hoisting ropes if they can come into contact.

Guard exposed moving parts, such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components that can constitute a hazard under normal operating conditions; securely fasten the guards. Guards should support without permanent distortion, the weight of a 200-pound person unless the guard is located where it is impossible for a person to step on it.

Equip each independent hoisting unit of a crane with at least one self-setting brake, or holding brake, applied directly to the motor shaft or some part of the gear train. In addition, outfit each independent hoisting unit of a crane, except worm-gear hoists, the angle of whose worm is such as to prevent the load from accelerating in the lowering direction, with control braking means to prevent speeding.

Make sure holding brakes for hoist motors have not less than the following percentage of the full load hoisting torque at the point where the brake is applied:

- 125 percent when used with a control braking means other than mechanical.
- 100 percent when used in conjunction with a mechanical control braking means.
- 100 percent each if two holding brakes are provided.

# Safety Works for Machine Shops

## Chapter 11 Slings

A sling is an assembly that connects the load to the material handling equipment. Whenever any sling is used, observe these practices:

- Do not use damaged or defective slings;
- Do not shorten slings with knots or bolts or other makeshift devices;
- Do not kink sling legs;
- Do not load slings in excess of their rated capacities;
- Balance the loads to prevent slippage when slings are used in a basket hitch;
- Securely attach slings to their loads;
- Pad or protect slings from the sharp edges of their loads;
- Keep suspended loads clear of all obstructions;
- Keep all employees clear of loads about to be lifted and of suspended loads;
- Do not place hands or fingers between the sling and its load while the sling is being tightened around the load;
- Do not perform shock loading;
- Do not pull a sling from under a load when the load is resting on the sling.

Each day before using a sling, have a competent person designated by the employer inspect it and all fastenings and attachments for damage or defects. Perform additional inspections during sling use, where service conditions warrant. Remove damaged or defective slings from service immediately.

Permanently affix durable identification stating size, grade, rated capacity and reach on alloy steel chain slings.

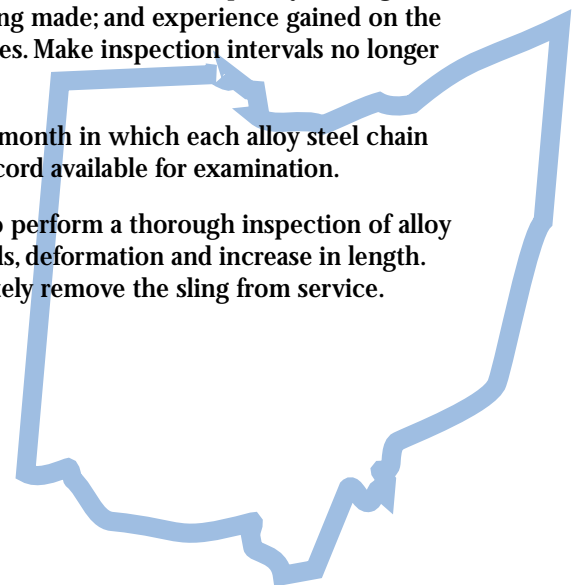
Make sure hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links or other attachments have a rated capacity at least equal to that of the alloy steel chain with which they are used. Do not use the sling in excess of the rated capacity of the weakest component.

Do not use makeshift links or fasteners formed from bolts or rods, or other such attachments.

In addition to the required inspection, make a thorough periodic inspection of alloy steel chain slings in use on a regular basis. Base the timetable on frequency of sling use; severity of service conditions; nature of lifts being made; and experience gained on the service life of slings used in similar circumstances. Make inspection intervals no longer than once every 12 months.

Make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected and have the record available for examination.

Make sure you designate a competent person to perform a thorough inspection of alloy steel chain slings, including wear, defective welds, deformation and increase in length. If defects or deterioration are present, immediately remove the sling from service.





Ensure that before use, each new, repaired or reconditioned alloy steel chain sling, including all welded components in the sling assembly, is proof tested by the sling manufacturer or equivalent entity, in accordance with paragraph 5.2 of the American Society of Testing and Materials Specification A391-65.

Do not use alloy steel chain slings with loads in excess of the rated capacities prescribed. Use slings not included in tables only in accordance with the manufacturer's recommendations.

Permanently remove alloy steel chain slings from service if they are heated above 1000° F. When the slings are exposed to service temperatures in excess of 600° F, reduce the maximum working load limits permitted in accordance with the chain or sling manufacturer's recommendations.

Do not use worn or damaged alloy steel chain slings or attachments until repaired. When welding or heat testing is performed, do not use slings unless repaired, reconditioned and proof tested by the sling manufacturer or an equivalent entity.

Do not use mechanical coupling links or low carbon steel repair links to repair broken lengths of chain.

If the chain size at any point of any link is less than that stated in appropriate tables, remove the sling from service.

Remove from service alloy steel chain slings with cracked or deformed master links, coupling links or other components.

Immediately remove wire rope slings from service if any of these conditions are present:

- Five broken wires in one strand in one rope lay or 10 randomly distributed broken wires in one rope lay;
- Wear or scraping of one-third the original diameter of outside individual wires;
- Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure;
- Evidence of heat damage;
- Cracked, deformed or worn end attachments;
- Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook;
- Corrosion of the rope or end attachments.

# Safety Works for Machine Shops

## **Metal mesh slings**

Permanently affix to each metal mesh sling a durable marking stating the rated capacity for vertical basket hitch and choker hitch loadings.

Make sure handles have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

Join the fabric and handles so that:

- The rated capacity of the sling is not reduced;
- The load is evenly distributed across the width of the fabric;
- Sharp edges will not damage the fabric.

Do not apply coatings that diminish the sling's rated capacity.

Do not use new and repaired metal mesh slings, including handles, unless proof tested by the manufacturer or equivalent entity at a minimum of one and one-half times their rated capacity. Proof test elastomer impregnated slings before coating.

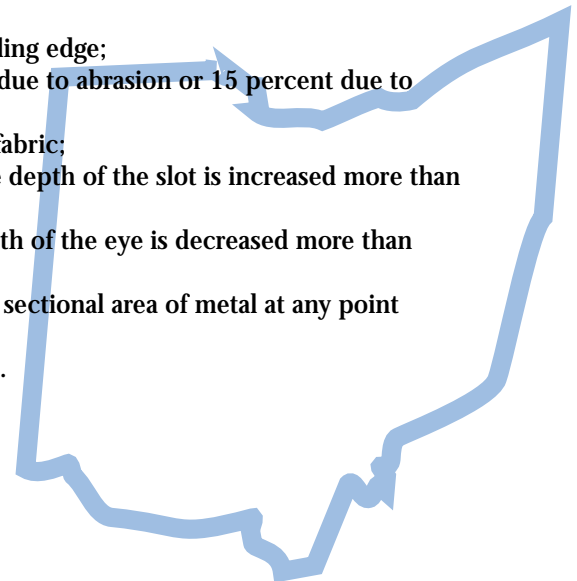
Do not use metal mesh slings to lift loads in excess of their rated capacities as prescribed. Use slings not included in tables only in accordance with the manufacturer's recommendations.

You may use metal mesh slings not impregnated with elastomers in a temperature range from minus 20° F to plus 550° F without decreasing the working load limit. You may use metal mesh slings impregnated with polyvinyl chloride or neoprene in a temperature range from zero degrees to plus 200° F. For operations outside these temperature ranges or for metal mesh slings impregnated with other materials, follow the sling manufacturer's recommendations.

Do not use repaired metal mesh slings unless a metal mesh sling manufacturer or an equivalent entity repairs them. Once repaired, permanently mark or tag each sling, or maintain a written record to indicate the date and nature of the repairs and the person or organization that performed the repairs. Make records of repairs available for examination.

Immediately remove metal mesh slings from service if any of these conditions are present:

- A weld or brazed joint is broken along the sling edge;
- A reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion;
- A lack of flexibility due to distortion of the fabric;
- A distortion of the female handle so that the depth of the slot is increased more than 10 percent;
- A distortion of either handle so that the width of the eye is decreased more than 10 percent;
- A 15-percent reduction of the original cross sectional area of metal at any point around the handle eye;
- A distortion of either handle out of its plane.



## **Natural and synthetic fiber rope slings**

Do not use fiber rope slings made from conventional three-strand construction fiber rope with loads in excess of the rated capacities prescribed. Fiber rope slings require a diameter of curvature meeting at least the minimums specified. Use slings not included in tables only in accordance with the manufacturer's recommendations.

You may use natural and synthetic fiber rope slings, except for wet frozen slings, in a temperature range from minus 20° F to plus 180° F without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, follow the sling manufacturer's recommendations.

Do not use spliced fiber rope slings unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

- In manila rope, eye splices consist of at least three full tucks, and short splices consist of at least six full tucks, three on each side of the splice center line;
- In synthetic fiber rope, eye splices consist of at least four full tucks, and short splices consist of at least eight full tucks, four on each side of the center line.

Do not trim strand end tails flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope less than one inch in diameter, make sure the tail projects at least six rope diameters beyond the last full tuck. For fiber rope one inch in diameter and larger, make sure the tail projects at least six inches beyond the last full tuck. If a projecting tail interferes with the use of the sling, taper the tail and splice it into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

Fiber rope slings need a minimum clear length of rope between eye splices equal to 10 times the rope diameter.

Do not use knots in place of splices. For splicing, use clamps designed specifically for fiber ropes. For all eye splices, make sure the eye provides an included angle of not greater than 60° at the splice when the eye is placed over the load or support.

Do not use fiber rope slings if end attachments in contact with the rope have sharp edges or projections.

Immediately remove natural and synthetic fiber rope slings from service if any of these conditions are present:

- Abnormal wear;
- Powdered fiber between strands;
- Broken or cut fibers;
- Variations in the size or roundness of strands;
- Discoloration or rotting;
- Distortion of hardware in the sling.

Use only fiber rope slings made from new rope. Do not use repaired or reconditioned fiber rope slings.

# Safety Works for Machine Shops

## **Synthetic web slings**

Mark or code each sling to show the rated capacities for each type of hitch and type of synthetic web material.

Make sure synthetic webbing is of uniform thickness and width and selvage edges are not split from the webbing's width.

Make sure fittings have a minimum breaking strength equal to that of the sling and are free of all sharp edges that could in any way damage the webbing.

The only method to attach end fittings to webbing and to form eyes is stitching. Make sure the thread is in an even pattern and contains a sufficient number of stitches to develop the full breaking strength of the sling.

Do not use synthetic web slings with loads in excess of the rated capacities specified. If slings not listed in rating charts or tables, use them only in accordance with the manufacturer's recommendations.

When synthetic web slings are used, do not use:

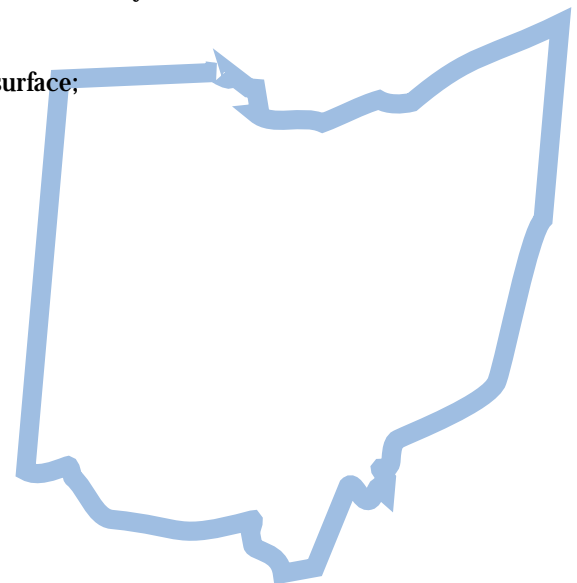
- Nylon web slings where fumes, vapors, sprays, mists or liquids of acids or phenolics are present;
- Polyester and polypropylene web slings where fumes, vapors, sprays, mists or liquids of caustics are present;
- Web slings with aluminum fittings where fumes, vapors, sprays, mists or liquids of caustics are present.

Do not use synthetic web slings of polyester and nylon at temperatures in excess of 180° F or polypropylene web slings at temperatures in excess of 200° F.

Do not use repaired synthetic web slings unless repaired by a sling manufacturer or an equivalent entity. The manufacturer or equivalent entity should proof test each repaired sling to twice the rated capacity prior to its return to service. Retain a certificate of the proof test and make it available for examination. Do not use slings, including webbing and fittings that have been repaired in a temporary manner.

Immediately remove synthetic web slings from service if any of these conditions are present:

- Acid or caustic burns;
- Melting or charring of any part of the sling surface;
- Snags, punctures, tears or cuts;
- Broken or worn stitches;
- Distortion of fittings.



## Chapter 12

### Hazard communication (HAZCOM)

HAZCOM ensures that all employees who come in contact with chemicals are aware of the hazards. Jobs requiring a HAZCOM program include manufacturing, warehouse operations, janitorial and laboratory.

#### OSHA standard

- 29 CFR 1910.1200 (General Industry)
- 29 CFR 1926.59 (Construction - Refers to 1910.1200)

#### Written program

- Identify responsibilities:
  - Who is responsible for training?
  - Who is responsible for ordering/maintaining MSDS?

#### Container labeling

- Legible
- Chemical name
- Target organs
- Manufacturer's name and address

#### MSDS

- Where located?
- How to obtain?

#### Employee training

- Frequency
- Who conducts training?
- Who needs to be trained?

#### Chemical inventory

- What company has on hand/quantity?
- Where located?

# Safety Works for *Machine Shops*

## **Employee training**

- New hires
- Transfers
- Temporaries
- New operations
- New products
- After accidents/incidents

## **Training topics**

- Overview of HAZCOM requirements
- Chemicals present in workplace
- Location/availability of written program
- Health effects of chemicals
- How to lessen or prevent exposures
- Engineering controls the company is using

## **MSDSs**

- Location
- How to read
- Labeling requirements

## **Contractors**

- Notification procedures
- Training contractors of company hazards
- Training company employees of contractor hazards

## **Source of additional help**

Chemical Hazard Communication published by OSHA.  
See page 12-6 for ordering information

## **Related training center courses**

- IHY 212: Hazard Communication



**Material Safety Data Sheet**

**The Clorox Company**  
 1221 Broadway  
 Oakland, California 94588  
 Tel. (510) 847-6100

I Product FORMULA 409 ALL PURPOSE CLEANER  
CLOROX ANTI-BACTERIAL ALL PURPOSE CLEANER

**Description:** LIGHT GREEN LIQUID  
**Other Designations:** EPA Registration Number 5813-55  
**Distributor:** Clorox Sales Company  
 1221 Broadway  
 Oakland, CA 94612

**Emergency Telephone No.**  
*For Medical Emergencies call:*  
 Rocky Mountain Poison Center (800) 446-1014  
*For Transportation Emergencies call:*  
 Chemtrec (800) 424-9300

II Health Hazard Data

**CAUTION:** EYE IRRITANT. Avoid eye and prolonged skin contact. Do not ingest.  
**FIRST AID:**  
 EYE: Flush eyes with water for at least 15 minutes. Call physician if irritation occurs.  
 SKIN CONTACT: Rinse skin with water. If irritation develops contact a physician.  
 INGESTION: Drink a glassful of water to dilute. Call a physician. Do not induce vomiting. Do not give anything by mouth to an unconscious or convulsing person.  
 INHALATION: Remove from area to fresh air. Seek medical attention if respiratory irritation develops or if breathing becomes difficult.  
**No medical conditions are known to be aggravated by exposure to this product. Under directed consumer use conditions this product is not expected to produce adverse health effects.**  
**KEEP OUT OF REACH OF CHILDREN**

III Hazardous Ingredients

Ingredients	Concentration	Worker Exposure Limit
Alkyl (C12 40%; C14 50%		Not Established
0.3% C16 10%) dimethyl benzyl ammonium chloride		
CAS #68424-85-1		
Ethylene Glycol 0.5-5%		25 ppm TLV-TWA
Monobutyl Ether		25 ppm PEL
CAS #111-76-2		

Substance can be absorbed through the skin and may contribute to overall exposure.  
 None of the ingredients in this product is on the IARC, NTP or OSHA carcinogen lists.  
 TLV-TWA — Threshold Limit Value — Time Weighted Average.  
 Source: ACGIH 1995-1996.  
 PEL - Permissible Exposure Limit. Source: OSHA

IV Special Protection and Precautions

No special protection or precautions have been identified for using this product under directed consumer use conditions. The following recommendations are given for production facilities and for other conditions and situations where there is increased potential for accidental, large-scale or prolonged exposure:  
**Hygienic Practices:** Wear safety glasses and gloves. Discontinue exposure to product if irritation or other adverse reactions develop.  
**Engineering Controls:** Use general ventilation to minimize exposure to mist.  
**Work Practices:** Avoid eye and skin contact. Do not inhale vapor or mist.

V Transportation and Regulatory Data

**U.S. DOT Hazard Class:** Not restricted  
**U.S. DOT Proper Shipping Name:** Compound, Cleaning and Liquid. Not restricted.  
**EPA - SARA Title III/CERCLA:** Bottled product is not reportable under Sections 311/312; contains chemicals regulated under Section 313 (ethylene oxide = trace, glycol ethers < 5%); and contains chemicals (glycol ethers < 5%, ethylenediaminetetracetic acid <1.0%, ethylene oxide = trace, and sodium hydroxide < 0.5%) which are regulated under Section 304/CERCLA.  
**TSCA Status:** All components of this product are on the TSCA Inventory.

VI Spill or Leak Procedures

**Spill Procedures:** Caution! Floors may become slippery. Wear appropriate protective equipment and NIOSH/MSHA approved respirator where mist or vapors of unknown concentrations may be generated (self-contained breathing apparatus preferred.)  
 Dike and contain spill with inert material (sand, earth, etc.) and transfer the liquid and solid separately to containers for recovery or disposal. Keep spill out of sewers and open bodies of water.

VII Reactivity Data

Stable under normal use and storage conditions.  
 Avoid strong oxidant or reducing agents.

VIII Fire and Explosion Data

**Flash Point:** >200F  
**Fire Extinguishing Agents:** Foam, Dry Chemical, Water and CO2. Must wear NIOSH/MSHA approval self-contained breathing apparatus and protective clothing. Cool fire-exposed containers with water spray.  
**Unusual Fire and Explosion Hazards:** Products of combustion are toxic.

IX Physical Data

pH ..... 11.5-13.0  
 Specific Gravity ..... 1.01 @ 25C  
 Solubility in Water ..... Soluble

# Safety Works for Machine Shops

## Chapter 13 Machinery and machine guarding

To prevent injuries, such as crushed hands and arms, severed fingers and blindness, safeguards are essential. Machine parts, functions, or processes that may cause injury must be controlled or eliminated. Affix guards to the machine where possible and secure elsewhere if attachment to the machine is not possible. Make sure the guard is not a hazard in itself.

### Safeguarding the point-of-operation

Provide and insure the use of point-of-operation guards or properly applied and adjusted point-of-operation devices on every operation performed on machinery and equipment. The point of operation for every type of equipment will be guarded — not just power presses.

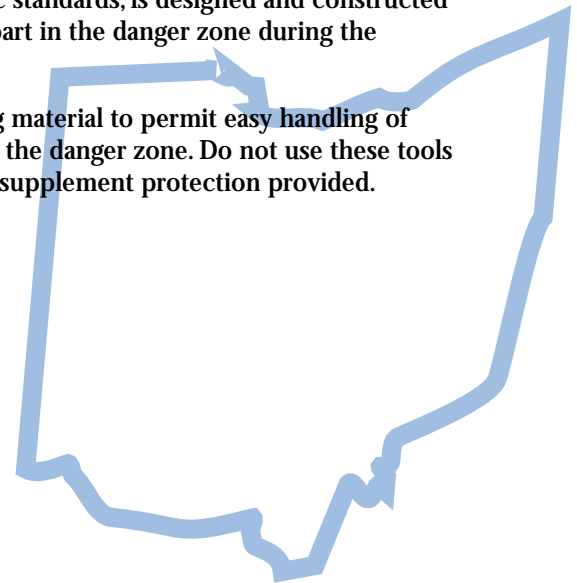
Point-of-operation guards:

- Prevent hands or fingers from entering the point of operation by reaching through, over, under or around the guard;
- Conform to the maximum permissible openings;
- Create no pinch point between the guard and moving machine parts;
- Use fasteners not readily removable by operator, so as to minimize the possibility of misuse or removal of essential parts;
- Facilitate its inspection;
- Offer maximum visibility of the point of operation consistent with the other requirements.

### Point-of-operation guarding

Point of operation is the area on a machine where work is performed upon the material being processed. Provide and ensure the use of point-of-operation guards or properly applied and adjusted point-of-operation devices to prevent entry of hands or fingers into the point of operation by reaching through, over, under and around the guard. Provide one or more methods of machine guarding (barrier guards, two-hand tripping devices, electronic safety devices, etc.) to protect the operator and other employees in the machine area from hazards such as those created by point of operation, in-going nip points, rotating parts, flying chips and sparks. Make sure the guarding device conforms to appropriate standards, or, if there are no specific standards, is designed and constructed to prevent the operator from having any body part in the danger zone during the operating cycle.

Use special hand tools for placing and removing material to permit easy handling of material without the operator placing a hand in the danger zone. Do not use these tools in place of other required guarding, but only to supplement protection provided.





Point-of-operation devices protect the operator by:

- Preventing and/or stopping normal stroking of the press if the operator's hands are inadvertently placed in the point of operation;
- Preventing the operator from inadvertently reaching into the point of operation, or withdrawing his or her hands if they are inadvertently located in the point of operation, as the dies close;
- Preventing the operator from inadvertently reaching into the point of operation at all times;
- Requiring application of both of the operator's hands to machine operating controls and locating the controls at such a safety distance from the point of operation that the slide completes the downward travel or stops before the operator can reach into the point of operation with his hands;
- Enclosing the point of operation before a press stroke can be initiated and maintaining this closed condition until the motion of the slide has ceased;
- Enclosing the point of operation before a press stroke can be initiated, to prevent an operator from reaching into the point of operation prior to die closure or prior to cessation of slide motion during the downward stroke.

Machines that usually require point-of-operation guarding include:

- Guillotine cutters;
- Shears;
- Alligator shears;
- Power presses;
- Milling machines;
- Power saws;
- Jointers;
- Portable power tools;
- Forming rolls and calenders.

### Where mechanical hazards occur

Dangerous moving parts in three basic areas require safeguarding:

- **The point of operation:** that point where work is performed on the material, such as cutting, shaping, boring or forming of stock.
- **Power transmission apparatus:** all mechanical-system components that transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks and gears.
- **Other moving parts:** all machine parts that move while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

# Safety Works for Machine Shops

## **Guards**

Guards are barriers that prevent access to danger areas. There are four general types of guards.

### **Fixed**

A fixed guard is a permanent part of the machine. It is not dependent upon moving parts to perform its intended function. It may be constructed of sheet metal, screen, wire cloth, bars, plastic, or any other material that is substantial enough to withstand whatever impact it may receive and to endure prolonged use. This guard is usually preferable to all other types because of its relative simplicity and permanence.

A fixed guard on a power press completely encloses the point of operation. The stock is fed through the side of the guard into the die area, with the scrap stock exiting on the opposite side.

### **Interlocked**

When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off or disengages, and the machine cannot cycle or be started until the guard is back in place.

An interlocked guard may use electrical, mechanical, hydraulic or pneumatic power or any combination of these. Interlocks should not prevent "inching" by remote control if required. Replacing the guard should not automatically restart the machine. To be effective, interlock all movable guards to prevent occupational hazards.

### **Adjustable**

Adjustable guards are useful because they allow flexibility in accommodating various sizes of stock.

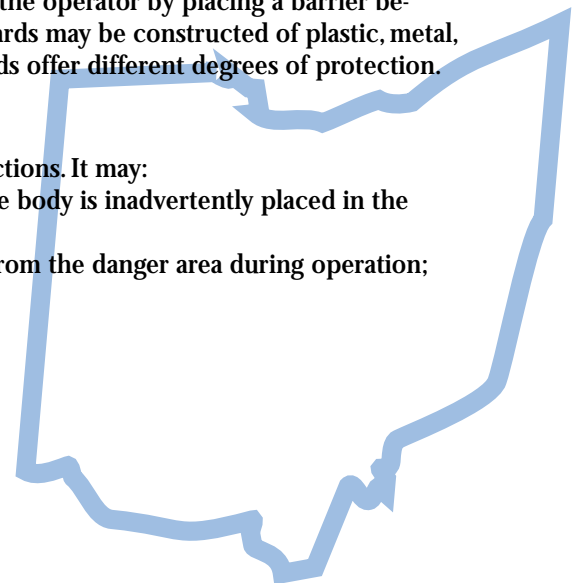
### **Self-adjusting**

The movement of the stock determines the openings of these barriers. As the operator moves the stock into the danger area, the guard is pushed away, providing an opening which is only large enough to admit the stock. After the stock is removed, the guard returns to the rest position. This guard protects the operator by placing a barrier between the danger area and the operator. The guards may be constructed of plastic, metal, or other substantial material. Self-adjusting guards offer different degrees of protection.

### **Devices**

A safety device may perform one of several functions. It may:

- Stop the machine if a hand or any part of the body is inadvertently placed in the danger area;
- Restrain or withdraw the operator's hands from the danger area during operation;



- Require the operator to use both hands on machine controls, thus keeping both hands and body out of danger;
- Provide a synchronized barrier with the operating cycle of the machine to prevent entry to the danger area during the hazardous part of the cycle.

### **Presence-sensing**

The photoelectric (optical) presence-sensing device uses a system of light sources and controls that can interrupt the machine's operating cycle. If the light field is broken, the machine stops and will not cycle. You must only use this device on machines that can be stopped before the worker can reach the danger area. The design and placement of the guard depends upon the time it takes to stop the mechanism and the speed at which the employee's hand can reach across the distance from the guard to the danger zone.

The radio frequency (capacitance) presence-sensing device uses a radio beam that is part of the machine control circuit. When the capacitance field is broken, the machine will stop or will not activate. Like the photoelectric device, you should only use this device on machines that can be stopped before the worker can reach the danger area. This requires the machine to have a friction clutch or other reliable means for stopping.

The electromechanical sensing device has a probe or contact bar that descends to a predetermined distance when the operator initiates the machine cycle. If there is an obstruction preventing it from descending its full, predetermined distance, the control circuit does not actuate the machine cycle.

### **Pullback**

Pullback devices use a series of cables attached to the operator's hands, wrists, and/or arms. This type of device is primarily used on machines with stroking action. When the slide/ram is up between cycles, the operator is allowed access to the point of operation. When the slide/ram begins to cycle by starting its descent, a mechanical linkage automatically assures withdrawal of the hands from the point of operation.

### **Restraint**

The restraint (holdout) device uses cables or straps that are attached to the operator's hands at a fixed point. The operator must adjust the cables or straps to let his or her hands travel within a predetermined safe area. There is no extending or retracting action involved. Consequently, hand-feeding tools are often necessary if the operation involves placing material into the danger area.

Have the operator inspect all restraints and pullback devices prior to each use of the equipment. This includes prior to the beginning of each shift, after lunch, after breaks, etc. Document each inspection and have a supervisor or member of management verify.

# Safety Works for Machine Shops

## Training

Even the most elaborate guarding system cannot offer effective protection unless the worker knows how to use it and why. Specific and detailed training is a crucial part of any effort to provide guarding against machine-related hazards. Thorough operator training should involve instruction or hands-on training in the following:

- A description and identification of the hazards associated with particular machines;
- The guards themselves, how they provide protection and the hazards for which they are intended;
- How to use the guards and why;
- How and under what circumstances guards can be removed, and by whom (in most cases, repair or maintenance personnel only);
- What to do (e.g., contact the supervisor) if a guard is damaged, missing or unable to provide adequate protection.

This safety training is necessary for new operators and maintenance or setup personnel, when putting into service any new or altered safeguards, or when workers are assigned to a new machine or operation.

A gate is a movable barrier that protects the operator at the point of operation before the machine cycle can be started. In many instances, gates are designed to be operated with each machine cycle.

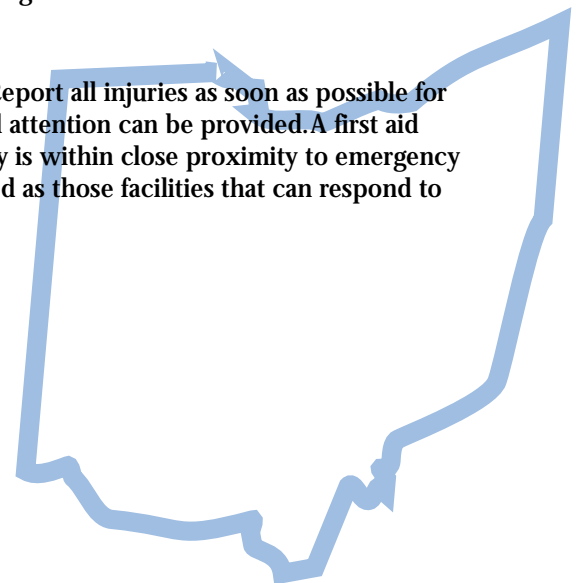
A gate or movable barrier device protects the operator as follows:

- A Type A gate or movable barrier device protects the operator by enclosing the point of operation before a press stroke can be initiated, and maintaining this closed condition until the motion of the slide has ceased.
- A Type B gate or movable barrier device protects the operator by enclosing the point of operation before a press stroke can be initiated, so an operator cannot reach into the point of operation prior to die closure or prior to cessation of slide motion during the downward stroke. Type B gates are not permitted on full revolution clutch presses.

Put a system in place to properly inspect all machinery for appropriate point-of-operation guards. In addition, have a system in place to train machine operators and other personnel on the importance of machine guarding.

## First-aid equipment

Make first-aid equipment available at all times. Report all injuries as soon as possible for medical attention. Provide first aid until medical attention can be provided. A first aid responder should be on-site unless the company is within close proximity to emergency medical facilities. Close proximity can be defined as those facilities that can respond to an incident that requires medical treatment.



## **Chapter 14** **Lockout/tagout**

Employers are required to develop and implement an effective isolation and control program for hazardous energy when maintenance and/or service is performed for machinery. Employers are required to develop specific procedures to isolate and control all energy sources for each piece of equipment in the workplace. In addition, employers are required to identify specific employees who are authorized to perform machine lockout/tagout. The following outline identifies the requirements of an effective lockout/tagout program.

### **Purpose**

To protect employees from unexpected release of stored energy, including:

- Mechanical;
- Hydraulic;
- Chemical;
- Gravity;
- Electrical;
- Pneumatic;
- Thermal;
- Any other sources of stores energy.

### **OSHA standard**

- 29 CFR 1910.147 (Lockout/Tagout)

**Note:** The standard does not apply to construction sites, but does apply to yards and fabrication shops.

### **Written program**

- Identify all sources of energy for each piece of equipment.
- Provide each employee with his or her own lock and key. The supervisor may have a second key, but well-established procedures must be in place for when the second key can be used.
- Verify employee is not at the facility.
- Make a reasonable effort to inform the employee that the lock has been removed.
- Ensure that the employee is informed about the action before returning to work in the facility.
- Review procedures annually (not by one performing lockout/tagout).
- Notify outside contractors of the program.

### **Employee training**

- Methods of identifying energy sources
- Shut down/start-up procedures
- Lockout procedures

# Safety Works for *Machine Shops*

## **Sources of additional help**

- Control of Hazardous Energy, an OSHA publication. See page 12-6 for ordering information.
- Manufacturer of equipment

## **Related training center courses**

- SAF 105: Mechanical Power Press
- SAF 107: Electrical Hazard Recognition and Abatement
- SAF 109: Lockout/Tagout



## **Chapter 15** **Electrical safety**

Share these basic electrical safety issues with all employees:

- Inspect all cord and plug-connected equipment on a regular basis.
- Train employees on the hazards of electricity and importance of electrical safety.
- Use extension cords on a temporary basis when using portable power tools, maintenance or servicing of machinery.
- Use three-wire type extension cords with an appropriate grounding conductor.
- Do not use two-wire extension cords.
- Provide all equipment unless it is double insulated with an appropriate grounding conductor.
- Ground and secure electrical outlets.
- Do not use damaged or defective equipment.
- Identify and make accessible all electrical equipment.
- Do not use flexible cords and cables as a substitute for fixed wiring.
- Do not permit extension cords with metal knockout boxes.
- Provide a ground fault circuit interrupter (GFCI) in damp or wet locations.

### **Means of egress**

- Identify all exits.
- Provide emergency lighting in accordance with local building codes.
- Never lock, block, etc., exit access and exits.
- Identify all non-exit doors.

Place lighting as to reduce glare and prevent too much contrast between work areas and adjacent areas. Illumination will be sufficient for general safety and ordinary visual needs. Locate and guard lighting fixtures such that there will be no hazard to persons should there be accidental breakage of the lamp or fixture. Where failure of primary lighting can result in hazards to any person, provide emergency lighting.

# Safety Works for Machine Shops

## Chapter 16

### BWC Division of Safety & Hygiene services

When you set out to hire the best safety consulting service to meet your needs, you look for a company with:

- A broad skill base;
- Excellent credentials and experience;
- Reasonable up-front costs;
- Non-punitive associations;
- The ability to deliver a positive financial impact.

As an employer participating in Ohio's exclusive workers' compensation system, you should know that BWC's Division of Safety & Hygiene can meet all your needs.

The division provides a broad spectrum of services, including research, education, publications, local information networks and on-site consulting. We offer expertise in industrial safety, construction, industrial hygiene and ergonomics. Many of our staff holds nationally recognized professional designations. Your workers' compensation premium includes the cost of our services. You invest your safety dollars in on-site improvements rather than consulting fees.

The Ohio Legislature established the Division of Safety & Hygiene as a consultative service to inform, educate and assist employers in loss-prevention activities. The division does not engage in enforcement of local or federal safety requirements. The division has strategies to assist you in reducing workplace accidents and injuries, and the associated costs.

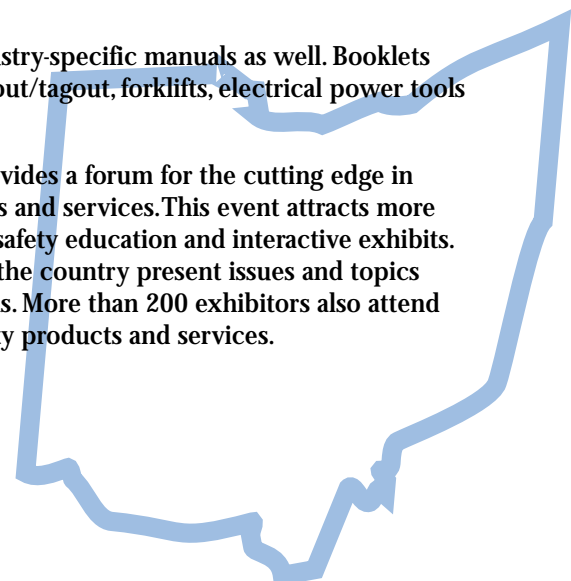
#### Up-to-date information

You can obtain the most up-to-date information on occupational safety and health, rehabilitation and workers' compensation by contacting our library.

The library's staff uses online computer systems to perform safety and health-related research in addressing your specific questions. You also can request a list of Web sites to access directly. In addition, the video library has a collection of more than 3,000 occupational safety and health videotapes that Ohio employers may borrow. And you can obtain publications covering many safety issues, including comprehensive safety manuals for both construction and general industry.

We are in the process of producing several industry-specific manuals as well. Booklets are available on 15 safety topics, including lockout/tagout, forklifts, electrical power tools and fall protection.

Each year, the Ohio Safety Congress & Expo provides a forum for the cutting edge in workplace safety practices, technology, products and services. This event attracts more than 6,000 attendees and combines workplace safety education and interactive exhibits. Hundreds of the top safety experts throughout the country present issues and topics that affect today's safety and health professionals. More than 200 exhibitors also attend the Safety Congress to present the latest in safety products and services.





## **Safety training for your employees**

You can receive training on 42 safety and health topics through the Division of Safety & Hygiene's Training Center to provide the necessary knowledge and skills to prevent occupational injuries. The curriculum includes train-the-trainer programs and courses that help you build an action plan for improving safety performance. All courses offer continuing education credits.

The Training Center offers courses in Columbus, Cincinnati, Cleveland, Toledo, St. Clairsville, Portsmouth and Youngstown.

When you need supplemental materials to support your in-house safety training efforts, the video library's collection covers a wide range of topics. In addition, the 10-Step Business Plan booklet can show you how to make safety a part of your overall business operations.

The Ohio Safety Congress & Expo also is a good source of training information, with its educational sessions covering both general and industry-specific topics.

In conjunction with Safety & Hygiene, 53 area safety councils across the state promote occupational safety and health awareness in their communities through educational meetings, networking and local support.

The councils also direct annual safety campaigns, and member companies that maintain exceptional safety and health records during the year are recognized at the councils' annual awards banquets.

## **Site-specific help**

Many employers call the division with requests for on-site services. The success of any safety effort, however, depends heavily upon the commitment and involvement of the employer.

You can receive any of our on-site services provided you demonstrate a commitment to making worker safety part of the overall business operation and you implement change to become self-sufficient. Our area offices offer assistance in the following areas:

### **Safety program advice**

You may ask for assistance with written safety programs, violence in the workplace programs, record keeping, the 10-Step Business Plan and other programs that can help you improve your loss-prevention management.

The Division of Safety & Hygiene will help you analyze your company's injury history; support you with program-design assistance; provide information on training, literature, Web sites and other resources; and teach you how to track program results.

# Safety Works for Machine Shops

You will be expected to develop specific company safety policies, provide employee training, establish accountability for worker safety, implement the new safety program, and track the results.

## **Hazard assessment and control assistance**

You can benefit from our expertise in industrial safety, construction safety, industrial hygiene and ergonomics to improve hazard recognition, evaluation and control in your workplace. The division will help you analyze your company's injury history and safety processes; help you design a method to assess your work operations; teach you to perform your own safety audits; provide access to sample programs, training and other resources; equip you to gain management commitment and show you how to track results.

You will be expected to demonstrate management support and provide resources to implement corrective actions.

## **Safety culture/behavior change processes**

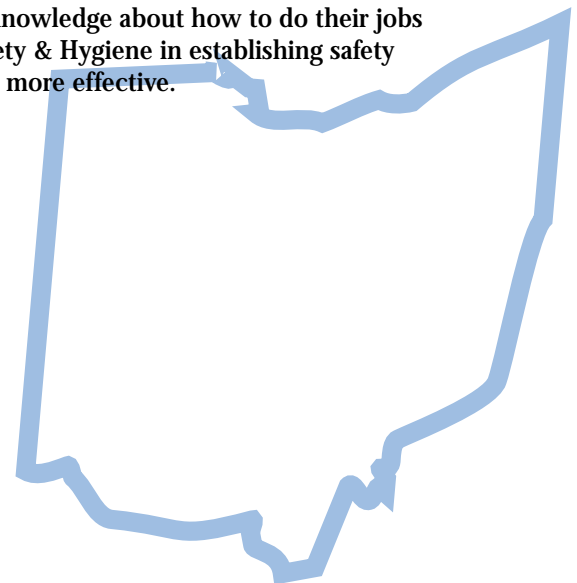
Safety culture assessments, leadership training, management systems evaluation, and behavior-based safety systems can help your company achieve better results through its safety process. The Division of Safety & Hygiene will provide in-depth injury-history analysis; report results and make recommendations on how to change the current safety culture; be available for answers and advice; facilitate leadership workshops and strategic planning; recommend best industry practices and models for cultural and behavioral change; and teach you how to track results.

Your top company official must agree to manage a high-level action plan that includes evaluating and re-designing management systems, and urge the entire work force to participate in culture surveys. Top managers are expected to attend leadership workshops and will be held accountable for implementing the company's action plan.

## **Safety team/committee evaluation and design**

Safety committees are an excellent way to improve communication on safety issues and get employees involved in the safety process.

They are beneficial because they use workers' knowledge about how to do their jobs safely. You can get help from the Division of Safety & Hygiene in establishing safety committees or teams, or to make existing teams more effective.



# Safety Works for Machine Shops

## **We are your safety professionals**

The division provides a comprehensive service to assist employers in achieving outstanding safety performance. You can receive a thorough assessment of technical and cultural factors; on-site consultation; identification of employer-required resources; assistance in creating an appropriate, employer-driven action plan; information on how to track and monitor the success of initiatives; and ongoing consultation with division personnel.

So, contact us today to reduce injuries, illnesses and costs because Safety Works for You.

## **BWC Division of Safety & Hygiene Offices**

### *Administrative Offices*

Call **1-800-OHIOBWC** and press 22 or send a fax to 614-644-5707 to access the following:

- Library
- Safety Congress
- Safety Councils
- Publications
- Training Center
- Video Library

### *Area Offices*

Canton	(330) 471-0064,	FAX (330) 471-0057
Columbus North	(614) 728-6457,	FAX (614) 728-2914
Columbus South	(614) 728-3008,	FAX (614) 644-5707
Dayton	(937) 264-5230,	FAX (937) 264-5251
Governor's Hill	(513) 583-7085,	FAX (513) 583-7080
Independence	(216) 573-7200,	FAX (216) 573-7233
Mansfield	(419) 529-7603,	FAX (419) 529-4104
Toledo	(419) 327-8988,	FAX (419) 327-8998
Warren	(330) 306-4165,	FAX (330) 305-4173
Zanesville	(740) 450-5161,	FAX (740) 450-5171



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