



Toolbox Safety Talks for Fabrication Shops



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MCAA Toolbox Safety Talks for Fabrication Shops

Training Documentation for Test # _____

The undersigned workers have participated in safety training covered by the MCAA Toolbox Safety Talk that corresponds to the number in the space above.

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Instructions for the Toolbox Safety Talk Presenter

Preparation:

1. Select the most appropriate talk for the week.
2. Keep track of the talks you present so you don't inadvertently repeat them.
3. Photocopy the talk you plan to use (one for each participant).
4. Print a copy of the generic training documentation sheet and write in the number of the Toolbox Talk in the blank at the top.

Presentation:

1. Answer any questions from the previous week's talk that you were unable answer at the time of the talk. Give a copy of the new talk to each participant.
2. Present the content of the talk slowly and clearly.
3. Relate any experiences you've had that deal with the topic.
4. Ask the participants to share their own experiences that relate to the topic.
5. Ask whether there are any questions or comments.
6. Write down any questions that you can't answer and any comments that you think would be useful to the company.
7. Have each participant sign the training documentation sheet.
8. File the training documentation sheet where you can access it quickly if needed.

Follow-Up:

1. Be sure to re-read the questions and comments you recorded.
2. Find the answers to the questions you were unable to answer. Start the next week's talk by answering those questions.

Talk #1 – The Most Common Fabrication Shop Injuries

There are different types of injuries that occur in fabrication shops, but some stand out more than others because they occur more frequently, and recur more often than other types of injuries. Any time injuries occur frequently and repetitively it's worth a closer look. Following are the most common injuries in mechanical industry fabrication shops, and safe work practices to help you prevent them.

- Back injuries are one of the most common injuries that occur in prefab shops. The injuries occur most often during the manual handling of materials. To help prevent these types of injuries:
 - Have the materials staged as close to your work station as possible.
 - Use material moving equipment such as gantry cranes, forklifts, pallet jacks, mobile pipe racks, wheeled carts, etc. to move materials.
 - When you have to move materials manually, make sure your muscles are warm and flexible, get help when the materials are heavy and/or bulky, and use proper lifting techniques.
- Hand Injuries are another common prefab shop injury. Most hand injuries are cuts from sharp pipe or sheet metal edges, gouges from slipping hand tools, and pinches from moving materials. Occasionally, someone gets a hand crushed by moving materials, machines or other equipment. To help prevent these types of injuries:
 - Wear cut resistant gloves that fit correctly and allow you to grip materials firmly.
 - Be cognizant of where you place your hands when you are moving materials, especially stacked materials.
 - Before you use power tools and equipment, make sure the guards are in place and properly secured.
- Eye injuries are also common in prefab shops. Most of the time they take place when safety glasses weren't used at the time the injury occurred or someone looked at a welding arc without proper eye protection. To help prevent these injuries:
 - Get in the habit of putting your safety glasses on before you enter the shop, and never take them off until you exit the shop. Always keep your safety glasses on, even when you're welding. They work in conjunction with your welding helmet.
 - Use the proper shaded lens or lenses when you are welding and cutting, and always use a welding screen to protect the eyes of others in the work area.

Talk #2 – Fabrication Shop Safety

Working in fabrication shops safely isn't difficult if you know where to focus your attention. The industry already knows how most fabrication shop injuries occur and how to prevent them. The best way to work safely in your shop is to learn how most shop injuries occur, take the necessary steps to prevent them, and stay cognizant about them throughout each work day. The safe work practices that follow will help you protect yourself from shop injuries.

- Put on all of the necessary protective equipment before entering the shop. At a minimum you'll need safety glasses, cut resistant gloves, and protected toe boots. If there is excessive noise in the shop you'll need ear plugs or ear muffs, and if there are overhead hazards, you'll need a hardhat.
- Check to determine whether the shop is properly ventilated before you start working. The local exhaust ventilation system should be turned on and functioning properly. If the shop utilizes fans to move air, make sure they are turned on and functioning properly as well.
- Additional protective equipment is needed for welding. Make sure you have all of the necessary protective equipment and the proper shade of lens or lenses before you start to weld.
- Avoid moving pipe and other materials by hand as much as possible. Use materials moving equipment such as gantry cranes, forklifts, pallet jacks, mobile pipe racks and wheeled carts whenever you can.
- When you have to move materials by hand, make sure your muscles—especially your back muscles—are warm and flexible, and use proper lifting techniques.
- Before using any type of equipment or power tools, ensure that the guard or guards are present, located in the proper place, and properly adjusted and secured.
- Inspect power tools before you plug them in to ensure that the cords and plugs are in good condition. If you identify a tool with a damaged cord, missing ground prong or any other type of damage, take it out of service immediately and follow your company's procedures for taking defective equipment out of service.
- Place welding screens between your work station and the rest of the shop so that passersby won't inadvertently look at the welding arc.
- When welding fumes are a concern due to inadequate ventilation, use a point-of-operation ventilation system, such as a smoke eater, when you're welding.

Talk #3 – Fabrication Shop Housekeeping

Keeping your prefab shop clean and orderly is important for several reasons that pertain to safety. When shops are not clean and orderly there are an inordinate number of slips, trips and falls, many of which result in injury. Also, shops that aren't clean are much more susceptible to fires. Think about all the potential ignition sources in your shop, which include welding, cutting and grinding sparks generated from everyday work. When the shop isn't clean it's just a matter of time before a fire gets started. The following are fabrication shop housekeeping items that will help you keep your shop clean and orderly.

- Keep the walkways, aisles, and work station floors completely clear of objects.
- When walkways, aisles, and work station floors get wet, muddy or greasy put a barricade, such as caution tape, around them to keep others out of the area, and don't remove the barricade until the area is clean.
- Store pipe and other materials in designated staging areas in a neat and orderly fashion.
- Use pipe racks, shelves, pallets and similar materials storage devices to keep materials off the ground and arranged in an orderly fashion.
- Keep potential trip hazards, such as power cords, stinger leads and cylinder hoses, out of walkways and aisles.
- Arrange cords, leads and hoses so that you can enter and exit your work station without having to step over or around them.
- Remove scrap materials from all walking surfaces and work station floors immediately after they are cut. Place them in a designated bin or cart for later removal.
- Dispose of all greasy, oily rags and other flammable materials in approved containers with self-closing lids.
- Sweep up and remove trash, metal shavings and other disposable materials from the floor as often as necessary to prevent slips, trips and falls.
- Empty trash bins before they start to overflow to keep trash off the floor.

Talk #4 – Fabrication Shop Job Safety Planning

Planning each job will go a long way towards helping you prevent fabrication shop injuries. The planning process takes very little time, but thinking ahead about what you'll need, when you'll need it, how you will get it to your work station, how you will organize it there, and how to proceed when the job is completed will reduce your exposure to potential fabrication shop hazards. Take just a minute or two to plan each job.

- Consider each job in steps using the fewest possible steps without jeopardizing your ability to identify any potential hazards. An example of a sequence of steps for a job is:
 1. cutting pipe;
 2. moving pipe and fittings to your welding work station;
 3. organizing your work station;
 4. welding; and
 5. moving the completed fixture to a designated staging area for transportation.
- Once you have the steps figured out, think about everything you'll have to do to complete each step individually.
- An example of what you might have to do to complete the first step described above is
 1. lift a piece of pipe off a rack to place it on the cutter;
 2. secure the pipe in place;
 3. start the cutter;
 4. make the cut;
 5. shut off the cutter; and
 6. lift and move the pieces of pipe to place them on a cart.
- Now identify the potential hazards associated with each step by thinking through the things you'll have to do to complete it. An example of a hazard that could be associated with the "make the cut" step is the manual handling of the pipe, which could result in a back injury if not done properly.
- Finally, follow the safe work practices that will help you eliminate the potential hazards that you've identified.
- An example with regard to avoiding the manual handling of pipe and a potential back injury would be to get someone to help you lift the pipe off the rack and place it on the cutter.

Talk #5 – Fabrication Shop Chemical Hazards

All fabrication shops have chemicals and chemical compounds that can be hazardous if they aren't handled carefully. Some chemicals can be explosive, flammable, toxic and/or reactive to other substances. Some of the common fabrication shop chemicals and best safe work practices are described below.

- Acetylene – An extremely flammable gas under pressure that may explode if heated. Keep it away from heat, sparks, open flames and hot surfaces, and store it in a well-ventilated place.
- Oxygen – A non-flammable gas that rapidly accelerates the rate of combustion. Keep it away from flammable gases, and flammable/combustible materials.
- Argon – A gas under pressure. It may explode if heated. Store it in a well-ventilated area.
- Propane – An extremely flammable gas under pressure that may explode if heated. Keep it away from combustible materials, and store it in a well-ventilated area.
- Welding Rod – A solid made up of several different chemicals. The chemical composition differs based on the type of rod. Common concerns with welding fumes include manganese, and hexavalent chromium (when using stainless steel rods).
- Welding Flux – A chemical compound, the chemical composition of which differs depending on the type of flux. It may cause eye, skin and respiratory tract irritation.
- Acetone – An extremely flammable liquid that also presents health hazards. It can be extremely irritating to eyes and skin and can cause drowsiness and dizziness if inhaled.
- Aerosol Paint – A liquid made up of different chemicals. The chemical composition differs depending on the type of paint. Many aerosol paints are extremely flammable, highly irritating to eyes and skin, and can cause drowsiness and dizziness if inhaled.
- Thread Sealant – A chemical compound that can cause skin, eye and respiratory irritation.
- Gasoline – An extremely flammable liquid that also presents a health hazard because it contains the carcinogen benzene.
- Check the Safety Data Sheets (SDS) for these and other chemical substances in your shop. Pay close attention to the *Hazard Identification* and *Exposure Controls/Personal Protection* sections (sections 2 and 8 respectively).

Talk #6 – Fabrication Shop (GHS) Hazard Communication

You have the right to know about the chemical substances that are in your shop. However, the way you will be informed about the hazards associated with those chemicals has recently changed. The new method, which is described below, is referred to as the Globally Harmonized System (GHS) of hazard communication. All hazardous chemical substances that come from a manufacturer or distributor are required to have hazard warning labels. The labels should include the following:

1. **Signal Word.** The signal word will be either “Danger” or “Warning.” “Danger” means the chemical substance is associated with more severe hazards. “Warning” means the chemical substance is associated with less severe hazards.
 2. **Hazard Statement.** A “Hazard Statement” is a statement assigned to a specific hazard class and category that describes the nature of the hazard. For example, the hazard statement for acetylene is: *“Acetylene – Extremely flammable gas. Explosive: fire blast or projection hazard. Acetylene is a highly flammable gas that is unstable under certain conditions and can decompose explosively.”*
 3. **Precautionary Statement.** A “Precautionary Statement” is a phrase that describes the recommended protective measures to minimize or prevent adverse effects resulting from exposure to a chemical or improper storage or handling of a hazardous chemical. As an example, the “Precautionary Statement” for oxygen is: *“Oxygen – Keep away from combustible materials. Keep valves and fittings free from oil and grease.”*
 4. **Pictogram(s).** Pictograms are symbols and other graphic elements intended to convey specific information about the hazards of a chemical. There are eight safety pictograms: **Health Hazard** (carcinogen, target organ, etc.), **Flame** (flammables, etc.), **Exclamation Mark** (skin and eye irritants, skin sensitizers, etc.), **Gas Cylinder** (acetylene, oxygen, argon, etc.), **Corrosion** (skin corrosion, burns, etc.), **Exploding Bomb** (explosives, self-reactives, etc.), **Flame Over Circle** (oxidizers) and **Skull and Crossbones** (acute toxicity).
- All hazardous chemical substances are required to have a Safety Data Sheet (SDS). The SDS for each of them has sixteen similarly organized sections that describe what you’re working with, the hazards associated with the chemical substance, the protective measures needed to prevent overexposure, and other useful information. Make sure you know how to access the SDSs for all the chemical substances in your shop. When you have a concern, check the SDS for the chemical substance you’re concerned about. Pay close attention to the *Hazard Identification* and *Exposure Controls/Personal Protection* sections (sections 2 and 8 respectively).

Talk #7 – Head Protection

Any time there is the potential to be struck in the head by an object, or to strike your head against an object, it's important to use safe work practices to prevent head injuries. Potential hazards can include being struck by materials falling from overhead, being struck by materials swinging from the side, being struck by materials being carried by someone else, and slipping, tripping or falling into a stationary object. Potential hazards to watch out for and safe work practices you can use to help prevent head injuries follow.

- One of the potential hazards is objects falling from above you, such as materials being accessed in racks or shelves that are above head height. To protect yourself, ensure that you do not have to reach up over your head to retrieve the materials. For example, you could use mobile stairs or rolling ladder platforms to access the materials safely.
- Another potential hazard is from materials being lifted overhead by a crane or a hoist. Never trust the rigging. The best protection is to ensure that you're never underneath a load. If you're controlling the load, walk with it, but far enough to one side to keep from getting hit if the load does fall. If you're just passing by a moving load, avoid it by taking another path around it.
- Swinging loads can be hazardous, too. If you're moving a load that tends to swing, use a tagline and get a second person to control the load with the tagline until the load gets to its destination and is safely lowered to its place.
- When someone else in the shop is carrying bulky materials—especially long pieces of pipe being carried on someone's shoulder—there is potential to be hit in the head. Establish and mark off a materials moving path in the shop. Use that path exclusively for moving materials. Also, establish a simple communication/warning system so that everyone who has to move materials will get in the habit of giving a heads up to others in the area.
- Make sure the shop stays clean, neat and organized. Good housekeeping will help prevent slips, trips and falls that could result in head injuries. Keep scrap materials, tools, trash and other potential slip/trip/fall hazards off the floor.
- When they are needed, hardhats are a great source of head protection. There are different types of hardhats depending on the potential hazards.
- Class II hardhats are designed to reduce the force of impact from the top or the side of the head, such as when materials fall from overhead or pipe swings in from the side. When you're in a situation where you could be struck by a falling object or materials from the side, wear a Class II hardhat.

Talk #8 – Eye and Face Protection

There are quite a few potential eye and face hazards in fabrication shops including flying objects, flying particles, chemicals, ultraviolet radiation, infrared radiation and visible glare. Eye and face protection is mostly about selecting and properly using the right personal protective equipment to keep the eyes and face safe since these potential hazards can't be engineered out of the workplace. Safe work practices for eye and face protection follow.

- Wear the proper type of eye and face protection any time there is the potential for flying objects, flying particles or chemical splashes, or in the presence of ultraviolet or infrared radiation.
- For starters, you should always put on a pair of safety glasses before you enter into a working fabrication shop.
- Select safety glasses that provide either wrap-around protection or side shields so that flying objects or particles can't get into your eyes from the sides.
- If you wear regular glasses, you can either have prescription safety glasses made or wear contact lenses under your standard safety glasses.
- Be sure to keep your safety glasses on at all times, even when you're welding. They won't affect your welding helmet, so be sure to wear them underneath.
- When working with chemicals that can be harmful to your eyes such as acids or solvents, wear splash-proof safety goggles and a face shield.
- When soldering use safety goggles with, at a minimum, #2 shaded lenses. When brazing your safety goggles should have at least #3 shaded lenses.
- When cutting with oxy-acetylene use shaded goggles designed specifically for that purpose. The minimum shade for the lenses is #5.
- When welding, your welding helmet filter plate shade will need to be somewhere between a #10 and a #14 depending on what type of welding you're performing and several other factors. If you're not sure what shade of filter plate you need, check the welding machine manufacturer's recommendations or check with your supervisor.
- Always wear a face shield when you're grinding, chipping, wire brushing, using chemicals or performing any other type of work that could result in a face injury. But, always remember that a face shield does not provide adequate protection for your eyes. You always need to wear safety glasses or safety goggles under your face shield.

Talk #9 – Hand Protection

Potential hand hazards are everywhere in fabrication shops. There are a myriad of pinch points, sharp edges, opportunities to get caught up in equipment, and plenty of potential burn hazards. And, there is a tendency to become desensitized to the hazards when performing similar tasks day after day. However, there are safe work practices you can follow to help you protect yourself from hand injuries as follows.

- Try to stay cognizant of hand hazards and the consequences of where you are about to place your hands. Every time you see a cut resistant glove, welding glove or chemical protection glove, remind yourself to stay aware of the shop's potential hand hazards.
- Look materials over carefully before you reach for them. Look for sharp and jagged edges, especially where you plan to grip them.
- Wear cut resistant gloves at all times in the shop unless you have to take them off to weld. Just remember to put them right back on as soon as you remove your welding gloves.
- Always wear welding gloves when performing torch cutting, arc gouging or welding.
- Before you use any type of power tool or machine, make sure the guard or guards are properly in place. If a guard or guards are missing, don't use the machine until they have been replaced.
- If guards are present, make sure they are in good condition, positioned properly, and secured in place before you start the machine.
- If guards are missing or damaged, don't use the machine. Follow your company's procedures for taking defective equipment out of service until the necessary replacements and/or repairs are completed.
- When working with chemicals that could be harmful to your skin, be sure to wear the appropriate type of gloves. For acids and solvents, which are common in prefab shops, use neoprene gloves.
- If you're not sure what type of gloves to use for a specific chemical, check the *Exposure Controls* and *Personal Protection* section (section 8) of the Safety Data Sheet (SDS) for the chemical substance.
- When you're about to start grinding, select gloves that will provide some protection from the abrasive wheel, and also from the sparks. Leather gloves work well for grinding as do some types of the cut resistant gloves. Just make sure that whatever you choose doesn't cause you to lose a great deal of dexterity.

Talk #10 – Foot Protection

Potential foot hazards exist just about everywhere in fabrication shops. Everything from dropped objects to rolling pipe can cause injuries to your feet. The information that follows describes the most common prefab shop foot hazards and accompanying safe work practices to help you avoid them.

- Some of the most common foot hazards in prefab shops are:
 - tools, materials or equipment dropped on a foot;
 - heavy objects, such as a finished prefabricated plumbing unit, set down on a foot;
 - heavy pipe rolling up on a foot;
 - objects with wheels, such as forklifts, skid steer loaders, mobile carts, mobile stairs, mobile platform ladders, etc., rolling up on a foot; and
 - sparks or slag from a hot work operation falling inside a shoe.
- The best means of protection is to avoid the potential hazards altogether. Stay cognizant of where you'll be placing your feet, just like you would with your hands.
- Get help when you have to carry heavy and/or bulky items by hand.
- When carrying or moving objects such as finished prefabricated units, machines or equipment, think about your foot placement before you set the object down. Be sure there is clear communication with the person or persons who are helping you move the object.
- Keep tools and materials away from the edges of tables and work stations. Secure pipe in place so that it can't roll off the table.
- When necessary, use chocks to keep pipe from rolling.
- Make sure that stacked pipe is secured in place so that it won't roll off the truck, pipe rack, forklift or loader.
- Designate and mark materials moving pathways in the shop. Every time you see the marks it should remind you about the wheeled equipment the path is designed to control.
- Always wear protective footwear in the shop. It's best to wear flame resistant boots that have a protected toe, and that come up above the ankle to help prevent sparks and slag from getting inside the boot.

Talk #11 – Task-Specific Protective Equipment

There's quite a bit of protective equipment that doesn't have to be worn continuously while working in your fabrication shop because it's used for specific purposes like hot work or work with hazardous chemicals. The task-specific protective equipment that you're likely to need while working in your fabrication shop follows.

- Welding:
 - Flame resistant coverall or clothing and protected-toe flame-resistant work boots;
 - Welding helmet with the proper shade of lens (filter plate);
 - Safety glasses always, even under your welding helmet;
 - Welding gloves; and
 - Respirator when ventilation is inadequate. You must be properly trained, fit tested and medically qualified to use a respirator.
- Cutting, Brazing and Soldering:
 - Flame resistant clothing;
 - Safety goggles with the proper shade of lenses; and
 - Welding gloves or flame-resistant work gloves.
- Shaded Lens or Lenses:
 - Torch soldering – #2 shaded lenses;
 - Torch brazing – #3 or #4 shaded lenses;
 - Oxy-acetylene cutting – #5 shaded lenses;
 - Electric arc welding – #10, #12, or #14 shaded lens depending on the size of the electrode, and the amount of current that will be generated.
 - Gas metal arc welding – #11, #12, or #14 shaded lens, depending on the amount of current being generated.
- Grinding:
 - Safety glasses;
 - Face shield; and
 - Cut- and abrasion-resistant work gloves.
- Hazardous Chemical Use:
 - Safety goggles;
 - Face shield;
 - Protective coverall or apron; and
 - Appropriate gloves depending on the chemical substance. To determine which gloves are appropriate, check section 8 of the Safety Data Sheets (SDS) for each chemical substance.

Talk #12 – Respiratory Protection

On some occasion you may be required to wear a respirator when working in your fabrication shop. When it is necessary, it's because there's an excessive amount of fumes being generated from hot work, and the ventilation system by itself isn't efficient enough to handle it. When ventilation systems alone are not enough to prevent you from inhaling hazardous concentrations of toxic fumes, you can usually protect yourself adequately with an air purifying respirator. Basic guidelines on air purifying respirator use follow.

- Never use a respirator until you have received the proper training, fit testing, and medical clearance. Training covers your company's written respiratory protection program, including but not limited to hazard identification, respirator selection (so you'll know whether an air purifying respirator will be adequate for the job), fit testing, seal checks, use, maintenance and storage.
- Check with your supervisor about the hazardous substance exposure assessment. The assessment lets you and your company know what type of respirator you will need.
- Be prepared to go through a fit testing process. The process ensures that the respirator seals properly to your face. Make sure you are clean shaven wherever the respirator will contact your face.
- Inspect your respirator before every use. If you find any damage or defects, don't use it. Immediately follow your company's procedure for taking defective equipment out of service.
- Before using your respirator, perform a seal check. A seal check is a process to determine whether the respirator is properly sealed to your face. You will learn about, and practice, the process in training.
- Replace cartridges/filters as soon as you smell or taste any substance coming through the respirator.
- Any time it becomes difficult to breathe with your respirator on, it's an indication that the filters are dirty or clogged. When that occurs replace the filters immediately.
- Maintain your respirator and always keep it clean. You'll learn about maintenance and cleaning in training.
- When you're not using it, always store your respirator in a sealed bag or container and keep it in a cool, dry place.

Talk #13 – Hearing Protection

Sometimes it gets excessively noisy in fabrication shops. That's when you need some type of hearing protection. The type of protection you need is based on the amount of noise you'll be exposed to, and the length of time that you will be exposed to it. Noise is measured in decibels. The more decibels you're exposed to, the less time you can safely endure the noise. The information that follows will help you determine when you might be overexposed to noise, and how to protect your hearing while working.

- The maximum safe noise level in your shop is 85 decibels over an 8-hour time period.
- It's impossible to determine the exact number of decibels in your work area without specialized equipment such as a noise level reader or a noise dosimeter.
- One way to help determine whether it's too noisy in your work area without having to use special equipment is to have a normal conversation with someone who is standing two or three feet away. If you can't hear from that distance the chances are good it's excessively noisy in that part of the shop.
- Another way to make the determination is to gauge the noise level by comparing it to other noise levels with which you are familiar. For example, normal conversation takes place at around 60 decibels. A gas-powered lawnmower or chainsaw generates around 100 decibels. An air compressor generates around 90 decibels.
- If you believe that the noise level in your shop at any given time is at 85 decibels or more, or whenever you aren't sure, use some type of hearing protection, such as ear plugs or ear muffs.
- Each type of hearing protection has its own noise reduction rating (NRR). Even different types and/or brands of earplugs have different ratings.
- Having choices of hearing protection equipment with various NRRs allows you to choose protection that reduces the noise to a comfortable level, but doesn't reduce it to a point that you can't hear warnings such as a forklift operating nearby or someone's shout from within the shop.
- If you choose earplugs, make sure you insert them properly. If you're not sure how to do it, check with your supervisor.
- Use new disposable earplugs each day, or make sure you carefully clean reusable earplugs with warm water and a mild detergent before each use.

Talk #14 – Metals

Metals in their natural state are not generally hazardous. However, in fabrication shops we frequently change metals from their natural state when performing hot work such as welding, cutting, soldering or brazing.

- The most significant hazard is overexposure to metal fumes from inhalation. Here is what to watch out for whenever you work around metals:
 - Some of the more common and potentially hazardous metals that we could be exposed to include hexavalent chromium, zinc and manganese.
 - Welding and cutting stainless steel pipe may result in exposure to hexavalent chromium, which is carcinogenic in humans.
 - Welding and cutting galvanized metal generates zinc fumes, which could result in metal fume fever.
 - Certain types of welding rods generate manganese fumes, which can affect the nervous system.
- Before you start work, determine which metal or metals you'll be working with and whether there are hazards associated with those metals.
- To make the determination regarding hazards check the manufacturer's Safety Data Sheet (SDS) for the specific object you'll be working on. Look for section 2, which will identify the hazards; section 3, which will describe the ingredients/composition of the material; and section 8, which describes exposure controls and personal protection.
- Determine what you have to do to keep from becoming overexposed.
- Whenever you are welding, cutting, brazing or soldering, make absolutely sure that the ventilation in your work area is adequate for the job.
- If the ventilation is poor, respiratory protection may be required.
- Never use a respirator before you have received the proper training, fit testing and medical clearance. Always talk it over with your supervisor before you use a respirator.

Talk #15 – Hexavalent Chromium

Hexavalent chromium, which is also referred to as Cr(VI), is a heavy metal substance that may cause lung cancer and possibly other health problems if inhaled in large enough concentrations over a long enough time period. The potential for exposure to hexavalent chromium in fabrication shops is hot work on stainless steel. Stainless steel contains chromium which, when heated to its boiling point, converts to its hexavalent state. Information, including safe work practices that will help you protect yourself from overexposure to Cr(VI), follow.

- Hexavalent chromium is a known carcinogen. Overexposure to Cr(VI) over a long enough period of time can lead to lung cancer, and possibly other health issues.
- Some stainless steel materials contain more Cr(VI) than others, but those with higher concentrations typically generate greater exposure when hot work is performed.
- Stainless steel welding rods also emit Cr(VI).
- Certain work practices generate more exposure than others. For example, with all else being equal, stick welding generates considerably higher potential for overexposure to Cr(VI) than TIG welding.
- To prevent overexposure, implement protective measures to keep from inhaling fumes while performing hot work on stainless steel.
- Keep the shop well ventilated. Local exhaust systems help, and much of the time they are adequate. However, it's always a good idea to use a point-of-operation ventilation system, such as a smoke eater, whenever you are performing hot work on stainless steel.
- It's also a good safe work practice to keep your welding hood down and position your body, especially your chin, so that the fumes cannot get up underneath the hood and into your breathing zone.
- If your employer's hexavalent chromium exposure assessment shows that ventilation alone isn't enough to keep the fumes to safe exposure levels you'll be required to use a respirator.
- Never use a respirator before you have received the proper training, fit testing and medical clearance. Always talk it over with your supervisor before you use a respirator.

Talk #16 – Zinc

Hot work on galvanized metal generates fumes when the metal reaches its boiling point. Fumes from galvanized metals contain zinc oxide, which can make the welder and others in the shop feel pretty sick. Important information about zinc oxide, including safe work practices to help you protect yourself from getting sick when working around it, follow.

- Zinc is a heavy metal substance found in galvanized metals. When it gets hot enough it converts to zinc oxide, which can be inhaled by humans.
- If zinc oxide is inhaled in large enough concentrations over a long enough period of time it can result in zinc fume fever.
- Zinc fume fever (metal fume fever) is a temporary illness that manifests itself in flu-like symptoms.
- Symptoms may include a fever, which rarely exceeds 102 degrees Fahrenheit, chills, nausea, dryness in the throat, cough, fatigue, aching head, and sometimes aching throughout the body.
- If the victim gets fresh air immediately the symptoms rarely last more than 24 hours. However, that 24 hour period can be miserable. Prevention is a much better option.
- To help prevent overexposure to zinc oxide, make sure the work area has plenty of ventilation.
- An efficient local exhaust ventilation system may be all you'll need to reduce exposure to zinc oxide to safe levels.
- However, when local exhaust ventilation by itself is inadequate, use a point-of-operation ventilation system, such as a smoke eater.
- If a smoke eater is not available, use one or more large industrial fans to continuously move the fumes away from your breathing zone.
- When ventilation by itself is inadequate, you'll need to use a respirator. Never use a respirator before you have received the proper training, fit testing and medical clearance.
- Always talk it over with your supervisor before you use a respirator.

Talk #17 – Manganese

Manganese is a metal that is part of the composition of many types of welding rods. Although carbon steel electrodes have a higher concentration than stainless steel electrodes, there isn't a whole lot of manganese in either type of rod. Overexposure to manganese usually takes place in work areas that are not well ventilated, and that have several welding operations going on simultaneously that are generating manganese fumes, such as fabrication shops. More information about manganese and safe work practices to help you protect yourself from overexposure to manganese, follow.

- Fumes created by welding can generate airborne concentrations of manganese. These fumes can be harmful if they are inhaled in large enough concentrations over a long enough period of time.
- Overexposure to manganese can severely affect the nervous system and result in symptoms that are similar to Parkinson's Disease.
- The symptoms can include tremors, loss of balance, poor memory, slurred speech, lack of facial expression, and sleep disorders.
- If you're not sure whether the welding rods you're using contain manganese, check the manufacturer's Safety Data Sheet (SDS) for that specific rod. Look for the section that lists the ingredients/composition, which is Section 3 in the Globally Harmonized System (GHS) compliant SDSs.
- If the welding rod contains manganese, you need to make sure that you don't perform welding operations in poorly ventilated areas.
- One option is to use a point-of-operation ventilation system, such as a smoke eater.
- Another way to improve ventilation, which may by itself may be adequate, would be to open doors and windows, and use portable blowers or large industrial grade fans to blow the fumes away from your breathing zone.
- If adequate ventilation can't be established you'll need to wear a respirator. Never use a respirator before you have received the proper training, fit testing and medical clearance.
- Always talk it over with your supervisor before you use a respirator.

Talk #18 – Moving Materials and Equipment

Moving materials and equipment is a daily requirement in fabrication shops. Unfortunately, the improper handling of materials results in injuries to fabrication shop workers every day. However, there are a few key steps you can take that will help you prevent most material handling injuries. The following are safe work practices to help you protect yourself when moving materials and equipment.

- Unload materials from the delivery trucks as close to your immediate work area as you possibly can.
- Keep pipe, fittings and other materials off the ground as much as possible. Materials that aren't too big or too bulky should be stored on pallets, in mobile racks or on tables or shelves as close to waist height as possible.
- When moving materials and equipment, use material handling equipment such as forklifts, skid steer loaders, gantry cranes, pallet jacks, wheelbarrows, pipe carts, dollies and hand trucks.
- Never lift and move materials that can be moved by some other means.
- When you have to lift and move heavy or bulky objects always get help from a co-worker.
- Always use proper lifting techniques. Get as close to the object as you can. Bend your knees. Get a firm grip on the object. Keep your butt down and your head up. Tuck in your arms and elbows. Use your legs to raise your body and lift the object in a slow, smooth motion.
- When you are carrying an object, never twist your torso. Move only your feet to change direction.
- Wear cut resistant gloves to protect your hands from cuts and scrapes, especially when working with sheet metal or sharp edges on pipe.
- Think ahead about where you are placing your hands when moving materials to avoid having them pinched or crushed.
- Efficient material handling in your shop increases productivity. The good news is that for every percentage point that productivity is increased, the risk of injury decreases by one percentage point.

Talk #19 – Forklifts and Skid Steer Loaders

There are several different types of forklifts and skid steer loaders used in fabrication shops, but general safe work practices for the operators apply to most types of forklifts and loaders. And, the safe work practices for workers in the shop, who are working near the equipment, apply to all of them. Information about working safely with and near forklifts and skid steer loaders follows.

- Make sure you get proper training on how to safely and effectively operate each individual type of forklift and/or skid steer loader that you will be using.
- Inspected the forklift and skid steer loader each day before you use them. Make sure the tires are in good condition and properly inflated. Look for broken and missing parts, and fluid leaks. Also, operate the controls without a load in place to ensure that all of the equipment's functions are working properly.
- If you find any problems with the equipment, don't use it. Immediately follow your company's procedures for taking defective equipment out of service.
- Be sure to check the rated load capacity of the lift or loader before you start to use it. Find the ID plate on the equipment that describes the specifications.
- Never attempt to pick up a load that exceeds the rated capacity of the equipment.
- Keep the load centered on the forks or the bucket, and avoid making any sudden starts, stops, or sharp turns, and traveling on inclines.
- Regardless of whether you're operating a lift or a loader, travel only with the forks or bucket in the down position. There should only be enough height to safely clear speed bumps, tracks, uneven surfaces, etc.
- Always move slowly and carefully, scanning ahead on the path you're traveling.
- When using a forklift, be sure to match the width of the forks to your load and get enough tilt on the forks to ensure that the load won't fall while you're moving the lift. If necessary, secure the load in place with chains or ratchet straps.
- When using a skid steer loader, be sure to secure the load in place when necessary to keep it from falling out of the bucket while the loader is in motion. Use chains or ratchet straps to secure the load when needed.

Talk #20 – Gantry Cranes

Gantry cranes are extremely functional for moving heavy materials in fabrication shops. However, just like other types of cranes they come with several potential hazards. The biggest potential hazard for workers using or working around gantry cranes is being struck by an object falling from the crane/rigging, or struck or crushed by an object swinging into them. The information that follows describes some basic safe work practices to help you protect yourself from those hazards.

- Don't use the crane until you have received the proper training. Part of the training should include review of the manufacturer's recommendations regarding inspection, use, and maintenance. Make sure you have access to the operator's manual and spend time reading through it.
- Inspect the crane each day before you use it. Look for damaged components and hydraulic fluid leaks. Test the controls to ensure that all of the crane's functions, including the brakes holding/load control, are working properly.
- If during the inspection you find anything damaged or not functioning properly, don't use the crane. Immediately follow your company's procedures for taking defective equipment out of service.
- Before using the crane, make sure you know the rated load capacity and ensure that you never exceed it.
- Be sure to use the proper type of rigging and always inspect it before you use it. If you find any damage to the rigging, including any of the hardware, don't use it. Immediately follow your company's procedures for taking defective equipment out of service.
- Pre-plan the job so that the load is never lifted and moved over workers, other persons in the shop, or hazardous materials such as compressed gas cylinders and/or other large chemical containers.
- When the shop set up/workplace design by itself doesn't prevent the load from being lifted over areas where it could do harm, use barriers, warning systems, and/or task scheduling to prevent unsafe lift operations.
- When moving a load, be sure to control it throughout the move. Keep it as close to the ground as possible. When necessary get help controlling and guiding the load, especially if there are blinds spots along the pathway.

Talk #21 – Rigging

Rigging loads for shop gantry cranes, material hoists, and in some cases forklifts isn't much different than rigging loads for large cranes. The following are general safe work practices for safely rigging loads in your shop.

- Once you start the rigging process, be sure not to engage in any activity that could distract you from your rigging responsibilities, such as answering your cell phone or having a conversation with another worker.
- Always wear protected toe boots when rigging. Also, wear a hardhat anytime there is a chance of being struck by an object in the head, or hitting your head up against a stationary object.
- Determine the rated load capacity of the crane, hoist, or forklift if applicable.
- Determine the proper hitch/type of rigging needed for the lift.
- Determine the rated load capacity for the rigging you are considering for the job.
- Determine the weight of the load to be lifted and ensure that you never exceed the rated load capacity of the equipment and the rigging.
- Before you rig the load, inspect the slings, chokers, and/or fittings that you will be using. If any of them appear to be defective, don't use them. Immediately follow your company's procedures for taking defective equipment out of service.
- Rig the load so that it will move up and not sideways when the lift begins. Side pulls can lead to slipping loads, damaged rigging, and swinging loads. Position the hook as close to the center of the load as possible.
- Before lifting the load, make sure you have plenty of room to get out of the way if necessary. Never place yourself between the load and any other object such as stored materials, shop equipment, etc.
- Whenever possible, release the sling or choker before the lift begins. When you have to position the sling or choker until tension is applied to the cable, make sure your hands are positioned so that they won't be pinched or crushed when the cable is tightened.
- Test the positioning of the rigging by having the load lifted slowly, but be sure to keep all of your body parts out from under the load.

Talk #22 – Material Handling Equipment

Moving materials manually should be a last resort in fabrication shops. The proper use of material handling equipment is much more efficient. Not only will it make you more productive, but it will also help you prevent back, shoulder and other types of injuries. Safe work practices for material handling equipment follow.

- The best way to safely handle material is to handle it as little as possible manually. Use whatever means are available to reduce the number of times that you have to bend, reach, lift, and/or carry materials by hand.
- Your first choice for lifting and moving heavy and/or bulky materials and equipment should be to use powered material handling equipment whenever it's available. However, the powered equipment is only efficient when the materials are easily accessible and easy to load with as little manual handling as possible.
- Ensure that the materials are staged in such a way that accessing and moving them with powered material handling equipment is as efficient and effective as possible.
- Some of the most common powered material handling equipment found in fabrication shops includes forklifts, skid steer loaders, gantry cranes, and powered pallet jacks.
- Always inspect powered material handling equipment each day before you use it.
- Start the inspection from the ground up. Look for fluid leaks, worn tires, damaged parts, etc. Check the operational controls and warning systems where applicable. The steering, brakes, lights, horn, warning alarms, etc. should all be working properly. If anything on the equipment is out of order, don't use it. Immediately follow your company's procedures for taking defective equipment out of service.
- Lighter and less bulky materials may not require powered material handling equipment, but when that's the case, use wheel-equipped material moving equipment whenever possible. Manual pallet jacks, mobile pipe racks, carts, mobile tables, wheeled pipe and tubing movers, pipe dollies, etc. will help you move materials with a minimum of bending, reaching, lifting and carrying.
- Even the equipment used for removing scrap materials and trash should be on wheels. Make sure that scrap pipe and other scrap materials don't end up on the floor. Place them in designated wheel equipped bins so that someone won't have to bend down to pick them up off the floor later.

Talk #23 – Bending and Reaching

Back injuries, mostly lower back, are one of the most frequent injuries that occur in mechanical industry fabrication shops. Even though we're aware of this, these injuries continue to occur with too much frequency. One reason is that we are still bending and reaching way too often. As we go through the talk today keep in mind that for every single percentage point that you increase productivity, the risk of injury decreases by 1 percent. More information on bending and reaching, including safe work practices that will help you prevent injuries, follows.

- Bending means leaning your body far enough in any direction that it temporarily moves your spine out of its natural position. Mechanical fabrication shop workers do a lot of bending. The numbers of bends performed by those who work a full 30 year career are in the millions.
- Reaching means your arms are extended out, or overhead to the point that your hands are 20 inches or more away from your torso. Fabrication shop workers also reach quite a bit. The number of reaches performed by those who work a full 30 year career are also in the millions, and close to twice as many reaches as bends are performed over that 30 year period.
- One of the keys to back injury prevention is to reduce the number of bends and reaches as much as possible. If you can make a few changes that will increase your productivity and reduce the number of bends and reaches, the risk of injury will decrease substantially. Start by shooting for a 5 to 10 percent reduction in the number of times you have to bend and reach each day. It will make a huge difference over time.
- Ensure that all materials are delivered as close to your work area as possible by way of material moving equipment. Always limit the manual handling of materials as much as possible.
- Keep materials off the ground as much as possible. Large materials may have to stay on the ground, but most other materials should be stored and staged close to waist height so that you don't have to bend and/or reach to retrieve them. You can keep the materials on rolling carts, rolling tables, rolling pipe racks, etc. to keep them well up off the ground, and to limit the number of times and the distance that you would otherwise have to move them manually.
- Even small items should be stored in mobile storage bins. Also, make sure you consider the height of the shelving, and the position of materials so that you limit reaching.

Talk #24 – Manual Handling of Materials

The manual handling of materials is one of the leading causes of injury in mechanical industry fabrication shops. The most common injury is usually a lower back injury, but other injuries occur, too, such as shoulder injuries and cuts to the hands. It's best to avoid the manual handling of materials as much as possible, but when materials have to be handled manually there are ways to do so safely. The following safe work practices will help you prevent injuries caused by the manual handling of materials.

- When you get to the point in the process where the materials have to be moved by hand, assess how heavy and bulky they are before you start to handle them.
- If you can't handle them easily by yourself, get help from one or more of the other workers in the shop.
- When lifting materials, always use proper lifting techniques.
- As you prepare to lift, keep the object as close to your body as possible. Maintain the natural curves in your back by keeping your butt down and your head up.
- Lift with your legs and avoid twisting your back while you lift and carry the materials.
- Be aware of situations where your hands could get pinched or crushed between materials, or materials and stationary objects, and avoid them.
- Assume that all edges of pipe, fittings, ducts and other materials are sharp. Protect your hands by wearing cut resistant gloves.
- Watch carefully for hazards that could make you slip, trip, or fall while moving materials. Move the hazards or carefully go around them.
- If you are moving materials overhead, and any other time you could be struck in the head by an object or strike your head against a stationary object, wear a hardhat.
- Wear protected toe boots in the shop as well since heavy materials could drop or roll onto your feet.

Talk #25 – Aging Workforce

The industry is well aware of the most common fabrication shop injuries that occur during the manual handling of materials. However, even though we have aggressively addressed them with a number of injury reduction measures, the injuries still occur from time to time. One of the biggest reasons that they still occur is that we are an aging workforce. More than 50 percent of our workforce is officially in the aging category, which means most workers in our industry are 45 years old or older. More information about the aging workforce and safe work practices to help prevent material handling injuries follows.

- Once we reach that aging category the changes that our bodies go through increase rapidly. Among other things we lose strength, balance, speed of movement, and range of motion.
- We also get fatigued much more quickly, experience a reduction in our motor skills, and lose some of our hearing. Our eyes start to go bad even earlier. Usually somewhere between ages 35 and 40.
- In addition to the obvious concerns about aging workers and their ability to safely handle materials manually, there are not-so-obvious concerns such as the loss of tactile sensation in the feet and hands, and the loss of aerobic efficiency.
- The loss of tactile sensation means that pressure receptors in our skin lose their ability to sense pressure, such as when we're climbing a ladder or are gripping an object.
- The loss of aerobic efficiency means that our ability to repeatedly contract our muscles without fatigue is significantly reduced, which means that our muscles become fatigued much more quickly than they did when we were younger.
- To compensate for all of this it's a good idea to implement safe work practices, some of which may not have been necessary earlier in life.
- Use material handling equipment whenever possible.
- When you have to lift heavy or bulky objects, make sure your muscles are warm. A warm environment in addition to some simple stretching of the legs, back, neck and arms, will go a long way toward preventing an injury.
- Get help with lifting and moving all heavy and bulky objects, including those objects that are on the border between being manageable and a little too heavy to handle alone. Objects that you easily handled by yourself earlier in life could be the ones that cause injury today.

Talk #26 – Unloading Materials

Loading and unloading materials can be very hazardous without safe work practices and attentive behavior. The most common hazards associated with loading and unloading materials are falling or jumping from the truck bed or trailer, being struck by the load, being crushed by the load, and the improper manual handling of the materials. The following safe work practices will help you protect yourself from these hazards when unloading materials.

- Once the truck arrives at the previously designated material unloading zone, which should always be on firm, level ground, check to ensure that the truck's engine has been turned off, that it's in gear, and the parking brake is engaged. Set up a barricade using high-visibility traffic cones and caution tape to keep people out of the unloading zone.
- Wear a hardhat, safety glasses, cut resistant gloves that provide reasonably good dexterity, and protected toe boots.
- Carefully inspect the load to ensure that it hasn't become unstable during transportation. If the load has shifted enough to cause problems with any part of the unloading sequence, stabilize the load before proceeding with the sequence.
- Determine the weight of the load and compare it to the rated load capacity of the forklift or crane that will be used to move the load.
- Avoid getting up on the truck bed or trailer whenever possible. When you have to climb up to rig or otherwise prepare the load for removal, use the vehicle's built-in steps (if available), a suitable ladder, or some other safe means to get up and back down safely.
- Remove the primary load restraints, i.e. straps or chains, but keep the secondary load restraints, such as banding, in place during the unloading process.
- Make sure everyone is off the bed or trailer and outside of the demarcated unloading zone before the materials are moved.
- When a forklift is being used to unload the material, follow all appropriate safe work practices that apply to forklifts, including but not limited to inspecting the lift before it is used that day, never exceeding the rated load capacity, and ensuring that the size and spread of the forks are adequate for the load.
- When a crane is being used to unload the material follow all appropriate safe work practices that apply to cranes and rigging, including but not limited to inspecting the crane and the rigging before it is used that day, never exceeding the rated load capacity and using proper rigging techniques.

Talk #27 – Welding

Some types of welding operations generate fewer hazards than others, but all types of welding can be hazardous. Common hazards from welding include electrocutions, eye damage, burns, toxic inhalants, and fire. The following are general safe work practices to help you protect yourself from common welding hazards.

- One of the worst potential hazards from welding is electrocution. To protect yourself you have to keep from becoming the easiest path to ground, and from becoming part of the welding circuit itself. When you are electric arc welding be sure to insulate yourself from the work, the electrode, the electrode holder, and from ground. Clamp your work cable directly to the work and as close to the weld as is practical.
- To protect your eyes from ultraviolet and infrared radiation burns, put on proper eye protection before looking at an arc even for an instant.
- The proper shade of lens for your welding helmet depends on the type of welding you'll be performing. For example, when you're electric arc welding the shade you need depends on the size of the electrode and the amount of electrical current that will be generated. However, when you're gas metal arc welding the shade you need depends only on the amount of current that will be generated. Check with the welding machine manufacturer or your supervisor if you aren't sure about the appropriate shade of lens.
- Use a welding screen at your work station to protect the eyes of others working around you and those who are just passing through the shop.
- Wear safety glasses with side protection under your welding helmet to protect your eyes when you raise your helmet.
- Wear flame resistant clothing that will protect you from sparks and slag. The clothing should not have pockets or cuffs that could catch and hold slag. Also wear flame resistant boots that come up above the ankle.
- Make sure your work area is well ventilated to protect you from inhalation hazards. If your work area can't be properly ventilated, you may need a respirator. Make sure you have the proper training, fit testing, and medical clearance before using any respirator.
- Keep at least one Class ABC fire extinguisher in close proximity to your welding operation. Stop work at least 30 minutes before leaving your work station to watch for smoldering materials.

Talk #28 – Electric Arc Welding’s Greatest Hazard

The biggest hazard in electric arc welding isn’t from heat, sparks, fumes or intense infrared radiation, but from electrical current (electrocution). Whenever you’re performing electric arc welding make sure you’re continuously thinking about the electrical hazards. The following are safe work practices that will help you protect yourself from this hazard.

- On most manual electric arc welding operations, the current ranges from 10 to 600 amps. However, it only takes 70 to 100 milliamps to kill most people and 70 milliamps is only a fraction of one single amp.
- Your best protection is to keep from becoming the current’s easiest path to ground and to keep from becoming part of the actual welding circuit itself.
- Make sure you are always insulated from the welding circuit, the work itself, and from ground.
- Inspect the stinger leads for damage. There can be no damage in the first 10 feet of active stinger lead. Minimal lead damage elsewhere can be repaired by a qualified person with vulcanizing or heat shrinking kits.
- Clamp the work cable directly to the work and as close to the weld as is practical.
- Always keep yourself insulated from the electrode and electrode holder, especially if you are wet from sweat or some other source. Use well-insulated electrode holders and welding cables.
- Keep your clothes and hands as dry as possible. Use insulation between your body and the ground such as a welding mat when the specific welding operation calls for it.
- Cover or otherwise arrange the cables in a way that will prevent sparks and slag from burning through the insulation.
- Avoid changing electrodes with bare hands or wet gloves.
- Ground the welding unit according to the National Fire Protection Association’s National Electrical Code (NFPA 70).

Talk #29 – Shielded Metal Arc Welding (Stick)

There are several common hazards associated with shielded metal arc welding, including radiation from the arc, molten metal, welding fumes, and electrical current. Safe work practices to help you protect yourself from these hazards follow.

- Wear approved flame resistant clothing and work boots. Shirts should have long sleeves and should not have pockets. Also, wear long pants without cuffs and use appropriate welding gloves.
- Make sure you have a welding helmet with the proper shade of lens and use a welding screen to shield the eyes of others. In general, recommended shades for lenses based on welding current are below, but if you aren't sure about the proper shade of lens check with the welding machine manufacturer or your supervisor.
 - Shade #10 – 75 A to 200 A;
 - Shade #12 – 200 A to 400 A; and
 - Shade #14 – Over 400 A.
- Always wear safety glasses with side protection under your welding helmet.
- Make sure you have plenty of ventilation in your work area. Point-of-operation ventilation, such as a smoke eater, is ideal, but adequate local exhaust ventilation works well, too.
- Clear the area of any flammable/combustible substances and materials.
- Make sure you have a fully charged, recently inspected Class ABC fire extinguisher in your immediate work area.
- Carefully inspect your welding leads each time before you start work. Look over the full length of the leads, checking the insulation for cuts, abrasions, or any other type of damage.
- Also, inspect the electrode holder. Make sure there is no visible damage and ensure that the jaws are properly insulated.
- If you find damage to any of the welding equipment, don't use it. Immediately follow your company's procedures for taking defective equipment out of service.
- Always clamp your work cable directly to the work and as close to the weld as is practical.
- Keep yourself insulated from the welding circuit, the work itself, and from ground.

Talk #30 – Gas Metal Arc Welding (MIG)

Gas metal arc welding hazards are similar to other types of arc welding hazards. Protection from electrical current, eye hazards, inhalation hazards, burns, and fires is always necessary when you're MIG welding. Safe work practices to help you protect yourself from common MIG welding hazards follow.

- Before you start to weld inspect the leads for cuts, nicks, abrasions, and other damage.
- Also, inspect the welding gun to ensure that the insulation on the handle is in good condition, that the trigger is working properly, and that the wire feeds through the nozzle correctly.
- If you find damage to any of the equipment, immediately follow your company's procedures for taking defective equipment out of service.
- Keep the shielding gas cylinder in an upright position and secure it so that it can't be accidentally knocked over.
- Make sure that the welding machine and the work piece are properly grounded, and keep yourself insulated from the welding circuit, the work itself, and from ground.
- Clamp your work cable directly to the work and as close to the weld as is practical.
- Use dry, flame resistant clothing, boots and welding gloves for protection from burns and electrical shock. Make sure your clothing doesn't have pockets, cuffs or folds that could trap hot slag.
- Use the proper shade of lens on your welding helmet to protect your eyes from ultraviolet and infrared radiation burns. You'll need a #10, #12, or #14 lens depending on the amount of electrical current that will be generated during the process. Check with the welding machine manufacturer or with your supervisor if you're not sure about the right shade of lens, and always wear safety glasses with side protection under your welding helmet.
- Check the Safety Data Sheet (SDS) for the wire you'll be using and pay close attention to the *Hazard Identification* and *Exposure Controls/Personal Protection* sections (sections 2 and 8 respectively). Carefully follow the personal protection recommendations.
- Make sure your work station is well ventilated. Use a point-of-operation ventilation system, such as a smoke eater, if you have one available.

Talk #31 – Gas Tungsten Arc Welding (TIG)

Gas tungsten arc welding does not produce the quantity of fumes that are typically produced by other types of welding operations. However, TIG welding still generates its share of hazards. Electrical current, ultraviolet and infrared radiation, and hot metal are still prevalent with TIG welding operations. Below are safe work practices to help you protect yourself against the most common TIG welding hazards.

- Carefully inspect the leads and torch for any damage to the insulation. If you find any damage, don't use the equipment. Immediately follow your company's procedures for taking defective equipment out of service.
- Keep yourself insulated from the welding circuit, the work itself, and from ground.
- Be sure to clamp your work cable directly to the work and as close to the weld as is practical.
- Make sure the shielding gas cylinder is secured in an upright position.
- Wear flame resistant clothing that is appropriate for welding applications. Shirts should not have pockets, and pants should not have cuts.
- Flame resistant boots such as leather boots that also come up above the ankle are ideal for welding. The taller boot helps keep slag from getting inside a shorter boot or work shoe.
- Use dry welding gloves to help keep you insulated from the work and to keep from burning your hands.
- Choose the proper shade of lens to protect your eyes from ultraviolet and infrared radiation burns. The shade you'll need depends on the amount of current that will be generated during the welding process. The shade you need may change when you switch from direct to indirect current. Check with the welding machine manufacturer or your supervisor about the correct shade of lens for each specific welding application.
- Even though TIG welding operations don't produce the quantity of fumes that some of the other welding applications do, your work area still needs to be properly ventilated. Local exhaust ventilation systems are usually more than adequate for TIG welding operations. However, if your work station needs additional ventilation use one or more commercial fans to move the fumes away from your breathing zone.

Talk #32 – Compressed Gas Cylinders

Compressed gas cylinders present several potential hazards in fabrication shops. The main hazards are fire, explosion, and cylinders propelled by escaping gas when valves are broken (a cylinder can be propelled like a rocket). The following safe work practices will help you protect yourself from the most common compressed gas cylinder hazards in your shop.

- Whether you are using, transporting or storing cylinders, always keep them secured in their upright position with chains, strong wire, or straps.
- Keep compressed gas cylinders away from all sources of electricity, sparks, flames, and other sources of heat. Avoid subjecting them to heat over 125 degrees Fahrenheit.
- When the cylinders are not being used, always protect the valves by replacing the valve protection caps.
- Store oxygen cylinders separately from acetylene or other gas fuel cylinders. Separate them by at least 20 feet or a 1/2-hour rated noncombustible barrier that is at least 5 feet high.
- Inspect all cylinders, hoses, valves, and torches before using them.
- Take all defective parts out of service, replace them, and follow your company's procedures for taking defective equipment out of service.
- Clean out torch tips before use.
- Before connecting a regulator to a cylinder valve, clean out the valve by standing to one side and quickly opening and closing the valve.
- Inspect hoses and torch valves for leaks after opening the cylinder valve. If there are any leaks, close the cylinder valves immediately. Take the hoses and torch assembly off and immediately follow your company's procedures for taking defective equipment out of service.
- Use only friction lighters to light torches.
- Before removing a regulator, close the cylinder valve and bleed the gas lines.
- Be sure to leave the wrench on the stem of the cylinder valve so it can be turned off quickly in an emergency.

Talk #33 – Hot Metal Hazards

Fabrication shop workers are continuously exposed to hot metal hazards. There are several hazards to be aware of while you are working. The main ones are inhalation of fumes, burns to the skin and eyes, and shop fires. Hot metal hazards are generated by hot work such as welding, cutting, soldering and brazing. The safe work practices shown below will help you protect yourself from these common hot metal hazards.

- Protect yourself from exposure to harmful concentrations of metal fumes. Potentially harmful fumes include but are not limited to: hexavalent chromium, zinc and manganese.
- Overexposure to metal fumes can result in many kinds of health issues, depending on the type of fumes and the degree of overexposure. Examples of some of the potential health issues are kidney damage, reproductive defects, birth defects and cancer.
- Make sure the area you are working in is well ventilated. Properly working local exhaust ventilation systems typically work well, but if the ventilation is still poor you can use commercial fans to move the fumes away from your breathing zone.
- If you're performing hot work on stainless steel, you may need a point-of-operation ventilation system, such as a smoke eater, to protect yourself from overexposure to hexavalent chromium. If you're not sure whether the ventilation in your work area is adequate, be sure to check with your supervisor.
- Keep molten metal away from moisture and protect your skin by wearing flame resistant clothing.
- Always wear the proper eye protection. When working around molten metal, use flame-resistant cup goggles and a face shield.
- If there is exposure to ultraviolet radiation, infrared radiation or visible glare, make sure you wear eye protection with appropriate shaded lenses. If you're not sure about the proper shade of lenses, ask your supervisor before you start work.
- Be aware of the fire hazards when working around hot metals. Hot metals are an ignition source, so keep the area clear of explosive, flammable and combustible materials such as acetylene cylinders, gasoline, solvents, trash, grease, oily rags, etc.

Talk #34 – Shaded Lenses

Shaded lenses are vital in the fabrication shop when you're welding because they filter out harmful ultraviolet and infrared radiation as well as visible glare, each of which can burn or otherwise damage your eyes/sight. It would be really tough to perform welding without a shaded lens on your welding helmet, but performing some of the other hot work tasks without shaded lenses is somewhat common. However, it's always a good safe work practice to wear shaded lenses for all types of hot work, even when you're just soldering, brazing or torch cutting. Safe work practices with regard to shaded lenses follow.

- Shaded lenses are not just provided for welding helmets. There are shaded safety glasses and safety goggles for other types of hot work applications as well.
- Choosing the appropriate shade of lens or lenses is as important as choosing the right type of safety eyewear.
- Failure to use the appropriate lens or lenses can result in inflammation of the cornea (welder's flash) or damage to the eyes' lenses and/or retinas.
- The American National Standards Institute (ANSI) has established a numbering system to help us identify the different shades of lenses and select the shade that is most appropriate for each specific task.
- For torch soldering, use safety glasses or goggles with #2 shaded lenses.
- For torch brazing, use safety glasses or goggles with #3 or #4 shaded lenses.
- For cutting with oxy-acetylene, use safety glasses or goggles with #5 shaded lenses.
- For electric arc welding, the shade of lens you need to attach to your welding helmet depends on the size of the electrode and the amount of electrical current being generated. Check with your supervisor to find out whether you need a #10, #12 or #14 shaded lens for each specific electric arc welding application.
- For gas metal arc welding, the shade of the lens you will need to attach to your welding helmet depends only on the amount of arc current being generated. Check with your supervisor to find out whether you need a #11, #12 or #14 shaded lens for each specific gas metal arc welding application.

Talk #35 – Welding Radiation

Electric arcs and gas flames from welding and cutting produce ultraviolet and infrared radiation. With repeated exposure, mechanical fabrication shop workers can become overexposed and suffer damage to their eyes and skin. The following safe work practices will help you protect yourself from the most common welding radiation hazards.

- Ultraviolet radiation can cause the equivalent of a sunburn to the surface of the eye. The injury is painful and disabling, but it is usually temporary.
- Ultraviolet radiation also can cause the equivalent of severe sunburn to exposed skin.
- Infrared radiation heats exposed skin tissue, but isn't harmful unless it's hot enough to cause a thermal burn.
- However, infrared radiation can cause permanent eye damage if the welder or others nearby stare directly into the arc without eye protection.
- Protect your skin by wearing long sleeve shirts and long pants made from a flame resistant material (no synthetic fabrics). Be sure that there are no pockets in the shirt and cuffs in the pants so that sparks and slag aren't inadvertently trapped.
- Always use a welding hood with the appropriate shaded lens. You will need a #10, #12 or #14 shaded lens for electric arc welding depending on the size of the electrode and the amount of current being generated.
- For gas metal arc welding, you will need a #11, #12 or #14 shaded lens depending on the amount of current being generated.
- Check with the welding machine manufacturer or your supervisor before you start to weld to ensure that you have the appropriate shade lens.
- Be sure to wear a pair of safety glasses with side protection under your welding hood.
- Never look at a welding arc, even for an instant, without proper eye protection.
- Use welding screens around your welding area to protect others who may otherwise look at the arc without protection.

Talk #36 – Flammable/Combustible Liquids

Flammable and combustible liquids used in fabrication shops can be very hazardous because there are so many potential sources of ignition from welding, cutting, brazing, soldering, etc. The following safe work practices will help you protect yourself and others around you from the hazards associated with flammable/combustible liquids.

- Common flammable and combustible liquids used in prefab shops include gasoline, acetone, solvents, aerosol paints, etc.
- Whenever possible, substitute nonflammable/noncombustible liquids that do the same job for flammable or combustible liquids. Eliminating the hazard is the best option.
- When you can't substitute, keep the quantities of flammable/combustible liquids as small as possible. Keep only the amount you will use right away.
- Keep these liquids in containers designed specifically for their use. Whenever possible, keep the liquids in their original containers.
- Metal safety cans with self closing lids that are UL Approved are a good choice for containing flammable liquids like gasoline that are transferred from a larger container to a smaller, more portable container.
- Every container should be properly and clearly labeled so shop workers won't unintentionally use the wrong liquid. For example, don't use a container labeled for gasoline to store a cleaning solvent. Doing so could lead to a hazardous situation.
- Be constantly aware of the location of these liquids in relation to sources of ignition. Keep them well away from ignition sources even though they are in approved containers.
- Static electricity can be a source of ignition. When transferring one of these liquids from a drum to a smaller container, protect yourself from this ignition source by grounding the drum first. Then bond the drum and container by attaching a conductive wire from the drum to the container.

Talk #37 – Flammable/Explosive Gases

Flammable gases are prevalent in fabrication shops. Three of the most common flammable gases that are found in most fabrication shops are acetylene, propane and butane. All types of flammable gases can be hazardous in shops because there are so many potential ignition sources such as sparks from welding and grinding and flames from cutting torches. Several general safe work practices that will help you protect yourself and others around you from the hazards that are associated with flammable/explosive gases follow.

- Because there are so many potential sources of ignition in fabrication shops, it is critically important to keep fuel gases from being unexpectedly released.
- Since gases are stored in cylinders, it's important to close the cylinder valves when they're not being used and to protect the valves with valve cover caps.
- It's also important to check hoses for leaks, especially when you first connect them to the cylinder manifold. Use a soapy water solution just like you would if you're trying to find a slow leak in a car tire.
- An explosion is nothing more than rapidly accelerated combustion. That's why oxygen, which by itself is neither flammable nor explosive, can be extremely hazardous.
- Think about how much more rapidly acetylene burns when oxygen is added. If the right amount of oxygen is released into the air with a flammable fuel gas and the mixture is ignited, an explosion will occur.
- Even though oxygen by itself is not flammable, it should be treated like other fuel gases. Avoid releasing it into the air around you. Close the valves when the cylinder is not in use and check for leaks each time you attach a hose to the cylinder manifold.
- Be especially careful to keep oxygen from coming into contact with oil, grease or other petroleum based substances.
- Fuel gases and oxygen must be stored properly. For example, propane should not be stored inside a building as a general rule.
- Keep oxygen cylinders separate from acetylene or other gas fuel cylinders. Separate them by at least 20 feet or a 1/2-hour-rated noncombustible barrier that is at least 5 feet high.

Talk #38 – Fire Extinguishers

Fire extinguishers are required in all fabrication shops and should be readily accessible to all work stations where hot work is being performed. Since not all fire extinguishers are alike, it's important to know the differences. The following information will help you prepare yourself to extinguish a fire in the shop should it ever become necessary.

- Fire extinguishers are rated for use based on the class of fire they are designed to extinguish. The three basic fires that we have to consider for fabrication shops are classified as A, B and C fires.
- **Class A Fires** – These fires are made up of ordinary combustible materials such as paper, rags, scrap lumber, etc.
- Class A Fires require a cooling agent for extinguishment. The recommended fire extinguishers are water and soda acid (**Class A Fire Extinguishers**).
- **Class B Fires** – These fires are made up of flammable liquids, oils and grease.
- Class B Fires require smothering for effective extinguishment. The recommended fire extinguishers are carbon dioxide, dry chemical and foam (**Class B Fire Extinguishers**).
- **Class C Fires** – These fires are made up of electrical equipment.
- Class C Fires require a non-conductive fire-extinguishing agent. The recommended fire extinguishers are carbon dioxide and dry chemical (**Class C Fire Extinguishers**).
- It's common today to see fire extinguishers that are designed to extinguish more than one class of fire. For example, you might see a Class BC extinguisher for flammable liquids, oil, grease and electrical fires, or a Class ABC extinguisher that will extinguish both of those classes of fires plus ordinary combustible material fires.
- Look at the fire extinguishers in your shop to determine what class or classes of fires they are designed to extinguish. The class or classes of fires will be clearly marked on each extinguisher. The best fire extinguishers for fabrication shops are the ones that will effectively extinguish all three types of fires (Class ABC extinguishers).
- If you use a fire extinguisher or see one that has a gauge indicating that it is not fully charged, let your supervisor know immediately. The extinguisher should be recharged or replaced right away.

Talk #39 – Fire Prevention

Fire prevention in fabrication shops is necessary because there are so many potential ignition sources, and flammable, combustible chemicals such as acetylene, butane, propane, gasoline, acetone, cleaning solvents, aerosol paints, etc. The good news is that most shops are constructed of non-combustible materials. The bad news is that a raging chemical fire could badly hurt someone in the shop and do a lot of damage to the equipment, tools and materials. General safe work practices to help you prevent fires in your shop follow.

- Poor housekeeping is a major contributing cause of shop fires. Paper, cardboard and any other combustible materials should be picked up and thrown away. Clean-up should occur frequently enough so that trash does not accumulate.
- Oily rags should be disposed of in fire-safe containers that are manufactured and approved specifically for this purpose.
- Flammable and combustible liquids should be kept in their original containers whenever possible. When they have to be transferred to a portable container, make sure they are fire-safe containers with self-closing lids that are approved specifically for this purpose. Flammable and combustible liquids should be properly stored whenever they are not being used.
- Flammable gases like acetylene should be kept a safe distance from ignition sources. Make sure that fuel gas and oxygen cylinder valves are shut off when they are not in use.
- When you are finished with the cylinders for the day, shut off the gases at the cylinder, bleed the hoses and remove them, attach the valve cover caps and properly store the cylinders.
- Uncontrolled sources of ignition are the other major contributing cause of jobsite fires. Welding, cutting, torch brazing, torch soldering, grinding, operating a pipe cutter, etc., are all potential ignition sources. When welding, use fire resistant covers and spark shields to keep sparks contained in the immediate area. Before you start grinding, look around and remove anything combustible or flammable. When you are finished, recheck the immediate area for signs of fire.
- Make sure the fire extinguishers are adequate and readily accessible.
- Don't forget that a fire watch has to be posted before the shop quits for the day. Be sure to carefully follow your company's fire watch procedures.

Talk #40 – Fire Watch

Considering all of the hot work performed in fabrication shops, it's no wonder that unexpected fires get started from time to time. There are many things that can be done to help prevent fires, such as establishing good housekeeping practices; taking steps to contain welding, grinding and pipe cutting sparks; and controlling other ignition sources. However, the last line of defense for fire prevention is fire watch. Information and safe work practices regarding fire watch follow.

- Fire watch means that at least one person is assigned to stay in the shop for a designated period of time after all potential ignition sources are extinguished.
- The person assigned to fire watch duties walks through the shop looking for signs of fire such as smoke, flames and smoldering materials.
- Stop all of your hot work ahead of quitting time and according to your company's procedures.
- The minimum fire watch observation period is at least 30 minutes before leaving the shop, but be sure to carefully follow your company's procedures regarding the fire watch period.
- If you are not the designated fire watch, find that person and let him or her know that you are finished for the day.
- If you are the fire watch, check around the hot work areas for signs of fire such as smoldering trash piles, smoke and flames.
- Use the required fire watch time to clean up the area and put tools and equipment away.
- Go back to the hot work areas at the end of the required time period to check them again for signs of fire.
- Pay special attention to areas where flammable, combustible chemicals are present.
- Also make careful observations around combustible materials such as paper, cardboard, wood, etc.
- Be sure to carefully look for signs of fire in the areas where grinding, pipe cutting or other spark generating tasks were performed that day.

Talk #41 – Chop Saws

Like any type of saw used in fabrication shops, chop saws are great tools when used properly, but they can be extremely hazardous when safe work practices are not observed. The biggest concern is, of course, being cut by the sharp, fast moving blade. The following are safe work practices that will help you protect yourself from chop saw-related hazards.

- Always wear safety glasses while in the shop, but when you're using a chop saw, wear a full face shield over your safety glasses.
- Wear snug-fitting cut resistant gloves.
- Don't wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught up in the fast moving blade.
- Ensure that all guards are in their proper positions and operating properly.
- Be sure to keep the guards clean and working properly.
- When necessary, follow your company's procedures for controlling stored energy, such as unplugging or disconnecting the power to the saw, or perhaps implementing more elaborate lockout procedures to clean and/or repair the guards before using the saw.
- The same holds true for installing or changing a blade. At a minimum, the saw must be unplugged or the power disconnected. But be sure to follow your company's procedures for controlling stored energy.
- Carefully follow the manufacturer's instructions with regard to RPMs and blade sizes.
- Check and, when necessary, tighten the blade and blade attachment mechanism on a regular basis.
- Securely clamp the material in place before you start to cut.
- Make sure long material is supported at precisely the same height as the saw table.
- Never place your hands or fingers in the path of the blade.
- When you are finished cutting, release the trigger switch and allow the blade to come to a complete stop. Then raise the stopped blade before you reach for the material so that you won't inadvertently cut yourself on the teeth of the resting blade.

Talk #42 – Band Saws

Band saws are used in the vast majority of fabrication shops because they're effective and efficient tools when used properly. However, they can be hazardous when they are not used properly. Severe lacerations and worse injuries do occur when band saws are not used correctly. Below are some general safe work practices that will help you protect yourself from the most common hazards associated with band saw use.

- Always wear safety glasses and snug-fitting cut resistant gloves when using a band saw.
- Don't wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught up in the blade.
- Before using a band saw, make sure the blade is installed correctly with the teeth pointing down toward the table. Check the blade tension and tracking before you begin working.
- Close the wheel guard doors before starting the saw.
- Ensure that the blade guard and guide are in place and only 1/4" above the material.
- Make sure no one is standing within several feet of the saw in case a blade breaks while you're cutting.
- Never place your hands or fingers in the path of the blade.
- Use push sticks to control the material.
- Be sure to use a jig when the material you're cutting isn't flat on the bottom.
- Also, use a V block when cutting cylindrical shaped materials.
- When you're preparing to make a long cut or to cut a tight curve, make several relief cuts to take pressure off the blade.
- If you ever need to back out of a cut, make sure you shut the machine off first. Wait until the blade comes to a complete stop before backing out.
- When preparing to install or replace a blade be sure to follow your company's procedures for controlling stored energy. At a minimum, turn off the saw and unplug it or disconnect the power first. However, your company may require more elaborate lockout procedures.

Talk #43 – Abrasive Cut-off Saws

Abrasive cut-off saws can be just as hazardous as saws with steel blades, but when they are used properly they are safe, effective and useful tools in fabrication shops. The most common potential hazards include body part contact with the rotating disc, metal sparks, flying particles and burns from hot materials. General safe work practices, which will help you protect yourself from the most common abrasive cut-off saw hazards, follow.

- Always wear safety glasses when using abrasive cut-off saws and at all times in the shop.
- Also, be sure to wear snug-fitting cut and heat resistant gloves.
- Be sure not to wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught up in the moving blade.
- Ensure that the saw is properly secured to the work table.
- Carefully check the abrasive wheels you plan to use to ensure that they are the correct size. They need to have the proper size arbor hole, and the appropriate maximum safe operating speed based on the RPMs. Carefully follow the manufacturer's instructions with regard to RPMs and blade sizes.
- Inspect the cut-off wheels for chips and cracks. If they are damaged, don't use them. Follow your company's procedures for replacing defective blades.
- Make sure that all of the guards are in good condition, securely in place and properly adjusted. Also, check the depth stop to be sure that it is properly adjusted.
- Clamp the work securely in the vise. Don't ever hold the material you're cutting in your hands.
- Keep your hands, fingers and the rest of your body out of the path of the rotating abrasive disc.
- Make sure you allow the blade to reach full speed before you start to cut.
- After making the cut, release the trigger switch, continue to hold the saw arm down and allow the abrasive blade to come to a complete stop before you reach for the material.
- When installing or changing a blade, at a minimum, the saw must be unplugged or the power must be disconnected, but be sure to carefully follow your company's procedures for controlling stored energy.

Talk #44 – Grinders

Several types of grinders, such as angle grinders, straight grinders, tuck point grinders and bench grinders, are used in fabrication shops. Each type of grinder has its own unique function, but most of the characteristics that make grinders potentially hazardous are the same. The following are general safe work practices that will help you protect yourself from the most common hazards associated with grinders.

- Always wear safety glasses, a full face shield and appropriate work gloves when using any type of grinder.
- The grinders you will be using need to be properly grounded. Make sure the ground prong on the grinder is in place and in good condition. Inspect the rest of the grinder, too. Look for cuts or tears in the cord, cracks in the housing, chips in the grinding wheel and missing or broken guards.
- If any part of the grinder is not in good condition, don't use it. Immediately follow your company's procedures for taking defective equipment out of service.
- Carefully check the abrasive wheels you plan on using to ensure that they are the correct size. They must have the appropriate maximum safe operating speed in relation to the RPMs. Carefully follow the manufacturer's instructions with regard to RPMs and blade sizes.
- Ensure that the replacement wheel fits freely on the spindle and doesn't have to be forced on.
- Be sure not to over tighten the spindle nut, but be sure that it is snug.
- Never use a grinder without a guard properly secured in place.
- The guard should cover the spindle end, nut and flange projections.
- Make sure the work is properly secured before you start work on it. Use a vise or clamps to hold the work in place.
- Floor and bench-mount grinders should have protection hoods over the grinding wheels and work rests should be attached not more than 1/8" from the grinding wheel.
- When installing or changing a grinding wheel, at a minimum the grinder must be unplugged or the power must be disconnected, but be sure to carefully follow your company's procedures for controlling stored energy.

Talk #45 – Drill Presses

Drill presses don't usually conjure up images of horrific fabrication shop injuries, but they are much more powerful than most people realize. The hazards include hand and finger contact with the bit, flying particles, flying objects such as broken bits and objects getting caught up and pulled into the rotating bit or chuck. Most drill press manufacturers don't provide a guard to prevent contact with the bit/chuck. However, aftermarket guards are available. General safe work practices to help you protect yourself from the most common drill press hazards follow.

- Wear safety glasses and snug-fitting cut resistant gloves when using a drill press, but don't wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught up in the rotating bit or chuck.
- If your company has purchased a guard, make sure it is properly secured in place.
- Carefully follow your company's procedures with regard to controlling stored energy. You may be required to unplug the drill press or implement more elaborate procedures when preparing to change bits, make adjustments, etc.
- Be sure to use wood backing so that the bit won't make contact with the drill press table, which could break the bit if enough pressure is applied to it and damage the table.
- Make sure the bit you're going to use is inserted correctly into the chuck and adequately tightened with the chuck key. And, be sure to remove the chuck key from the chuck before you start the motor.
- Make sure the material you'll be drilling into is adequately secured to the drill press table. Use a suitable clamp or vise. If you're going to be drilling into a cylindrical object such as a piece of pipe, use a V shaped block to keep it from rolling.
- Be sure not to exceed the manufacturer's recommended speeds for the type and size of drill bit and the material being drilled. Check the operator's manual or check with your supervisor.
- If the drill bit binds, don't force it, which will likely break the bit and send it flying. Turn the drill press off. Wait for the chuck to come to a complete stop. Then turn the chuck backwards with a gloved hand to free the bit.
- Always turn the drill press off and wait for the chuck to come to a complete stop before reaching in to make adjustments to the material, or to grab the chuck.

Talk #46 – Iron Workers

The iron worker is one of the most universal machines in the fabrication shop, but it does come with its fair share of hazards. The biggest concerns are cuts and pinched or crushed hands and fingers. However, when iron worker machines are used properly, they're just as safe as any other properly used machine in the shop. The following safe work practices will help you protect yourself from the most common hazards associated with iron worker machines.

- Always wear safety glasses when using an iron worker and at all times in the shop. Also, be sure to wear protective gloves that are suitable for the job.
- Never exceed the capacities of the iron worker or its tooling. Read the operator's manual provided by the manufacturer before using the machine. Also, be sure not use the machine for anything other than its intended purposes.
- Make sure all of the safety guards are in place and in good condition, and be sure to use them every time you make a punch, shear, bend or notch.
- Check all of the blade clearances at every tooling change or when you're performing extended operations.
- Also, check punch and die alignment after every tooling change or when you're performing extended operations.
- Be sure to keep the pipe notch tooling clean.
- Make sure that the material you're working with is supported, and don't stack materials.
- Secure the material in place with the material hold-downs before operating the machine and stay well away from all moving parts once operations begin.
- Before making any kind of adjustment or change in tooling, be sure to read and carefully follow the instructions provided in the operator's manual provided by the manufacturer.
- When making adjustments or tooling changes, carefully follow your company's procedures for controlling stored energy, such as locking out the machine before service.
- Keep the iron worker clean. Remove fillings, scraps, etc. that start to accumulate on the machine.
- Always turn the iron worker off when it's not being used. Never leave a powered up machine unattended.

Talk #47 – Powered Pipe Cutters

There are many different brands and models of powered pipe cutters that are used in fabrication shops, but for the most part, the same general safe work practices apply to all of them. The following are safe work practices that apply to most powered pipe cutters. These safe work practices will help you protect yourself from the most common hazards associated with their use. However, be aware that there may be additional, specific safe work practices for particular brands or models of powered pipe cutters.

- Before using any unfamiliar powered pipe cutter, read the operator's manual. Pay special attention to the safety information about the cutter in case it has characteristics that are unfamiliar.
- Look the cutter over before you use it. Check for moving parts that are starting to bind, broken/damaged parts and any necessary alignments/adjustments.
- Make sure the guard is in good condition and properly secured in place.
- Check the cutter wheel to ensure that it is sharp and in good condition. Dull and damaged wheels will bind in the rotating pipe and could create an unexpected hazard.
- If anything appears to be damaged or missing, don't use the cutter. Immediately follow your company's procedures for taking defective equipment out of service.
- Wear safety glasses when using a powered pipe cutter and at all times in the shop. Also, wear protected-toe work boots, and snug-fitting cut resistant gloves.
- Be sure not to wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught in, and draw your body into, rotating machine parts or rotating pipe.
- Make sure everyone else is a safe distance away before you start to work.
- When operating the cutter, keep your hands and fingers away from the cutter blade, and be sure not to force the cutter.
- When making adjustments or changing accessories, at a minimum, the saw must be unplugged or the power must be disconnected, but be sure to carefully follow your company's procedures for controlling stored energy.
- Position your body, especially your feet, so that if a piece of pipe falls after the cut is made you won't be struck by it.

Talk #48 – Copper Pipe Cut-off and End Prep Machines

Copper pipe cut-off and end prep machines may not be the most hazardous piece of equipment in the fabrication shop, but hazards do exist without proper precautions. There are many different brands and models of these machines, but for the most part, the same general safe work practices apply to all of them. The following safe work practices will help you protect yourself from the most common hazards associated with these machines.

- Before using any unfamiliar copper pipe cut-off and end prep machine, read the operator's manual. Pay special attention to the safety information about the machine in case it has characteristics that are unfamiliar.
- Look the machine over carefully before you use it. Check for moving parts that are starting to bind, broken/damaged parts and any necessary alignments/adjustments.
- Make sure the guard is in place and in good condition. Also, make sure the motor cover is secured in place. Never operate the machine with the cover removed.
- Check the cutting tools to ensure that they are sharp and in good condition. Dull and/or damaged tools will bind, potentially creating additional hazards.
- If anything appears to be damaged or missing, don't use the cutter. Immediately follow your company's procedures for taking defective equipment out of service.
- Wear safety glasses when using a powered pipe cutter and at all times in the shop. Also, wear protected-toe work boots, and snug-fitting cut resistant gloves. Be sure not to wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught in, and draw your body into, rotating machine parts or rotating tubing.
- Before you start, inspect the tubing to ensure that it isn't bent and that there are no fittings attached so that you won't experience excessive vibration while cutting. When operating the machine, make sure the tubing is properly supported. Position your body, especially your feet, so that if a piece of tubing falls after the cut is made you won't be struck by it.
- Be sure to keep your hands and fingers away from the reamer and wire brushes. Also, never reach inside the tubing, and keep your hands and fingers away from the edges of the tubing.
- When making adjustments or changing accessories, at a minimum, the machine must be unplugged or the power must be disconnected, but be sure to carefully follow your company's procedures for controlling stored energy.

Talk #49 – Pipe Threading Machines

Pipe threading machines used in fabrication shops vary in size, brand and model. However, for the most part, the same general safe work practices apply to all of them. Below are general safe work practices that will help you protect yourself from the most common hazards associated with pipe threading machines.

- Before using any unfamiliar pipe threading machine, read the operator's manual. Pay special attention to the safety information about the machine in case it has characteristics that are unfamiliar.
- Use this machine only for its intended purpose(s).
- Look the machine over carefully before you use it. Check for moving parts that are starting to bind, broken/damaged parts and any necessary alignments/adjustments.
- Make sure the covers are secured. Never operate the machine with the covers out of place.
- If anything appears to be damaged or missing, don't use the machine. Immediately follow your company's procedures for taking defective equipment out of service.
- Wear safety glasses when using a pipe threading machine and at all times in the shop. Also, wear protected-toe work boots, and snug-fitting cut resistant gloves. Be sure not to wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught in, and draw your body into, rotating machine parts or rotating pipe.
- Make sure that long heavy pieces of pipe are properly supported with pipe supports designed specifically for the purpose.
- Keep the machine's handles free from oil and grease.
- Operate the machine from the side where the control switch is located so that you never have to reach across the machine.
- Be sure to keep your hands and fingers away from rotating pipe and fittings. Also, be sure the machine is off and has come to a complete stop before reaching for the pipe or the machine chucks.
- When making adjustments or changing accessories, at a minimum, the machine must be unplugged or the power must be disconnected, but be sure to carefully follow your company's procedures for controlling stored energy.

Talk #50 – Plasma Pipe Cutting Machines with Conveyors

There are several potential hazards associated with plasma cutting machines used in fabrication shops. Add an entrance/discharge conveyor and the number of potential hazards increases. However, when used properly, the machines are safe, efficient and very effective. The following are safe work practices to help you work safely with plasma pipe cutting machines.

- Always wear safety glasses with properly shaded lenses.
- If you will be standing in close proximity to the cut, wear a face shield to protect your face from the sparks.
- Also, be sure to wear welding gloves, flame resistant clothing and protected-toe work boots.
- Always keep in mind that gas cylinders are under extreme pressure. Even though the gases used for plasma cutting are non-flammable and stable, an explosion could still occur if the cylinder is heated.
- Make sure the shop is properly ventilated before you start to work. The inert gases used in the process, such as argon and nitrogen, rapidly displace oxygen. If a cylinder is leaking in a poorly ventilated area, asphyxiation could occur. Ensure that the local exhaust ventilation system is on and working properly, and open bay doors if necessary.
- Inspect the machine before you start to use it. Make sure that there is no obvious damage to the machine, that the gas hose and nozzle are in good condition and that there are no gas leaks in the system.
- If anything looks out of place, don't use the machine. Immediately follow your company's procedures for taking defective equipment out of service.
- Remove any flammable/combustible materials from the immediate work area before you start to work.
- Make sure no one else is in close proximity to the machine before you start the process.
- When using a conveyor, pay close attention to the process so that you can carefully control the pipe and ensure that it is properly received at the discharge end of the conveyor.
- As you're operating the conveyor, be thinking about hand placement. The pipe and the conveyor together create hazardous pinch points when the pipe is moving.

Talk #51 – Oxy/Acetylene Pipe Cutting Machines with Conveyors

The hazards associated with oxy/acetylene cutting machines used in fabrication shops are similar to other types of cutters, but there are some differences. When these machines are used in conjunction with an entrance/discharge conveyor, the number of potential hazards increases. However, when used properly, the machines are safe, efficient and very effective. General safe work practices, which will help you work with oxy/acetylene cutting machines safely, follow.

- Always wear safety glasses with # 5 shaded lenses.
- If you will be standing in close proximity to the cut, wear a face shield to protect your face from the sparks.
- Also, be sure to wear welding gloves, flame resistant clothing and protected-toe work boots.
- Always keep in mind that oxygen and acetylene cylinders are under extreme pressure. And, even though oxygen is a non-flammable gas, oxygen cylinders and acetylene cylinders can explode when heated.
- Make sure the shop is properly ventilated before you start to work. Make sure the local exhaust ventilation system is on and working properly, and open bay doors if necessary.
- Inspect the machine before you start to use it. Make sure that there is no obvious damage, that the gas hoses and nozzles are in good condition and that there are no gas leaks in the system.
- If anything looks out of place, don't use the machine. Immediately follow your company's procedures for taking defective equipment out of service.
- Remove any flammable/combustible materials from the immediate work area before you start to work.
- Make sure no one else is in close proximity to the machine before you start the process.
- When using a conveyor, pay close attention to the process so that you can carefully control the pipe and ensure that it is properly received at the discharge end of the conveyor.
- As you're operating the conveyor, be thinking about hand placement. The pipe and the conveyor together create hazardous pinch points when the pipe is moving.

Talk #52 – T-Drills

T-Drills are not the most hazardous pieces of equipment in fabrication shops, but there are potential hazards associated with their use. Whether you're using a portable hand held or a stationary mounted T-Drill, you'll have to be careful to prevent injuries. The following are safe work practices that will help you protect yourself from the common hazards associated with T-Drill use.

- Wear safety glasses when using T-Drills and at all times in the shop. Also, wear protected-toe work boots and snug-fitting cut resistant gloves.
- Be sure not to wear loose fitting gloves, clothing, jewelry, long hair, or anything else that could get caught in the rotating components.
- Inspect the T-Drill that you plan to use before you begin to work. Make sure the cord and plug are in good condition, and that there is no obvious damage to the drill.
- Also, ensure that the moving parts are properly aligned and that they are not starting to bind.
- If you find any misalignment, binding or damaged parts, don't use it. Immediately follow your company's procedures for taking defective equipment out of service.
- Make sure the tool is sharp and in good condition. Dull tools can cause binding, which can create other hazards. If the tool is dull or damaged, replace it before you use it.
- Be sure to keep the drill clean and free from oil and grease.
- When cleaning the drill, making adjustments or changing tools the drill must be unplugged, or the power must be disconnected, but be sure to carefully follow your company's procedures for controlling stored energy.
- Make sure the tube is properly secured with vises or clamps before you start the work.
- Also, be sure that you have removed all keys and wrenches before starting the drill.
- Once you start drilling, make sure you don't force it. Allow the drill to operate at its intended pace.
- Be sure not to touch the rotating tool at any time during the process.

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