

MAJOR PROGRAM POINTS

"MACHINE GUARDS AND SAFETY DEVICES"

Part of the "GENERAL SAFETY SERIES"

Quality Safety and Health Products, for Today...and Tomorrow

Outline of Major Points Covered in the "Machine Guard Safety" Course

The following outline summarizes the major points of information presented in the course on "Machine Guard Safety". The outline can be used to survey the course before taking it on a computer, as well as to review the course when a computer is not available.

- **A hundred years ago, there were ten times more industrial accidents than there are today.**
 - Many of them occurred because machines had few safety features.
 - Training workers on how to do their jobs safely wasn't a priority for most companies either.
- **Today, properly guarded machines and effective training programs have made workplaces much safer.**
 - Yet even with these precautions, machine-related accidents still injure thousands of people every year.
 - These tragedies often occur because workers come in contact with moving machine parts.
- **There are three primary areas at a machine where hazards can be encountered. These include:**
 - The machine's "perimeter"... the area around a machine, where falling objects, flying debris or other hazards can be encountered.
 - The "drivetrain"... the moving parts that run the machine.
 - "Points of operation"... where a machine's mechanical or electrical energy is used to cut, bend, move or otherwise process materials.
- **In general, it is a machine's movements that dictate the kind of hazards that it presents.**
- **All equipment operates using a combination of three basic motions:**
 - Rotation... moving in a circular pattern.
 - Reciprocation... moving back and forth.
 - Transverse motion... moving in a straight line.

- **When these are combined, they produce “articulated motion.”**
 - This can be especially dangerous, because articulated motion makes it hard to predict which way a machine's parts will move.
- **It is because all of these types of movements can create hazards that using Machine Guards and Safety Devices is essential to protect people who work with this type of equipment.**
- **Machine Guards and Safety Devices protect you in different ways.**
- **Machine Guards provide protection from all types of hazards, by covering the area with a barrier of:**
 - Metal.
 - Some other material.
- **In contrast, Safety Devices don't use physical barriers. Instead they protect workers in one of two ways:**
 - Stopping a machine.
 - Restricting the machine operator's movements when they get too close to a hazardous area.
- **Since Machine Guards use barriers to shield workers, they provide more protection than Safety Devices do.**
 - They keep workers from touching moving parts.
 - They have the added benefit of protecting workers from flying debris, sparks and splashing chemicals.
- **There are three types of Machine Guards:**
 - Fixed Guards (which are immovable barriers).
 - Adjustable Guards (that can be moved by the machine operator).
 - Self-Adjusting Guards (which automatically move as materials enter or move through the machine).
- **Fixed Guards are stationary barriers that are usually firmly fastened in place, making it difficult to remove them.**
 - This makes them ideal for protecting areas that workers seldom need access to, such as a machine's drivetrain.

- **When used around drivetrains, Fixed Guards are often built into a machine's housing... completely sealing the drivetrain with solid metal.**
 - In places where workers need to view the machinery, plexiglass shields or wire barriers are often used.
- **Fixed Guards consisting of these materials are used to:**
 - Cordon-off dangerous areas around machine perimeters.
 - Block hazards at points of operation.
- **However, these barriers can only be used where they will not interfere with setting up or operating a machine.**
- **In situations where fixed Guards would interfere with machine functions, Adjustable and Self-Adjusting Guards are commonly used.**
 - These Guards are movable, allowing them to be used in many situations... particularly around points of operation.
- **Adjustable Guards are manually set by a machine operator.**
 - Some simply swing into position.
 - Others must be carefully set up to accommodate different sized raw materials.
- **The flexibility of Adjustable Guards makes them the best choice for many situations.**
 - However, since they must be manually positioned, there is always a chance that human error can lead to an accident.
 - So it is important to double check to make sure that these Guards are positioned correctly.
 - If you are unsure how to do this, ask your supervisor for help.

- **Since they move automatically, Self-Adjusting Guards do not require constant re-positioning.**
 - These Guards automatically move out of the way to allow materials of different sizes to be processed.
 - They can be moved by electric motors or air pressure... but most often this adjustment is accomplished by simply having the material entering the machine push against the Guard.
 - Once the material passes, the Guard falls back into place... again covering the point of operation.

- **Machine Guards are the most common way to protect workers. However, there are situations where even Adjustable and Self-Adjusting Guards might get in the way.**
 - A good example of this is when a worker must place materials at a Point-of-Operation quickly and without restriction.
 - In situations like this Safety Devices are used to provide protection and allow workers to operate the machinery with minimal restrictions.

- **Most Safety Devices protect a worker's entire body by quickly shutting down the machinery when tripped.**

- **Others only protect the hands. They do this by either:**
 - Keeping a machine from starting if a hand is in the wrong place.
 - Restricting the machine operator's hand and arm movements.

- **There are three basic types of Safety Devices that protect the entire body:**
 - Interlocks insure that Machine Guards are providing protection.
 - Photoelectric Devices use beams of light to detect a worker's presence.
 - Pressure-Sensitive Trips and Mats “feel” a worker's presence when they are touched.

- **Interlocks use sensors or switches attached to Machine Guards.**
 - These Safety Devices are unique because they do not directly protect workers.
 - Instead, they insure that the Guards are in a position where they are providing protection.
- **If an Interlock detects that the Guard is not in place, it's sensor trips a relay switch that shuts off the machine's power.**
 - This protects workers by making sure that unguarded machinery can not be used.
 - Once the Guard is positioned correctly, the machine can be turned back on.
- **Unlike Interlock Sensors, all of the other types of Safety Devices work independently of Machine Guards, and are used in situations where a Guard would not be practical.**
- **Photoelectric Devices are the most common, because they are reliable, easy to work with, and can be used in many different situations.**
 - They are often known as “light curtains,” because they use multiple beams of light that are directed into a series of electric eyes.
 - If anything breaks one of these beams, a switch is tripped and the machine's power is cut off.
 - This stops the machine before a worker can come into contact with its moving parts.
- **Light Curtains used at points of operation often have their beams of light set so that materials can pass through them without triggering a shutdown.**
 - Reflecting the beams of light into a series of mirrors, a curtain can also be projected around a machine perimeter to protect workers from hazards on all sides of the machine.

- **In addition to Light Curtains, there are other Devices... such as Pressure-Sensitive Trips and Mats... that can be used to protect workers.**
 - Pressure-Sensitive Trips are simply wires or cables that are attached to switches.
 - If a worker touches the cable, the switch "trips" and stops the machine.
- **Since the direction of the cables can be changed by running them through eyelets, Pressure-Sensitive Trips are often used in areas that curve or bend.**
 - Because the cables can also be extended to whatever length is needed, they are ideal for guarding conveyor lines and other machine perimeters that are very long.
 - In many of these situations, the trips protect workers by halting entire manufacturing areas.
- **To provide protection in smaller areas, Pressure-Sensitive Mats are sometimes used.**
 - These differ from ordinary rubber mats in that they have weight-triggered sensors in them.
- **There are two ways that Pressure-Sensitive Mats can be used to protect people.**
 - Most often, the Mats are set up to shut a machine down if someone steps on them.
 - This prevents workers from getting close enough to touch moving parts.
 - The other way that Pressure-Sensitive Mats can be used is to have the machinery shut down when an operator steps off of the Mat.
 - In this case workers must be on the mat and safely away from hazards for the machine to run.
- **Light Curtains, Pressure-Sensitive Trips and Mats provide protection to all parts of the body.**

- **However, on some machines workers have to manually place materials dangerously close to a point of operation. Because of this, other Safety Devices are designed to only protect hands and fingers. These include:**
 - Restrain and Pullback Devices, which use straps to keep worker's hands safely out of the way.
 - Drop-Probe Devices, that prevent the machine from starting if hands are in the way.
 - Two-Hand Trips, which force both hands to be in a safe position to operate the machine.

- **Restrain Devices use short cables... with straps that are attached to a machine operator's wrists... to prevent the operator from extending their hands into the point of operation.**
 - To be effective, the cables must be long enough for a worker to accurately place materials, but short enough to prevent their hands and fingers from entering the "danger" zone.

- **Pullback Devices permit machine operators unrestricted access to a point of operation when a machine is stopped.**
 - But they pull an operator's hands out of harm's way when the machine begins to move.

- **It is very important that both Restrain and Pullback Devices are set up for each worker that uses them.**
 - What may be a properly adjusted Device for one person may be too tight or too loose for another.
 - Even a little slack in these Devices is dangerous, because it will expose your hands to the machine's moving parts.
 - For this reason always check the adjustment of these Devices before you use them.

- **A Safety Device that uses a completely different protective method is the Drop-Probe.**
 - Drop-Probes allow workers to safely position materials directly at a point of operation.
 - The “Probe” is a small metal rod which is often bent to completely encircle a point of operation.
 - This rod falls to a predetermined spot just before the machine starts.
 - If the Drop-Probe falls freely, the machine begins its movement.
 - But if it hits a hand or other object, the machine will not start.

- **One drawback of Drop-Probe Devices is that they can only keep a machine from starting.**
 - They won't stop a machine that is already in operation.
 - For this reason Drop Probes must only be used on machines such as small riveters, that perform a single rapid movement each time they are activated.

- **Another type of Safety Device that should only be used on machines that perform their functions rapidly are Two-Handed Trips.**
 - These consist of two separate “start” buttons, that must be pushed at the same time in order to activate a machine.
 - This keeps the operator's hands safely on the buttons... and away from hazardous parts... once the machine starts moving.

- **In many cases, there will be several types of Guards and Devices on a single machine.**
 - Using multiple Devices is particular important when any single Safety Device does not completely protect workers from all of a machine's hazards.
 - By using multiple forms of protection, workers are less likely to be injured... even if one of the Guards or Devices should fail to work properly.

- **Machine Guards and Safety Devices will only protect you if they are well maintained and properly in place.**
 - You need to inspect, clean and adjust the Guards and Devices before each use.

- **When inspecting Safety Guards, be on the lookout for:**
 - Missing pieces.
 - Loose bolts.
 - Broken parts.
 - Sharp edges.
 - Corrosion.

- **Make sure that any damaged Guard or Device is repaired before you use it.**
 - Clean transparent Guards often, so that you can clearly see what you are doing.

- **Because they move, Adjustable and Self-Adjusting Guards need special attention.**
 - Keep them free of dirt and grease, which could prevent them from moving properly.
 - Adjust them carefully, making sure they don't touch moving parts or have any gaps large enough for even a finger to enter the danger zone.

- **Like Machine Guards, Safety Devices should also be inspected and maintained on a regular basis.**
 - Make sure that the straps and cables on Restrain and Pullback Devices are not frayed.
 - Replace any strap that you feel might rip or tear.

- **Insure that Interlock sensors will shut the machine off when opened.**
 - Have malfunctioning sensors fixed immediately.

- **Keep the cables on Pressure-Sensitive Trips taut, so that they are triggered at the slightest touch.**

- **Make sure that Light Curtains won't allow hands or other parts of the body to pass through them without shutting the machine down.**
 - If there is a problem, have the Curtain adjusted by a technician.

- **Because Light Curtains, Interlock Devices, Pressure-Sensitive Trips, and Pressure Mats protect workers by stopping machine movements, it is absolutely essential that a machine comes to a complete stop immediately after these Devices are tripped.**
 - A worker can still be severely injured by a machine that is grinding to a halt.
 - To prevent this, a machine's "stopping time" must be periodically checked by a qualified technician, using special testing equipment.
 - If the machine is not stopping quickly enough, adjustments to the Device or the machine's braking mechanism can usually fix the problem.

- **Remember, even if the Machine Guards and Safety Devices are in good working order you can still be injured.**
 - In addition to using your Guards and Devices properly, it is important to follow other safe work practices.

*****SUMMARY*****

- **Only use machines that you have been trained and authorized to operate.**

- **Give your job your full attention, and never operate a machine if you are sick, tired, or unable to concentrate.**

- **Maintain as much distance as possible between you and hazards.**
 - Use push sticks, or tools with magnetic ends, to feed and retrieve parts.

- **Keep your work area clean by removing all tools, materials and debris that could fall into your machine, hit moving parts and become projectiles.**

- **Wear personal protective equipment such as safety glasses and face shields.**
 - These protect you from sparks and flying material that may make their way past the Machine Guards.

- **Don't wear loose clothing, long hair, or jewelry around machinery.**
 - These can easily slip past a Guard, come in contact with moving parts and pull you into the machine.
- **Wear tight-fitting clothing, tuck in shirts and button sleeves.**
- **Keep your hair back and always remove jewelry.**
 - Wedding bands and other rings cause a lot of problems because people often forget to take them off.
- **On some machines, gloves must be worn to protect you from sharp edges when handling material.**
 - But because they can get caught in rotating parts, gloves must not be worn on machines such as lathes and grinders.
- **Most importantly, don't become complacent.**
 - Accidents usually happen to experienced workers who take dangerous short cuts and unnecessary risks.
- **With all of the good things that machines can accomplish, it is easy to forget how dangerous they can be.**
 - However, by remaining safety conscious and using Machine Guards and Safety Devices for protection, you will prevent accidents.
- **Remember, severe machine accidents still occur... and they can happen to you.**
- **So don't become a victim. Defend yourself with Machine Guards and Safety Devices... they will only protect you if you use them.**