

MACHINE GUARD SAFETY

COURSE OUTLINE

- **The power of machinery enables us to do things that we could never hope to do on our own.**
 - But there's a price to pay for this added productivity.
 - The more powerful and capable a piece of equipment is, the greater the danger it can pose to the people who are using it.
- **The hazards are very real.**
 - Roughly 15,000 machine-related accidents occur every year.
 - They cause severe injuries, such as amputations, lacerations, crushing and abrasions.
 - They result in hundreds of fatalities as well.
- **Yet most of these incidents can be prevented by machine guards and other safety devices.**
- **Machine guards are designed to keep you clear of mechanical danger zones, and protect you from hazards like sparks, flying particles and "kickbacks".**
- **To avoid the potential hazards of working with powered equipment, we need to understand the different ways a machine can move.**
- **All machinery operates using a combination of three basic motions:**
 - Rotation.
 - Reciprocation (moving back and forth).
 - Transverse motion (moving in a straight line).
- **These movements can also be combined to produce what is known as "articulated motion".**
 - Articulated motion can be especially hazardous, because it's hard to predict which way a machine's parts will move.
- **This is why machine guarding is often used to keep workers a safe distance away from robotic equipment.**
 - Computer-controlled machine movement can be very complex and very hazardous.

- **There are three areas where a machine's moving parts can create potential hazards.**
 - Within the "drive train" itself (the moving parts that power the machine).
 - At the machine's "perimeter" (the area around a machine where a worker could be injured by things like flying debris and swinging "arms").
 - At the "points of operation" (where the machine's mechanical energy is used to cut, bend, move or otherwise process materials).
- **These are the areas that we need to pay particular attention to when we're near any powered equipment.**
- **When we understand that working with machines can be hazardous, we can take steps to protect ourselves from their hazards.**
 - This is where safety guards and safe work practices come into play.
- **"Fixed guards" are the oldest and simplest type of machine guard.**
 - They include devices such as wire cages, clear plastic shields and metal covers, which create permanent protective barriers.
- **Drive trains are almost always protected by fixed guards.**
 - Often the guards are built into a machine's housing, to fully enclose the drive train's moving parts.
- **Fixed guards are sometimes used around a machine's "perimeters" and at "points of operation" as well.**
 - Since fixed guards are permanent, they must be positioned where they will not interfere with a worker's ability to access or operate the machine.
- **In situations where fixed guards would not work well, "interlock guards" are often used.**
 - These guards use an electronic sensor that will not permit a machine to run unless the guard is in place.
 - Interlock guards provide workers with complete protection, while at the same time enabling safe access to all of the areas in and around the machine.
- **When an interlock guard is opened, the sensor trips a relay switch that shuts off the machine's power.**
 - When the guard is closed, power is restored, and the machine can once again be operated.

- **While "fixed" and "interlock" guards can greatly reduce the number of accidents around a machine's drive train and perimeters, other measures are often required to prevent accidents at its "points of operation".**
 - Accidents are common at these points because workers are often only inches away from the equipment's moving parts.
- **It's extremely important to use machine guards at their points of operation, but the guards cannot interfere with an employee operating the machine.**
 - For this reason, "adjustable" and "self-adjusting" guards are frequently used at these locations.
 - Adjustable guards can be moved by the machine operators themselves to suit their needs, such as when they are working on objects of different shapes and sizes.
 - Self-adjusting guards move automatically, as the material makes its way through a machine.
- **Because of the way that they work, these types of guards must be inspected before each use, as well as every time there is a change in a machine's set-up.**
 - It's important to make sure that the guards are adjusted so that materials of various sizes can pass through without binding or kicking back.
 - Adjustable and self-adjusting guards must never leave gaps or openings that are large enough for any body part to fit through!
- **When any type of "guard" would interfere with a worker's ability to run a machine, "safety devices" should be used.**
 - They can protect workers in several different ways.
- **"Light curtains" are the most common safety device.**
 - These photoelectric systems use beams of fluorescent or infrared light to create "invisible barriers" around a machine's perimeter, and in front of its "points of operation".
 - If something breaks one of these barriers, a relay switch is tripped, and the machine's power is cut off.
- **By reflecting the light beams onto a series of mirrors, a "curtain of protection" can be created around a machine's perimeter.**
 - This "curtain" keeps workers from getting close to any part of the machine that is hazardous, while allowing for a clear view of all operations.

- **At "points of operation", light curtains are often set up so that raw materials that are being fed to the machine will not trigger a shutdown.**
 - If a light curtain permits a finger, hand or other body part to pass through it without shutting the machine down, it is not set up properly, and must be adjusted before someone gets hurt.
- **Any machine that has light curtains installed should come to a complete stop immediately after the curtain is tripped.**
 - A worker can still be severely injured by equipment that is "grinding to a halt".
 - A machine that is protected by a light curtain must have its stopping time checked periodically by a qualified technician, using special testing devices.
 - If the machine is not stopping quickly enough, some simple adjustments to the light curtain itself or the machine's braking mechanisms will usually fix the problem.
- **"Pressure-sensing devices" are another type of guard that is often used to protect workers by stopping a machine's movements.**
 - There are two types of pressure-sensitive devices, "trips" and "mats".
 - They are positioned around machines, to keep workers from entering hazardous areas.
- **Pressure-sensitive trips usually use wire cables as their "safety lines".**
 - If a worker touches a trip line, it triggers a switch that stops the machine.
 - In order for trips to be effective, their cables must be taut, and set so that they will stop the machine at the slightest pressure.
- **Because their cables can cover a wide area, pressure-sensitive trips are ideal for guarding long distances, such as next to conveyor belts.**
 - Trips can also be used to protect unusually shaped machine perimeters by routing their cables through eyelets.
- **"Pressure-sensitive mats" are another device that is frequently used to protect irregularly shaped machine areas.**
 - Because the mats are "movable", they provide more flexibility than "trips".
 - Mats have weight-triggered sensors in them.

- **In most cases, when someone gets too close to a machine and steps on the mat, a relay switch immediately cuts the power and stops the machine.**
 - Pressure-sensitive mats can also be set up to shut the machine down if the operator steps off of them.
 - Used this way, mats protect workers by forcing them to remain in a safe position while they are operating the machine.
- **Whichever way pressure-sensitive mats are used, they must be located directly in front of the areas where workers would be putting themselves in danger.**
 - As with light curtains and "trips", if there is any doubt about whether a machine is shutting down quickly enough, the machine and mat must be checked by a qualified technician.
- **While all types of machine guards can be used by themselves, in many cases there will be several types of guards and devices on a single machine.**
 - Using multiple devices is particularly important when any single device doesn't completely protect workers from all of a machine's hazards.
- **For instance, an electrical spot-welding machine might have the following protective devices:**
 - A transparent guard to prevent the operator from being hit by sparks or metal fragments.
 - A pressure-sensitive mat that allows the machine to function only when the operator is standing clear of its moving parts.
 - Fixed guards to prevent unauthorized persons from getting too close to the machine's power source.
- **While many safety devices can protect all parts of the body, others have been designed to specifically protect the hands.**
 - These devices are used on machines where workers are directly exposed to hand and finger injuries.
- **The simplest way to protect a worker's hands is to make sure that they are out of danger before a machine can start.**
 - "Two-hand controls" accomplish this by requiring the machine operator to push two separate buttons at the same time in order to activate the machine.
 - This keeps their hands safely on the controls, and away from moving parts.

- **On some machines a "drop probe device" can be used to allow workers to safely hold materials at a point of operation.**
 - A "drop probe" drops to a predetermined spot an instant before a machine starts.
 - If the drop probe falls freely, the machine begins its movement.
 - If it hits a worker's hand or some other obstacle, the machine will not start up.
- **One drawback of drop probe devices is that while they can keep a machine from starting, they can't stop a machine that is already in operation.**
 - So drop probe devices should only be used on machines that perform a single, rapid movement each time they're activated, such as small riveters.
- **"Restrain and pullback devices" are another type of hand protector.**
 - Unlike other guards and devices, these devices are attached to the workers that they protect.
- **"Restrain devices" use short straps or cables that are attached to an operator's wrists.**
 - These protect the worker by preventing their hands from extending into the point of operation of the machine that they're using.
- **"Pullback devices" give machine operators unrestricted access to a point of operation between a machine's movements.**
 - But they will "pull the operator's hands back" if they are too close to the point of operation when the machine starts moving.
- **Even when machines have guards or safety devices installed on them, that may not eliminate all their hazards.**
 - So it's essential to follow "safe work practices" at all times around powered machinery
- **Many accidents occur on machines that have had their safety guards and devices damaged, altered or even removed.**
 - So it is always important to check that guards and safety devices are present and fully functional.
 - Never operate a machine unless its guarding is in place and operating correctly either.

- **Keeping your work area clean and free of tools, materials and debris, is essential as well.**
 - Any of these could fall into your machine, hit moving parts, and become projectiles.
- **It's also important to wear personal protective equipment, such as safety glasses and face shields.**
 - They will protect you from sparks and flying material that may make their way past a machine's guards.
- **And you should never use a machine if you are sick, tired, or having trouble concentrating.**
 - Your full attention is required to avoid accidents.
- **Another thing you need to be careful about is how you dress and groom yourself.**
 - Loose clothing, long hair and jewelry can slip past a safety guard, get wrapped in moving parts, and pull you into the machinery.
- **Wear tight-fitting clothing whenever possible.**
 - Make sure to tuck in shirts, and button sleeves.
 - Keep your hair back, and always remove jewelry.
 - Wedding bands and other rings particularly cause problems, since it's easy to forget to take them off.
- **Most importantly, maintain a healthy respect for the machinery you work with.**
 - Many serious accidents happen to experienced people because they become complacent, and decide that they can get away with dangerous "short cuts".

*** * * SUMMARY * * ***

- **Be aware of the hazards that are created by the machinery you work with, and use machine guards and safety devices to protect yourself.**
- **Inspect guards and devices to make sure that they are undamaged, properly installed and adjusted, and fully functional.**
- **Never remove or disable a machine guard or safety device.**
- **Wear appropriate personal protective equipment and avoid loose clothing or jewelry when you work with machinery.**
- **Powered equipment can pose real hazards. But machine guards, safety devices and safe work practices can help protect you so that you can both increase your productivity and work more safely... every day!**