

# MSHA Goals

MSHA is reaching out in an effort to reduce the number of injuries and fatalities caused by lack of guarding, inadequate guarding, and lack of proper training to mine personnel. This PowerPoint, created in late 2017, contains instructional information with discussion points to assist mine operators, miners, and MSHA enforcement in guarding regulations. This training provides examples of adequate and inadequate guarding to help illustrate compliance. The examples are not intended to be definitive by nature due to the overwhelming number of unique guarding applications in the coal mining industry.

130 coal miners in the U.S. have been injured in the last five years in guarding-related accidents.



## Injuries By Related Regulation

30 CFR Part 75.1722 (c) or Part 77.400(d);

Except when testing the machinery, guards shall be securely in place while machinery is being operated.

60 injuries over last 5 years

## Injuries By Related Regulation

### 30 CFR Part 75.1722 (b) or Part 77.400 (c);

Guards at conveyor-drive, conveyor-head, and conveyor-tail pulleys shall extend a distance sufficient to prevent a person from reaching behind the guard and becoming caught between the belt and the pulley.

3 injuries over last 5 years

## Injuries By Related Regulation

### 30 CFR Part 75.1722 (a) or Part 77.400 (a);

Gears; sprockets; chains; drive, head, tail, and takeup pulleys; flywheels; couplings, shafts; sawblades; fan inlets; and similar exposed moving machine parts which may be contacted by persons, and which may cause injury to persons shall be guarded.

9 injuries over last 5 years

## Injuries By Related Regulation

### 30 CFR Part 75.1725 (c) or Part 77.404(c);

Repairs or maintenance shall not be performed on machinery until the power is off and the machinery is blocked against motion, except where machinery motion is necessary to make adjustments.

57 injuries over last 5 years

## Injuries By Related Regulation

### 30 CFR Part 77.204;

Openings in surface installations through which men or material may fall shall be protected by railings, barriers, covers or other protective devices.

One injury over last 5 years

# Mechanical equipment guards

30 CFR Part 75.1722

30 CFR Part 77.204

30 CFR Part 77.400

## Part 75.1722 Mechanical Equipment Guards

- (a) Gears; sprockets; chains; drive, head, tail, and takeup pulleys; flywheels; couplings, shafts; sawblades; fan inlets; and similar exposed moving machine parts which may be contacted by persons, and which may cause injury to persons shall be guarded.
- (b) Guards at conveyor-drive, conveyor-head, and conveyor-tail pulleys shall extend a distance sufficient to prevent a person from reaching behind the guard and becoming caught between the belt and the pulley.
- (c) Except when testing the machinery, guards shall be securely in place while machinery is being operated.

## 75.1722 Mechanical Equipment Guards (PPM)

Guards installed to prevent contact with moving parts of machinery shall:

1. Be of substantial construction;
2. Be of such construction that openings in the guard are too small to admit a person's hand;
3. Be firmly bolted or otherwise installed in a stationary position; and
4. Be of sufficient size to enclose the moving parts and exclude the possibility of any part of a person's body from contacting the moving parts while such equipment is in motion.

## 75.1722 Mechanical Equipment Guards (PPM) continued;

Guards designed to prevent contact with ventilating fans having exposed blades shall completely enclose the outby side of the fan blades.

Guards, such as substantial chains, cables, or the equivalent, installed to protect persons from contact with the inby side of ventilating fans shall:

1. Be located at least 6 feet on the inby side of the fan blade;
2. Be installed to a height of at least one-half the height of the air passageway; and
3. Extend the width of the air passageway. Inspectors should carefully examine each belt conveyor drive to determine whether all rollers are sufficiently guarded to prevent persons from becoming entangled between the rollers and the conveyor belt.

## Part 77.400 Mechanical Equipment Guards

- (a) Gears; sprockets; chains; drive, head, tail, and takeup pulleys; flywheels; couplings; shafts; sawblades; fan inlets; and similar exposed moving machine parts which may be contacted by persons, and which may cause injury to persons shall be guarded.
- (b) Overhead belts shall be guarded if the whipping action from a broken line would be hazardous to persons below.
- (c) Guards at conveyor-drive, conveyor-head, and conveyor-tail pulleys shall extend a distance sufficient to prevent a person from reaching behind the guard and becoming caught between the belt and the pulley.
- (d) Except when testing the machinery, guards shall be securely in place while machinery is being operated.

## 77.400 Mechanical Equipment Guards (PPM)

The word "line," used in paragraph (b) of this Section, means belt line and should read "... if whipping action from a broken belt line would be hazardous to persons below." The guard required in paragraph (c) should extend a minimum distance of 30 inches from the point where persons could become caught between the belt and the pulley.

MSHA has issued 5,358 enforcement actions to Coal operators related to guarding in the same five years.

The citation breakdown is as follows;

<b>Standard</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Grand Total</b>	
<b>75.1722</b>	13						13	
<b>75.1722(a)</b>	463	336	330	228	191	54	1602	
<b>75.1722(b)</b>	171	133	148	104	59	15	630	
<b>75.1722(c)</b>	171	109	101	77	79	12	549	
<b>77.400</b>	83						83	
<b>77.400(a)</b>	439	425	372	294	213	29	1772	
<b>77.400(b)</b>	15	12	12	8	7	1	55	
<b>77.400(c)</b>	76	53	56	38	32	7	262	
<b>77.400(d)</b>	90	57	86	82	64	13	392	
<b>Grand Total</b>	1521	1125	1105	831	645	131	5358	

# Guarded Conveyor Tail Pulley and Shaft

An adequately installed guard must be maintained and in place to provide protection from the hazard it is intended to guard. Proper examinations and maintenance are paramount for miner safety.



# What Problems Do You See?

Although expanded metal can make an excellent guard, the construction of this guard lacks a substantial frame, and adequate strength. Additionally, this guard lacks sufficient length and height to guard all moving machine parts and introduces sharp edges that can cut the skin. Adequate guards must encompass all moving machine parts to which miners are exposed.



# Keys to Proper Guarding

- Substantial Frame
- Adequate Strength
- Covers all moving machine parts

This guard provides protection from the rotating keyed shaft and coupling and also allows inspection of the coupling. It is strong and well maintained but still lacks a few key features like a lifting point and or handles.



# Poorly Maintained Guard

Rubber belting material can be a good choice for guarding material in some circumstances if maintained properly, however what once may have been an adequate guard has become inadequate due to failing to replace a few nuts and bolts.



# Poorly Constructed Conveyor Belt Take Up Guard

What is missing here? Lack of a substantial frame? How about the large gap where the two sections of guard meet? Notice, there is no latch or other means to secure the two sections together. Also the two cut outs meant for handles have sharp points that could puncture the skin and will allow the fingers to go beyond the protection of the guard, possibly contacting moving machine parts.



## Example of Proper Guarding

An adequately guarded conveyor tail roller will provide protection to all moving machine parts. Access to cleaning and maintenance should be a simple, uncomplicated task.

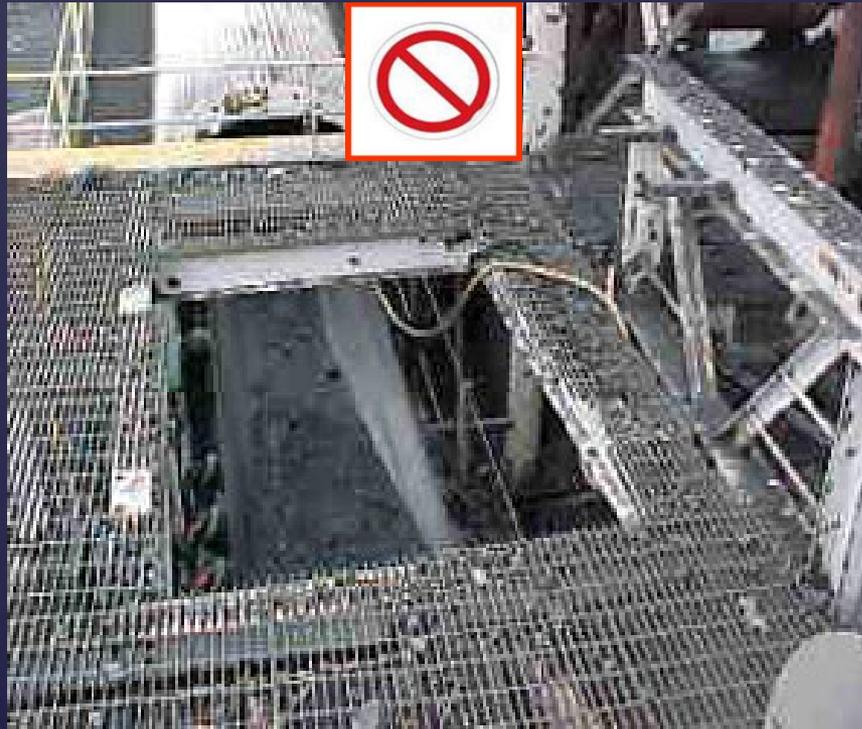


# Part 77.204 Openings in Surface Installations

Openings in surface installations through which men or material may fall shall be protected by railings, barriers, covers or other protective devices.

## Part 77.204 Openings in Surface Installations

Replace guards and man hole covers at elevated positions such as at prep plants and in walk ways. One miner was injured in an accident related to falling through an opening because the man hole cover/guard was not replaced after a maintenance task.



# Area Guarding

Area guarding is easily defeated and provides a false sense of protection from moving machine parts and flying debris. It often time restricts access to walkways and creates choke points for miners. Specific component guards are less restrictive and provide better protection.



## Area Guarding

Figure 31 shows an example of an area guard used to prevent contact with multiple belt tailpieces. Figure 32 shows a similar situation using point-of-contact guards.

An advantage of the area guard is that it may be less expensive. A disadvantage is that both belts need to be locked-out and tagged-out before entering the guarded area.

The advantages of the point-of-contact guards are that one belt can be maintained while the other belt continues to run, the belts can be cleaned around without lock-out/tag-out and maintenance on the chutes is possible without lock-out/tag-out.

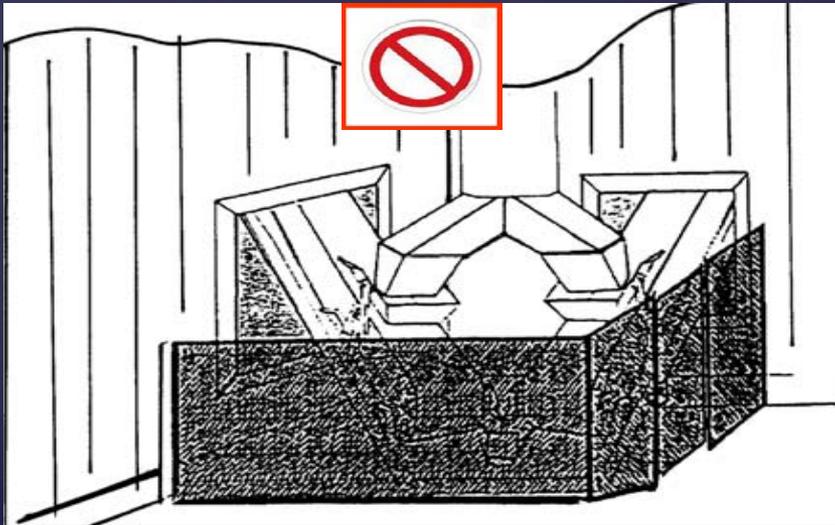


Figure 31

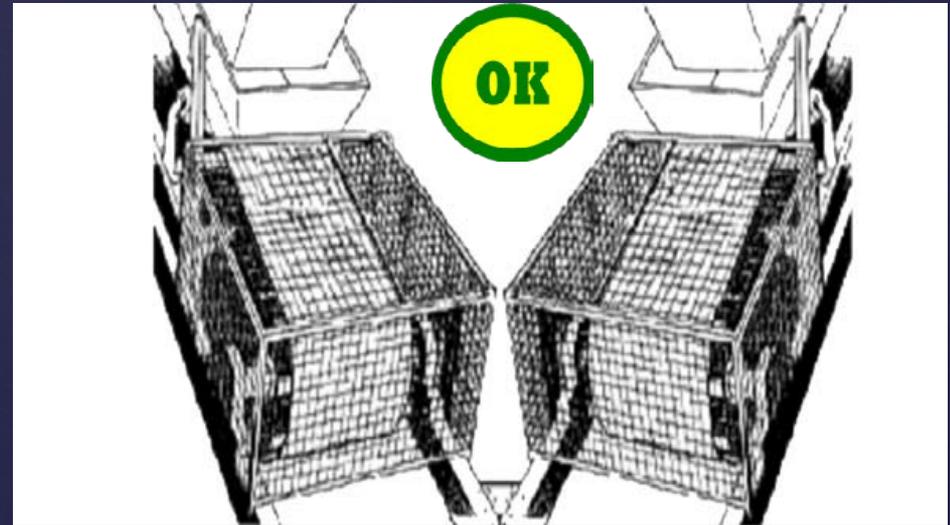


Figure 32

# Specific Component Guards

Specific component or point of contact guards are less restrictive for travelways and provide better protection from moving machine parts.



Before working on equipment, de-energize electrical power, lock and tag the power circuit with your lock and tag, and block parts that can move against motion. Never bypass or remove the guard beforehand! The results could be disastrous.

The picture on the left shows where a miner was positioned between the area guard and the conveyor belt drive when he came in contact with the shaft of the belt drive roller. An end shaft guard similar to the one on the right could have prevented the fatality.



# Lock Out Tag Out

Lock out, Tag out and Try out (LOTOTO). Lock out equipment with your lock. Tag out using your personal tag, and try out the equipment to ensure the energy source has been removed before starting repairs or maintenance.



LOCK OUT



TAG OUT



TRY OUT

## **Part 75.1725 Machinery and Equipment; Operation and Maintenance.**

(c) Repairs or maintenance shall not be performed on machinery until the power is off and the machinery is blocked against motion, except where machinery motion is necessary to make adjustments.

(d) Machinery shall not be lubricated manually while in motion, unless equipped with extended fittings or cups.

# Slow Down and Get Some Help!

Rushing repair work to save production time and taking short cuts will often end in extended down time due to substandard repairs, and may cause injuries and even death.

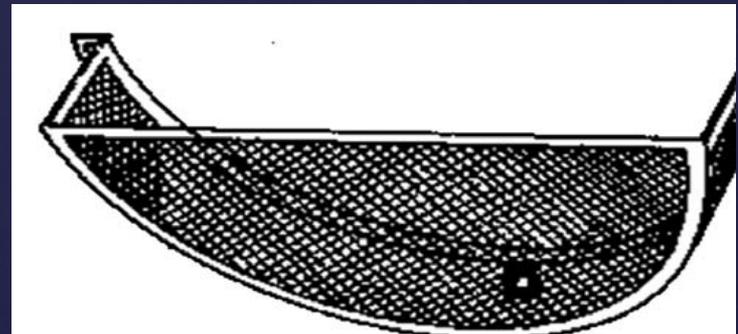
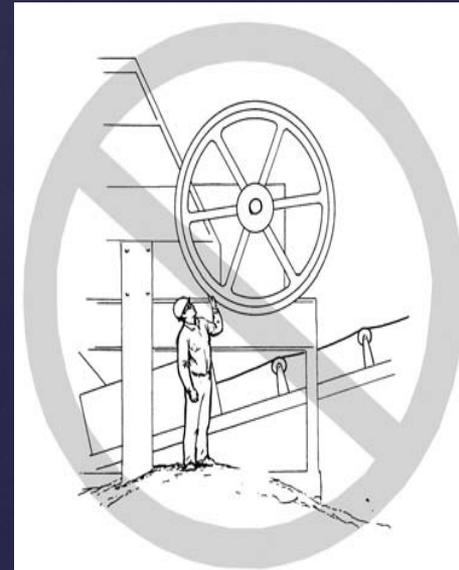
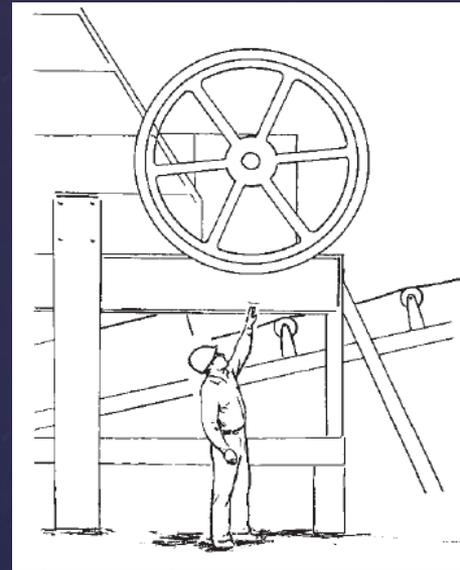
Clean it up and fix it right the first time!

Owl shift has enough to do.

# Guarding by Location



Figure 24 shows a flywheel guarded by location. Build-up of material may place the flywheel within easy reach, as shown in Figure 25. To protect miners from contacting the flywheel, the build-up must be removed or the flywheel must be guarded. An example guard is shown in Figure 26.



# Guarding by Location

The distance from the ground to the line shaft, sprockets and connecting chain is greater than 7 feet.  
The drive motor must be powered OFF and locked out when the elevated components are inspected or repaired



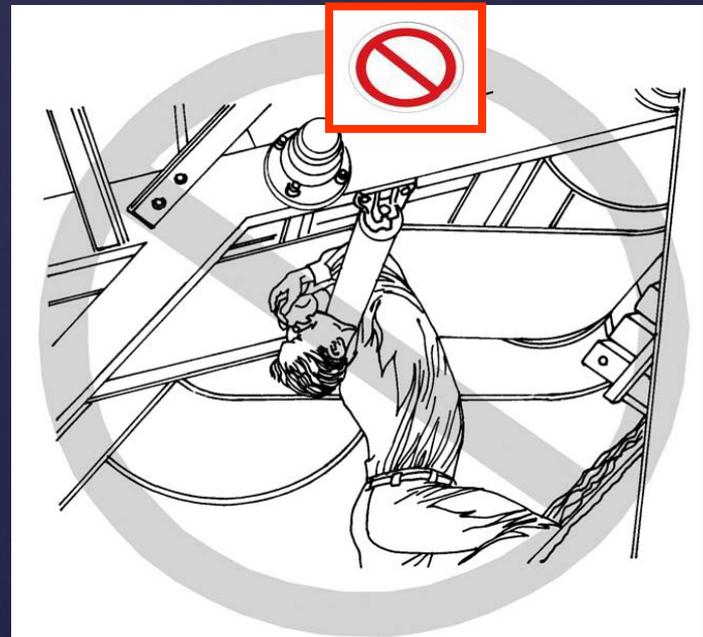
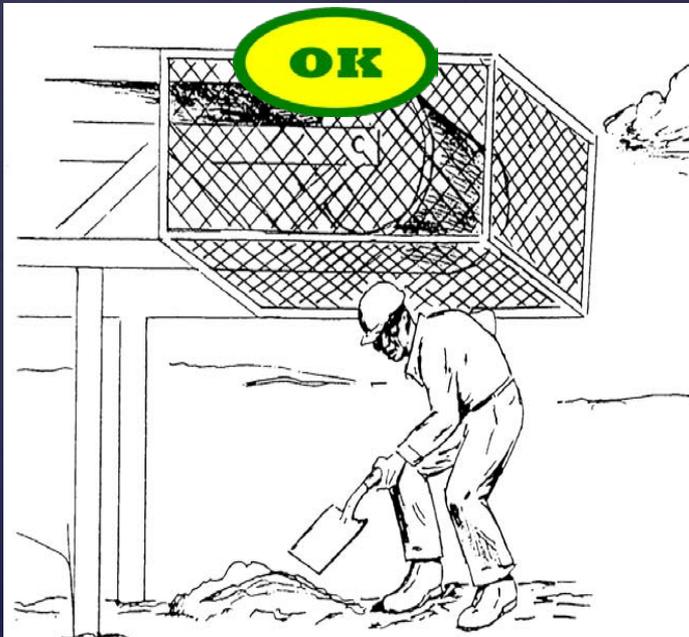
# Guarding by Location

Some moving machine parts or conveyors will be located a sufficient distance above ground to prevent contact and are therefore considered “guarded by location”. **Never attempt to gain access to the moving machine part or conveyor belt until it has been de-energized, locked and tagged, blocked against motion and tried out (LOTOTO). This bottom hold up roller was involved in a fatality, yet it was located 10 feet above the ground.**



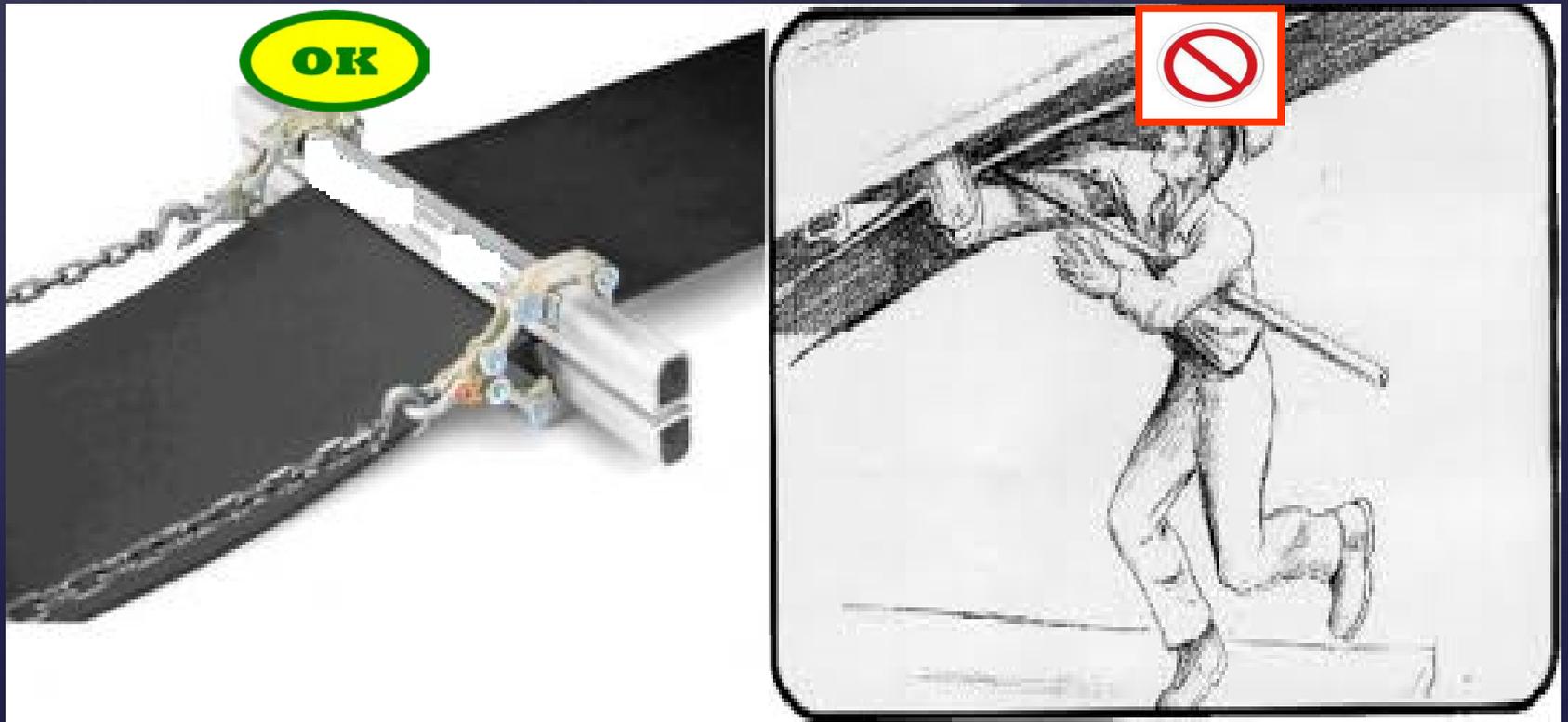
## Part 75.1728 Power-driven Pulleys

(c) Coal spilled beneath belt conveyor drives or tail pieces shall **not** be removed while the conveyor is in motion, except where such coal can be removed without endangering persons.



# Block Against Motion

Always block against motion before attempting to service or repair any moving machine part or belt conveyor. When using belt clamping devices, they should be secured to structural members of the conveyor system in both directions to restrain the belt from unexpected movement caused by stored energy.

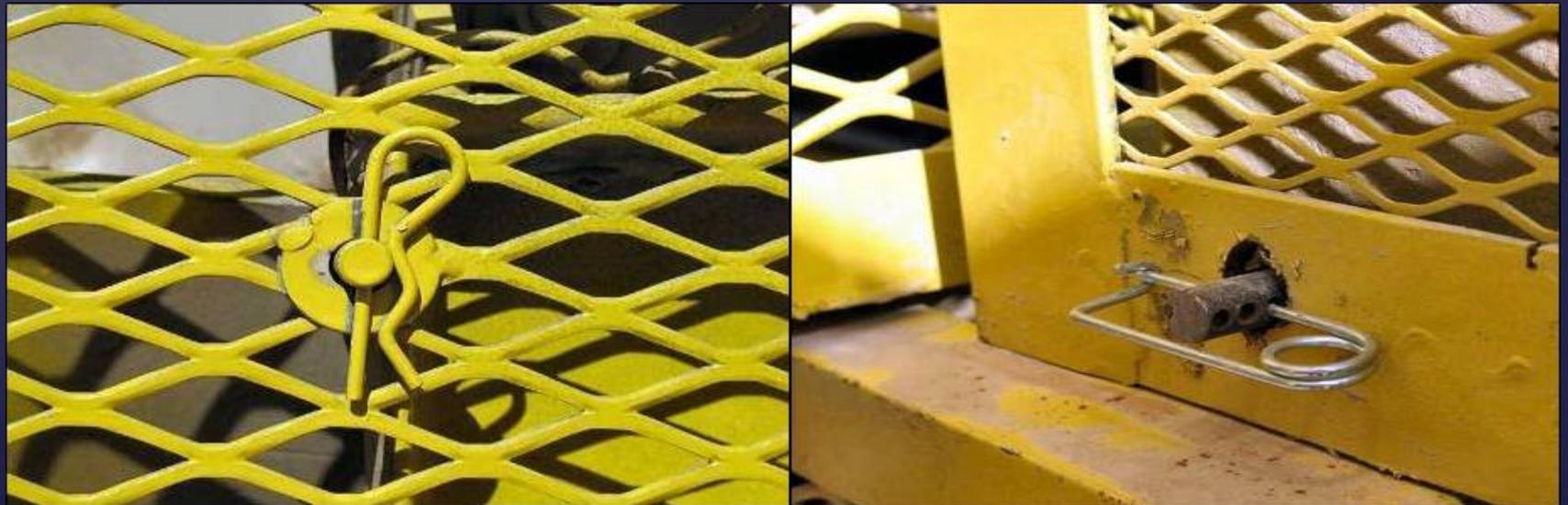


# Guard Design

**Simple guard design and construction** can eliminate guarding issues and injuries during installation and in the future. Where possible use pin and sleeve fasteners with hinges that will hold the guard securely instead of nuts and bolts. Let gravity work for you. Typically, the more nuts and bolts used to secure a guard the more likely some of those nuts and bolts will be lost or forgotten when it comes time to re-install the guard or make repairs. As a result, the once adequate guard has now become a heavy cumbersome piece of metal that is either not reinstalled or is reinstalled without all the fasteners and has gaps that expose miners to moving parts.

# Guard Design

Alternatives to nuts and bolts.

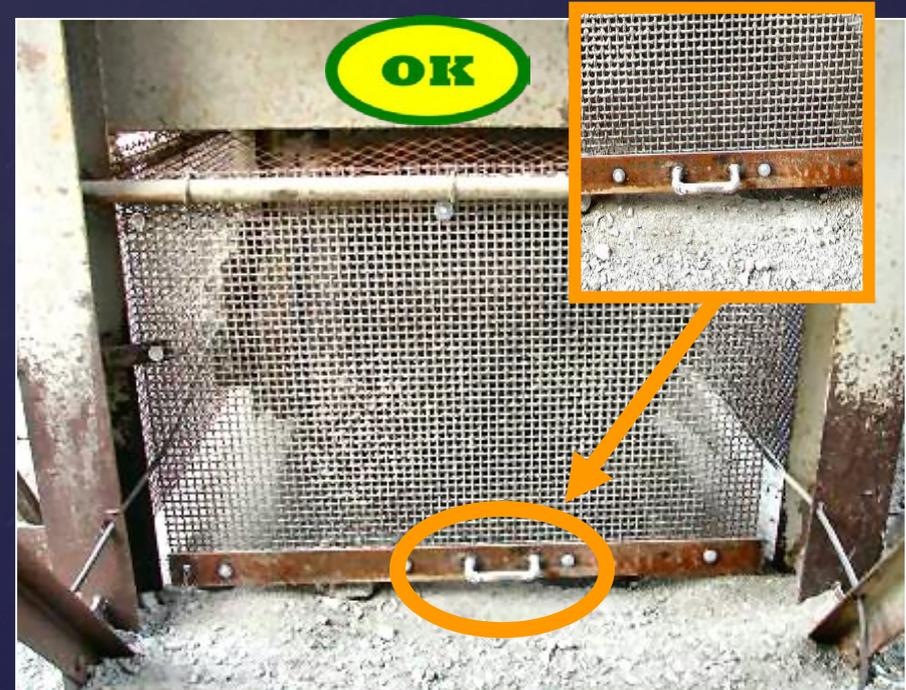


# Guard Design

A good start for a tail roller guard, but there are some things missing. (1) No handle to lift the guard which exposes the miners to cuts and scratches. (2) No way to secure the guard once it has been lifted into place. (3) No latch or means to secure the guard when it is returned to its closed position.

Now, doesn't this look better?

The operator added a lifting handle and a lock to secure the guard.



# Guard Design

Pinched fingers and strained muscles are the leading causes of guard injuries. Designing larger guards in smaller sections with handles facilitates easier installation and removal. Why remove a large bulky and cumbersome guard to access one end of the machine when you can remove a smaller, lighter section to gain access to perform the needed maintenance?



# Guard Design

Hinge points and locking mechanisms provide easier access for maintenance and repairs to machines and assist in re-installing the guards correctly when the job is completed.



# New Technology

New technologies may provide alternative means of guarding. As new technologies are developed and alternative ways of protecting miners become available, their use and application may provide a level of protection equal to, or surpassing, conventional guards.

Several new technologies show promise:

Laser beams may be effective at long range. They can monitor area perimeters and detect when entry into a hazardous area occurs.

Pulsed infrared light curtain systems may be useful as area guards. They are particularly useful in dusty environments.

Infrared scanners can detect changes in the reflective field of a monitored area.

# New Technology

Pressure plates can be equipped with sensors that detect changes in a radio frequency field or electrical capacitance. They can guard an area by sensing a person's approach through contact with the plate.

Mechanical pressure mats open electrical contacts to stop a motor when someone steps on the mat in a hazardous area.

Interlock systems are available with multiple contacts. Multiple contacts or zones can be used to trigger a warning alarm for entry into an area but shut a system down if the person continues past the warning and approaches a hazard too closely.

# New Technology

While new technologies may be suitable in some situations, you should also be aware of the pitfalls in systems that use these alternative guarding systems. The following types of questions should be asked:

Does the system react quickly and at sufficient distance to prevent contact with the machine parts before their motion has stopped?

Is the system redundant?

Can it be by-passed, such as ducking under a laser beam?  
Is there regular and frequent testing?

Will the system fail safe?

# Guard Design

Guards should not create other hazards such as tripping hazards, sharp edges, or choke points that narrow travelways.



# Guard Design

Provide warning signs to remind miners of the hazards of moving machine parts and belt conveyor systems at the guards location.



# Training and Equipment

Incorporate comprehensive task training for all miners, especially belt maintenance and repair personnel that includes belt conveyor systems, guarding design, rotating machinery parts, pinch points, materials handling, the clean up program and personal protective equipment.

Ensure all personnel involved in these activities have locks and tags for locking out electrical circuits before performing maintenance and or repairs on moving machine parts such as belt conveyors.

Locks and tags are not just for your electricians.

For additional information and guidance on guarding,  
please refer to:



**MSHA's Guide to Equipment Guarding**  
U.S. Department of Labor Mine Safety and  
Health Administration  
Other Training Material OT 3  
Revised 2004

Or contact your local MSHA District  
Office.