Safeguarding Conveyors

Injuries related to conveyors are common, costly, and often severe. Thirty-five percent of the work-related injuries that occurred in the manufacturing sector in the five-year period from 2008 to 2012 were related to conveyors. In total, $218 million was spent on such claims. Approximately one in four injuries that were directly associated with conveyors resulted in amputation or fracture. These statistics demonstrate how important it is to implement safeguards and lockout procedures.

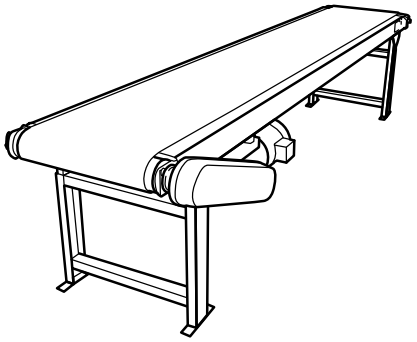
Types of conveyors and injuries associated with them

Three common types of conveyors are belt/chain conveyors, roller conveyors, and screw (auger) conveyors.

Belt/chain conveyors

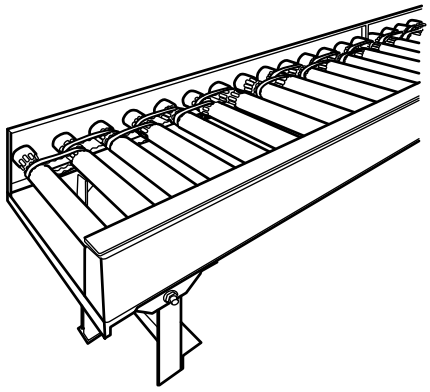
The main sources of injuries associated with unguarded belt/chain conveyors include:

- Power transmission drives (v-belt or chain-sprocket drive and transmission)
- Return non-powered rollers
- Parts of the conveyor belt around the head or tail spool



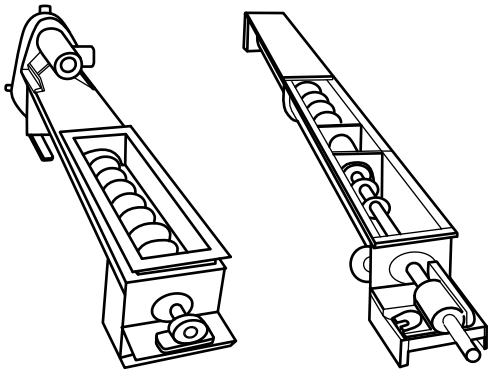
Roller conveyors

Roller conveyors have in-running nip points between the carrier rollers and belt, as well as between the chains and sprockets. The nip points are hazardous because they can cause injuries by snagging and pulling extremities, such as hands, hair, or clothing.



Screw (auger) conveyors

Moving parts, such as rotating augers or power transmission drives, are often involved in injuries related to unguarded screw conveyors. Such injuries can be devastating and may result in death.



How hazardous are conveyors?

While conveyors are convenient and beneficial for quickly moving materials, operating an unguarded conveyor can lead to traumatic injuries. The following are examples of such injuries:

- While working with an unguarded tail spool, a worker used a stick to clear debris from the underside of the belt. When the stick got caught in the spool, the worker instinctively held on to the stick, and his arm followed it into the nip point, leading to an amputation.
- A worker was trying to clear a wood jam in a chipper conveyor belt without turning off any part of the machine or using a picaroon. His hand and arm were caught in the teeth of the rotating rollers, and his body was pulled onto the chipper conveyor. The worker's arm was twisted off at the shoulder.
- A young worker was working with a hip-high roller conveyor when she noticed one of the packaging products had fallen under the conveyor. As she went down to retrieve it, her hair got caught, and she was drawn into the flexible drive pulley and driveshaft. She sustained scalp bruising and abrasion injuries.

How do I control the hazards?

In order to control the hazards at your workplace, you must first conduct a safeguarding risk assessment (see the five-step risk assessment on page 4). Performing a risk assessment will help you identify specific point-of-operation and power transmission hazards, prioritize the risks associated with these hazards, and implement appropriate safeguarding controls, which will reduce the risk to your workers.

It is important to ensure the participation of all your workers and supervisors in the risk assessment. Additionally, the risk assessment must consider the requirements of *ANSI Standard B20.1-1993*, which stipulates that all exposed moving machinery parts that are hazardous to workers must be guarded mechanically, electronically, or by location or position.

How can I safeguard equipment?

It is the employer's responsibility to protect workers by providing safeguards that prevent contact with moving parts on machines.

Belt/chain conveyors

For belt/chain conveyors, the v-belt or chain sprocket must be guarded by wire mesh with openings that meet *CSA Standard Z432-94, Safeguarding of Machinery* (hands and fingers must not be able to reach the pinch point). The following requirements apply:

- The guard must be secured with at least one fastener that requires a tool for removal.
- Both the underside and backside of the guard must be enclosed to prevent contact with moving parts.
- The in-running nip point between the running belt or chain and the head or tail spool must be fully enclosed (with access to the belt and spool) for a minimum of 1 m back from the centre line of the spool.
- The spool must be designed and fabricated to allow tracking adjustments (which must be done when the belt is moving) to be performed without removing the boot guard.
- Unless worker access to the conveyor is completely prevented by guarding, an emergency stopping system must be installed. In case of accidental contact, the emergency stopping system acts as the "first/last chance" to stop the machine.

Roller conveyors

Where possible, roller conveyors should have permanent, adjustable barrier guards installed to protect workers from nip and shear points. Adjustable barrier guards allow the safeguarding of the unused section of rollers closest to the worker when transporting small items that do not require the use of the entire roller width.

Screw conveyors

Most screw conveyors are guarded using solid metal covers if access to the trough is not required during operation. If access is required (for example, to feed material into the running auger), guards such as gratings or horizontal members should be used. The openings in guards must be designed in accordance with *CSA Standard Z432-94, Safeguarding of Machinery*. The following requirements apply:

- Openings must be small enough that body parts such as fingers, hands, arms, or feet cannot come into contact with the auger.
- The guard must be securely bolted in place using fasteners that require a tool for removal. Quick-release latches are prohibited.

What is lockout, and why is it necessary?

Lockout is the use of a lock or locks to render machinery or equipment inoperable or to isolate an energy source. The purpose of lockout is to prevent an energy-isolating device (such as a switch, circuit breaker, or valve) from accidentally being operated while workers are performing maintenance on machinery

or equipment. Lockout makes sure machinery or equipment won't start and injure a worker.

The following are examples of injuries that happened because lockout procedures were not followed:

- A worker was placing a conveyor chain back on a sprocket when the chain was unintentionally activated. The worker's fingers were crushed against the sprocket, leading to amputation of two fingers, between the first and second knuckles.
- A worker was cleaning inside the opening to a vertical screw conveyor. (The opening was 1⅜ in. in diameter and 1¾ in. deep.) The worker's fingertip was amputated when it contacted the operating screw conveyor.
- A worker was hosing down a running conveyor, with the hose in his right hand, while removing fruit debris with his left hand. As he was removing debris from the conveyor belt, his glove got caught in the moving belt. His fingers got stuck and were crushed between the conveyor belt and the track.

How do I lock out equipment?

Typically, lockout includes completely stopping the machine, isolating and de-energizing all energy sources, applying a lock to energy sources (as applicable), and testing to ensure the energy isolation/lockout is effective.

Most electrical equipment can be locked out simply by stopping the machine, disconnecting the power supply, and placing the plug end of the cord within sight. This allows the worker who is working on the machine to ensure that it is turned off and that the plug remains under his or her control. Locks must be applied to the energy source if the plug is not under the immediate and exclusive control of the worker during maintenance. If unplugging is not possible, an in-line switch can be used to control the electrical energy source to the machine. A lock must also be applied if the worker does not have immediate and exclusive control of the in-line switch.

Situations where lockout is required

Scheduled maintenance — This is when qualified workers conduct regular and planned (for example, weekly or daily) maintenance on a machine.

Unplanned maintenance — This is when there is an issue or upset condition with a machine that prevents it from performing its function. The issue may not be obvious and may occur suddenly, which might make it tempting for the worker who is operating the machine to attempt to fix or repair it without locking out.

Cleaning equipment — Cleaning around exposed moving parts puts workers at risk of being caught or otherwise injured by the machine.

Clearing jams or materials — During the normal production process, materials may become caught in the machine and require removal. Trying to clear a jam without locking out can lead to serious injury.

Safe work practices for conveyors

1	Do not perform maintenance on a conveyor until the motor disconnect is locked out.
2	Conveyor maintenance must be done by authorized and qualified maintenance workers.
3	Keep clothing, fingers, hair, and other body parts away from the conveyor.
4	Do not climb, step, sit, or ride on the conveyor at any time.
5	Do not exceed the design limits when loading a conveyor.
6	Do not remove or alter conveyor guards or safety devices.
7	Do not wear loose clothing or jewellery while working with or near conveyors.
8	Know the location and function of all start-stop controls.
9	Keep all start-stop controls and emergency stop devices free of obstructions and within reach of operators and affected workers.
10	All workers must be clear of the conveyor before it is started.
11	Operate the conveyor with trained workers only.
12	Keep the area around the conveyor clear of obstructions.
13	Report all unsafe practices to your supervisor.

Five-step risk assessment

Conduct a risk assessment for each piece of equipment in the workplace.

Step 1: Identify the hazards.

- Observe how the moving parts of a machine operate and how a worker could come into contact with those parts.

Step 2: Decide who might be harmed and how.

- Identify who could be harmed by a machine (for example, the worker who operates a ribbon blender).
- Identify how each worker could be harmed and the injury that could result. For example, the operator of a dough mixer could come into contact with the machine's rotating blades, which could result in an amputation.

Step 3: Identify what you can do to make your workplace safer.

- Describe what you are going to do about the identified hazards. Can you remove the hazard completely? If not, what can you do to help prevent injuries?
- Look at how the work is organized. Can you change the placement of equipment to make the workplace safer?

Step 4: Record your findings and start your plan.

- **Write** down the results of your risk assessment.
- **Share** the results with your workers.
- **Make** an action plan. Write down all the things you and your workers need to do. Put the most important things first.

Step 5: Review and update your assessment.

- **Review** your risk assessment regularly, and make any changes needed. Ask questions, such as the following:
  - Have there been changes in how work is done or who is doing the work?
  - Have you installed any new equipment?
  - Are there any new hazards?
  - Have there been injuries or near misses? Why did these incidents occur?

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