According to OSHA statistics, workers who operate and maintain machinery suffer approximately 18,000 amputations, lacerations, crushing injuries, abrasions, and over 800 deaths each year. Amputation is one of the most severe and crippling types of workplace injuries because it often leads to permanent disability. Due to the amputation potential, power transmission apparatus safeguarding is one of OSHA’s most frequently cited standards. Proper machine safeguarding can protect the machine operator and other workers in the area from hazards created by the rotating parts and in-running nip points of power transmission apparatus.

What is a Power Transmission Apparatus?
Power transmission apparatus includes all mechanical components that transmit energy to the part of the machine performing the work. Examples of such mechanical components include:

- Flywheels
- Couplings
- Belts
- Spindles
- Pulleys
- Cranks
- Cams
- Chains
- Connecting rods
- Gears

Hazards associated with power transmission generally involve motion: rotating (including in-running nip points), reciprocating, and transverse motion.

Hazardous Moving Parts
Even a smooth shaft rotating slowly can grasp clothing or hair, and upon mere skin contact, force an arm or hand into dangerous areas. Couplings, cams, clutches, flywheels, shaft ends, and meshing gears are examples of hazardous rotating mechanisms. The danger increases when bolts, nicks, abrasions, and projecting keys or set screws are exposed on rotating parts. Other rotating mechanisms that are, in many cases, located inside a stationary case or shell are revolving cylinders, screw conveyors, agitator blades, and paddles.

Reciprocating and transverse motions may also expose workers to hazards. Reciprocating motions may cause a worker to be struck or caught between a moving and stationary part as it moves back and forth or up and down. Transverse motions (motions in a straight, continuous line) create a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.

In-Running Nip Points
Operators should be aware of the danger caused by machine parts rotating toward each other. Nip points can occur on the in-running side of a chain and sprocket, between belts and pulleys, between feed rollers, on gear racks, and in many other locations. Nip points can also occur between rotating and fixed parts, creating a shearing, crushing, or abrading action. Examples are spoked flywheels, screw conveyors, or an abrasive grinding wheel with an incorrectly adjusted work rest.
Safeguarding Requirements
Safeguards should be installed and maintained on all power transmission apparatus to meet the following requirements:

- Prevent Contact — The safeguard should eliminate the possibility of any part of a worker’s body coming into contact with dangerous moving parts.
- Secure — Guards should be secured to the machine or equipment so operators are unable to remove or tamper with them. Guards should also be substantial enough to withstand the conditions of normal use.
- Protect From Falling Objects — Guards should be designed to eliminate the chance of objects falling into moving parts.
- Create No New Hazards — A safeguard should not introduce any new hazards, such as sharp edges that could cause a laceration.
- Create No Interference — Guards that impede an operator from performing the job efficiently and comfortably are likely to be removed or overridden. Consult with workers when designing guards to identify any potential interference or operational issues.
- Allow safe lubrication — Machine lubrication should be possible without removing guards.

Note: Original manufacturers’ guards should not be modified in such a manner as to reduce their effectiveness.

Safeguarding Methods
According to OSHA, guards should be installed to cover all rotating parts and in-running nip points located within 7 feet of the floor or working platform (e.g., mezzanines, runways, stairways, etc.).

The preferred guarding method to protect workers is to use a fixed guard that encloses the danger zone. As its name implies, a fixed guard is a permanent part of the machine. It is not dependent upon moving parts to function. It may be constructed of expanded metal, perforated or solid sheet metal, wire mesh on a frame of angle iron, or iron pipe securely fastened to the floor or to the machine frame. Fixed guards are usually preferable to all other types because of their relative simplicity.

Before Removing a Guard
According to OSHA regulations, Lockout/Tagout procedures should be used whenever:

- An employee is required to remove or bypass a guard or other safety device.
- An employee is required to place any part of his or her body in the “point of operation” of the machine or where an associated danger zone exists during the machine’s operating cycle.

Workers who are authorized to service or adjust a machine should ensure it is turned off and the power source has been locked out following proper lockout/tagout procedures. When the service/adjustment is completed, the guard must be replaced securely and in proper working order before using the machine.

For Additional Information
EMC Insurance Companies: www.emcins.com
- Online Training – Lockout/Tagout, Parts I and II
- Loss Prevention Manual – Machine Safeguarding, Lockout/Tagout
- Tech Sheets – Lockout/Tagout Program, Abrasive Wheel Grinders, and Machine Safeguarding Table Saws

Occupational Safety & Health Administration: www.osha.gov
- Machine Guarding eTool
- Machine Safeguarding checklist
- Mechanical Power Transmission Apparatus safeguarding standard 1910.219