Part 7. Guards for Power Transmission

Student Materials
MTI Level Two Compliance Course
Consultation Education and Training Division
Michigan Occupational Safety and Health Administration
Michigan Department of Labor and Economic Opportunity
www.michigan.gov/miosha
517-284-7720

MICHIGAN DEPARTMENT OF LABOR & ECONOMIC OPPORTUNITY

(Revised 02/24)

MIOSHA
Michigan Occupational Safety and Health Administration

Part 7
Guards for Power Transmission

(as amended June 11, 2019)

MIOSHA
Michigan Occupational Safety and Health Administration

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Objectives

- Apply basic and specific machine guarding techniques.
- Understand various rules addressing power transmission equipment.
- Explain different requirements for guard design and construction.

2

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Vertical vs. Horizontal Standards

- Vertical Standards
  - Standards which apply to a particular industry or to particular operations, practices, conditions, processes, means, methods, equipment or installations.
  - ***Examples**: GI Part 50 "Telecommunications" and GI Part 26 "Metalworking Machinery"*
- Horizontal Standards
  - Other (more general) standards applicable to multiple industries.
  - ***Examples**: GI Part 1 "General Provisions" and GI Part 2 "Walking-Working Surfaces"*

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Vertical vs. Horizontal Standards (continued)

- When a hazard is covered by both a vertical and a horizontal standard, the vertical standard shall take precedence even if the horizontal standard is more stringent.
- When a hazard is covered by both a horizontal (general) and vertical (specific) standard where the horizontal standard appears to offer greater protection, the horizontal (general) standard may be cited only if its requirements are not inconsistent or in conflict with the requirements of the vertical (specific) standard.

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Table of Contents

- General Provisions
- Power Transmission Equipment
- Starting and Stopping Devices
- Guard Design and Construction
- Power Disconnects and Lock-outs
- Appendix A - Guard Construction
- Appendix B - Acceptable Guard Construction

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Scope

- This part applies to all equipment used in the transmission of power, **excluding** the point of operation.
  - "**Point of operation**" means that point at which cutting, shaping, or forming by a machine is accomplished upon stock and other points that may offer a hazard to the operator in inserting or manipulating stock in the operation of the machine.

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Referenced Standard

- The Michigan Occupational Safety and Health Administration (MIOSHA) standard General Industry Safety and Health Standard Part 2. “Walking-Working Surfaces,” R 408.10201 to R 408.10241, is referenced in these rules.

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Definitions

- “**Belt**” includes any power transmission belt, including but not limited to, a flat belt, round belt, and V-belt, overhead chain and link belt. It **does not include** a conveyor belt.
  - "Belt conveyor" means an endless belt operating between a drive and a tail-end, with or without bend terminals, and over idler rolls or slider beds that handles bulk materials, packages, or objects placed directly on the belt.
- “**Belt pole**” means a device used in shifting belts on and off fixed pulleys on a line or countershaft if there are no loose pulleys.

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Definitions (continued)

- "**Belt shifter**" means a device for mechanically shifting belts from tight to loose idler pulleys or vice versa, or for shifting belts on cones of speed pulleys.

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Definitions (continued)

- "**Exposed to contact**" means that the location of an object is such that a person **might** come into contact with it and be injured.
- "**Flywheel**" includes a balance wheel and a flywheel pulley mounted and revolving on the crankshaft of an engine or other shafting.
- "**Gears**" means a set or train of wheels or parts that engages another part as by meshing teeth.

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Definitions (continued)

- "**Guarded**" or "**enclosed**" means that an object is covered, fenced, or surrounded so that it is not exposed to contact.
- "**Horizontal belt**" means a belt running within a 60-degree angle from horizontal.
- "**Maintenance runway**" means a permanent runway or platform used for oiling, maintenance, running adjustment, or repair work, but not for a passageway.

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Definitions (continued)

- "**Nip-point belt and pulley guard**" means a device which encloses a pulley and is provided with rounded or rolled edge slots through which the belt passes.
- "**Point of operation**" means that point at which cutting, shaping, or forming by a machine is accomplished upon stock and other points that may offer a hazard to the operator in inserting or manipulating stock in the operation of the machine.

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Definitions (continued)

- "**Securely fastened**" means that the safety device or object referred to shall be so secured in place that it cannot be moved under normal or reasonably foreseen conditions or circumstances.
- "**Vertical belt**" means a belt running within a 30-degree angle from vertical.

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Rule 711 Flywheels

- An employer shall ensure that any part of a flywheel **7 feet or less** above the floor or platform is guarded in 1 of the following ways:*
  - Enclosed by a guard pursuant to R 408.10751 to R 408.10754.
  - With guardrail systems placed **not less than 15**, nor more than 20, **inches** from the rim of the flywheel in compliance with General Industry Safety and Health Standard Part 2. "Walking-Working Surfaces," as referenced in R 408.10702.

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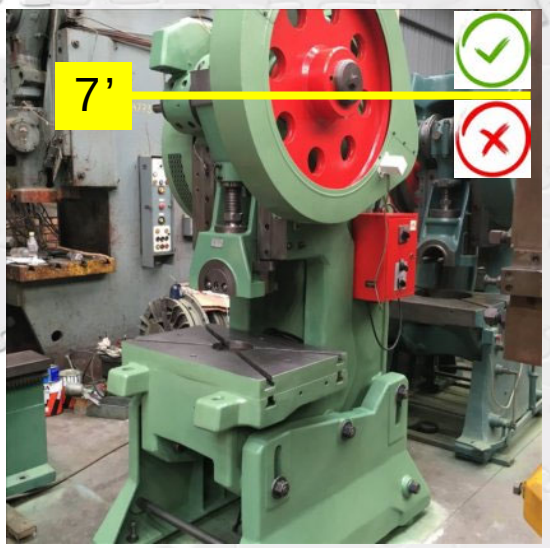
Rule 711 Flywheels (continued)



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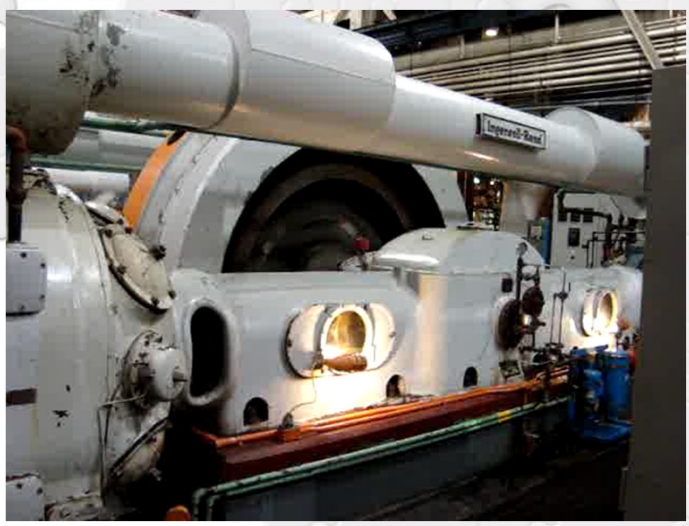
Rule 711 Flywheels (continued)



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Rule 711 Flywheels (continued)

- The upper rim of a flywheel protruding through a working floor is enclosed or surrounded by a guardrail system in compliance with General Industry Safety and Health Standard Part 2. “Walking-Working Surfaces,” as referenced in R 408.10702.

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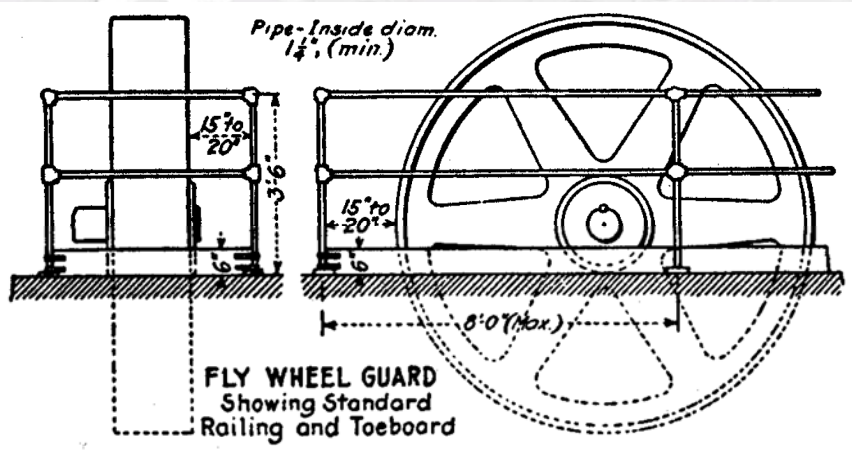
Appendix B
Acceptable Guard Construction



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Rule 711 Flywheels (continued)

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Rule 711 Flywheels (continued)

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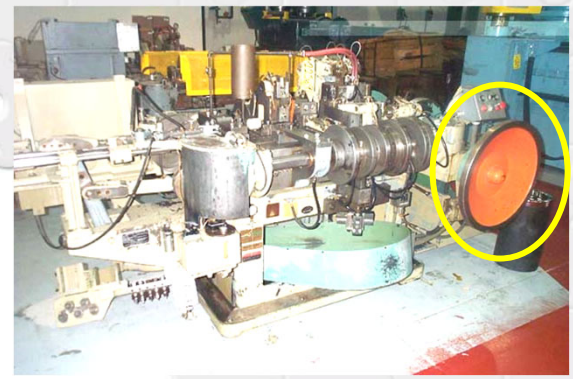
Rule 711 Flywheels (continued)

- A flywheel with a smooth rim **5 feet or less** in diameter may be guarded pursuant to R 408.10756.



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Rule 712 Cranks and Connecting Rods

- A crank and a connecting rod, if exposed to contact, must be guarded pursuant to R 408.10751 to R 408.10754 or by a guardrail system in compliance with General Industry Safety and Health Standard Part 2. “Walking-Working Surfaces,” as referenced in R 408.10702.

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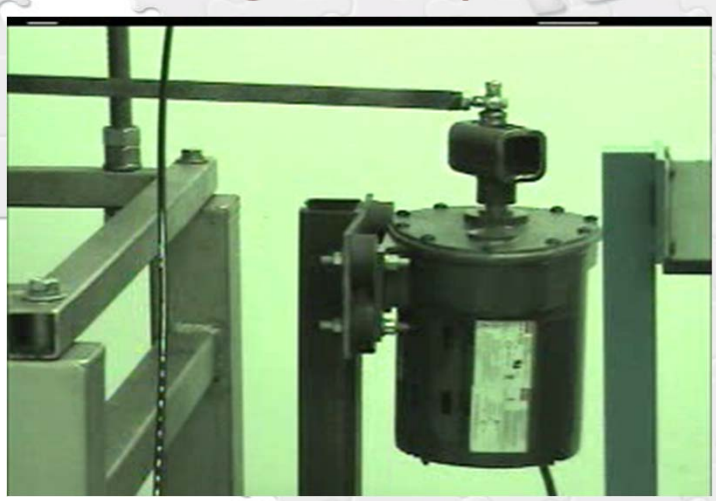
Rule 712 Cranks and Connecting Rods (continued)



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Rule 712 Cranks and Connecting Rods (continued)

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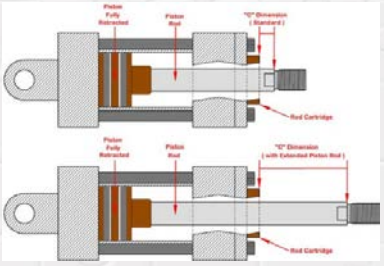
Rule 713 Tail Rods and Extension Piston Rods

- Tail rods and extension piston rods exposed to contact must be guarded pursuant to R 408.10751 to R 408.10754 or by a guardrail system in compliance with General Industry Safety and Health Standard Part 2. "Walking-Working Surfaces," as referenced in R 408.10702, which allows a clearance of **not less than 15**, nor more than 20, **inches** from the fully extended tail rod or extension piston rod.



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Rule 715 Discharge or Exhaust Pipes

- The discharge of an exhaust pipe or boiler blowoff, if exposed to contact, shall be guarded pursuant to R 408.10751 to R 408.10754.

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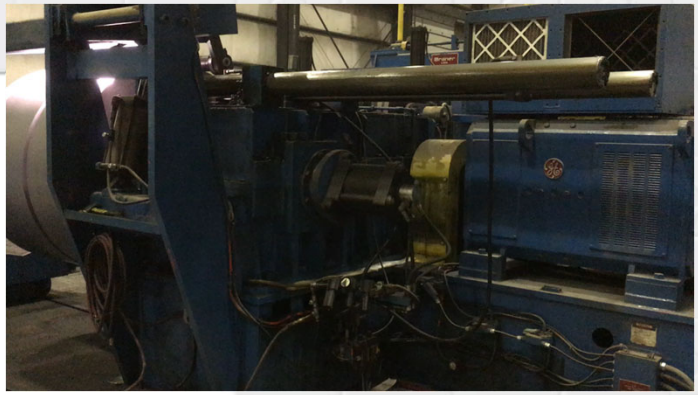
Rule 716 Revolving and Reciprocating Parts

- A revolving or reciprocating part, if exposed to contact, shall be guarded pursuant to R 408.10751 to R 408.10754.*



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Rule 721 Shafts

- A continuous line of shafting shall be secured in position against endwise movement.
- An inclined or vertical shaft will be held in position against endwise trust.
- A projecting shaft end, if exposed to contact, shall be made flush **or** guarded pursuant to R 408.10751 to R 408.10754.

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Rule 721 Shafts (continued)

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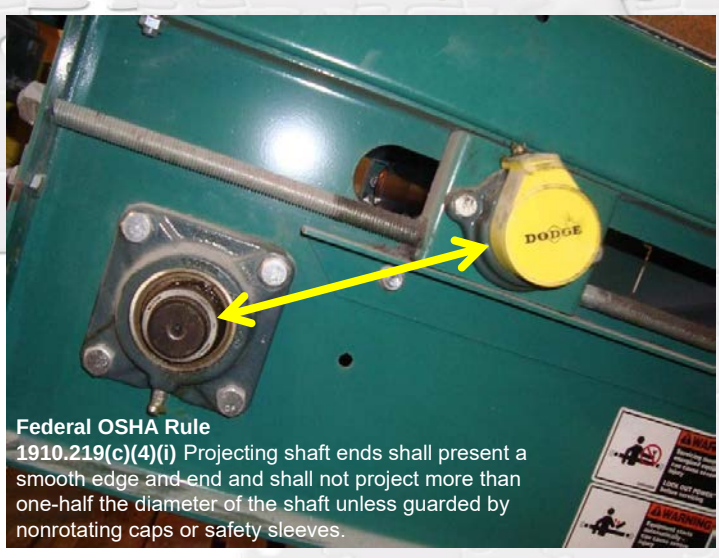
Rule 721 Shafts (continued)



Federal OSHA Rule
1910.219(c)(4)(i) Projecting shaft ends shall present a smooth edge and end and shall not project more than one-half the diameter of the shaft unless guarded by nonrotating caps or safety sleeves.

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Rule 722 Shafting

- Shafting exposed to contact **7 feet or less** above a floor or platform level shall be guarded pursuant to R 408.10751 to R 408.10754.*
- Horizontal shafting extending over a driveway shall be guarded with a trough guard unless it is located **15 feet or more** above the driveway or is a **part of an overhead traveling crane**.

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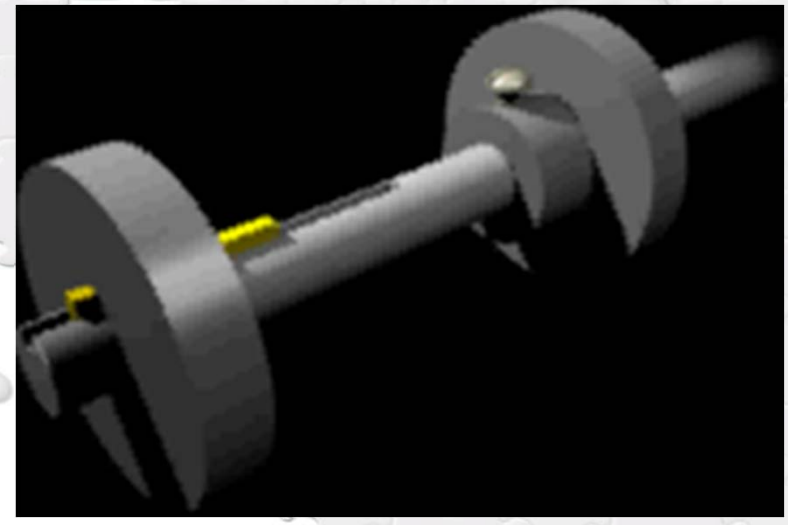
Rule 722 Shafting (continued)



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Rule 722 Shafting (continued)

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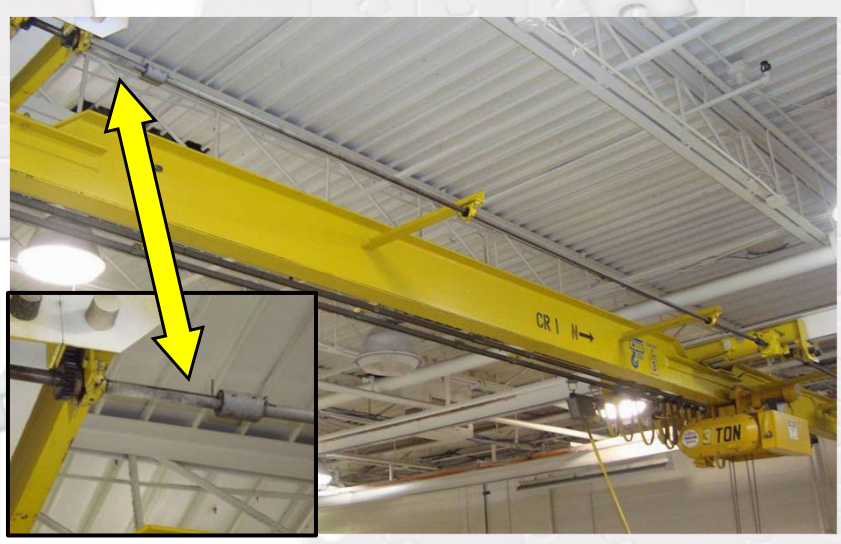
Rule 722 Shafting (continued)



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Rule 722 Shafting (continued)

- Horizontal transmission shafting exposed to contact under benches shall be guarded in 1 of the following ways:
  - Be completely enclosed.
  - Be guarded by a trough guard. The sides of the trough shall come to the underside of the table or, if the shafting is located near a floor, to the floor.
  - Be guarded on exposed sides with a rigid shield guard extending from the underside of the bench top to **2 inches below** the line of shafting.

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Rule 725
Pulley Guards and Guides

- A pulley and a pulley part exposed to contact **7 feet or less** from the floor or platform shall be guarded pursuant to R 408.10751 to R 408.10754.
- If the distance from a pulley to the nearest fixed pulley, clutch, or hanger is **less than the width of the belt** used, a guide shall be provided to prevent the belt from leaving the pulley.
- If there is an overhanging pulley on a line, jack, or countershaft with no bearing between the pulley and the outer end of the shaft, a guide to prevent the belt from running off the pulley shall be provided.

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Rule 726
Pulley Condition and Operation

- A pulley with a defect, including, but not limited to, a crack or a piece broken out, shall not be used.
- A pulley subject to active corrosive conditions shall be of corrosion-resisting material.
- A pulley permanently out of service shall not be allowed to remain on shafting which is in use, **unless** enclosed with a guard pursuant to R 408.10751 to R 408.10754.
- A pulley shall not be operated at more than its designed rim speed.

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Rule 727 Belts

- A belt and pulley that is **7 feet or less** above the floor or platform and that is exposed to contact must be guarded pursuant to R 408.10751 to R 408.10754. **In a power plant or power-development room**, a guardrail system may be used in compliance with General Industry Safety and Health Standard Part 2. “Walking-Working Surfaces,” as referenced in R 408.10702.*

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Rule 727 Belts (continued)

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Rule 727 Belts (continued)

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Rule 727 Belts (continued)

- A horizontal belt **more than 7 feet** above the floor or platform must be guarded for its entire length if located over a passageway or workplace pursuant to R 408.10753 and figure 2 contained in subrule (5) of this rule.

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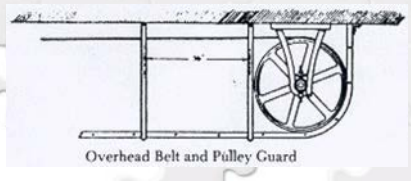
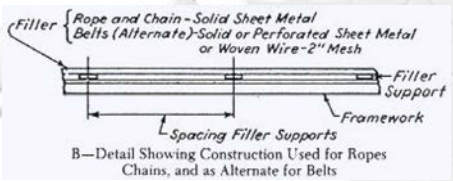
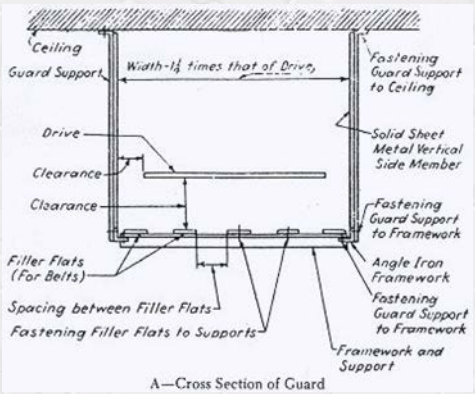
Rule 727 Belts (continued)

- Figure 2 reads as follows:







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Rule 727 Belts (continued)

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Rule 727 Belts (continued)

- A passageway between horizontal belts must have a lower run guarded by a platform that is provided with a guardrail system in compliance with General Industry Safety and Health Standard Part 2. “Walking-Working Surfaces,” as referenced in R 408.10702, and the upper run guarded pursuant to subrule (2) of this rule.

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Rule 727 Belts (continued)

- A vertical or inclined belt running over a lower pulley **more than 7 feet** above the floor or platform and located over a passageway or workplace must be guarded pursuant to subrule (2) of this rule.

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Rule 727 Belts (continued)

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Rule 729
Cone Pulley Belts

- A cone belt and pulley shall be equipped **with a belt shifter** so constructed as to adequately guard the nip-point of the belt and pulley. If the frame of the belt shifter does not adequately guard the nip-point of the belt and pulley, the nip point shall be further protected by means of a guard which extends at least to the top of the largest step of the cone.

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Rule 729
Cone Pulley Belts (continued)

- If the belt is of the endless type or laced with rawhide laces, and **a belt shifter is not desired**, the belt will be considered guarded if the nip-point of the belt and pulley is protected by a nip-point guard which extends at least to the top of the largest step of the cone, and formed to show the contour of the cone in order to give the nip-point of the belt and pulley the maximum protection.

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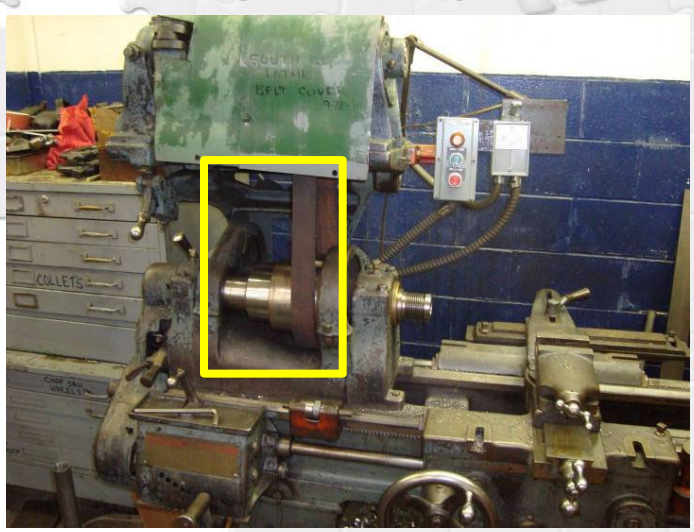
Rule 729
Cone Pulley Belts (continued)



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Rule 729
Cone Pulley Belts (continued)

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Rule 729
Cone Pulley Belts (continued)

- If the cone is located **less than 3 feet** from the floor or working platform, the cone pulley and belt shall be guarded to a **height of 3 feet** regardless of whether the belt is endless or laced with rawhide.

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Rule 730 Belt Tighteners and Counterweights

- A suspended counter balanced belt tightener and its parts shall be provided with a safety cable or device to prevent the tightener from being exposed to contact if the belt breaks or they shall be guarded pursuant to R 408.10751 to R 408.10754.
- A suspended counterweight exposed to contact or a part of a counterweight which could subject an employee to injury shall be guarded pursuant to R 408.10751 to R 408.10754 or shall be provided with a safety cable or device to prevent a fall.

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Rule 731 Gears, Sprockets, and Chain Drives

- Gears, sprockets, and chain drives exposed to contact shall be guarded pursuant to R 408.10751 to R 408.10754. This **does not apply to** hand-operated gear sprockets and chain drives used to adjust machine parts which do not move after hand power is removed.*
- Protection against falling chain or metal belts shall be provided pursuant to R 408.10751 to R 408.10754 where drives extend over a work area or passageway.

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Rule 731 Gears, Sprockets, and Chain Drives (continued)

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Rule 731 Gears, Sprockets, and Chain Drives (continued)

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Rule 732 Openings for Oiling

- If frequent oiling is necessary, openings with hinged or sliding self-closing covers shall be provided. Points not readily accessible shall have remote lubricating means if the lubricant is to be added while machinery is in motion and the oiler would be exposed to contact.

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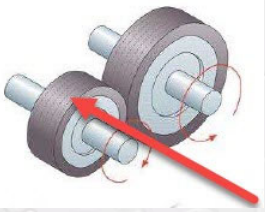
Rule 734
Friction Drives

- The driving points and moving parts of friction drives, if exposed to contact, shall be guarded pursuant to R 408.10751 to R 408.10754.

- **CIRCULAR**
  - FRICTION DRIVES: ARE MADE UP OF TWO OR MORE WHEELS THAT ARE IN CONTACT. THE FIRST WHEEL IS THE PRIMARY DRIVE WHEEL AND THE SECOND IS THE OUTPUT WHEEL.



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Rule 734
Friction Drives (continued)

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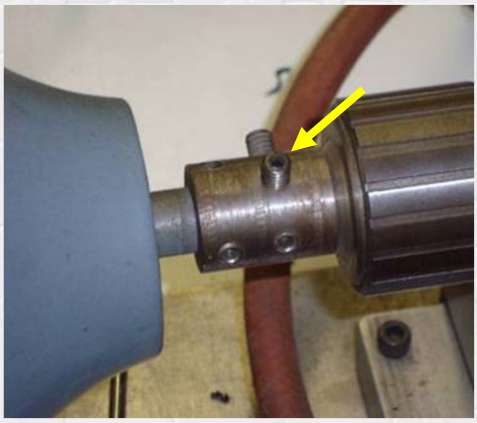
Rule 736
Projections

- Projecting keys, set screws and other projections in revolving parts exposed to contact shall be removed, made flush or guarded. This does not apply to keys or set screws within gear or sprocket casings or other enclosures, nor to keys, set screws or oil cups in hubs of pulleys **less than 20 inches** in diameter if they are within the plane of the rim of the pulley.



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Rule 736
Projections (continued)

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Rule 741
Clutches

- A clutch, cut-off coupling, or clutch pulley having any projecting parts exposed to contact shall be enclosed by a stationary guard constructed pursuant to R 408.10751 to R 408.10754.
- On a line shaft the shifting part of a jaw clutch and the shifting or mechanism part of a friction clutch coupling shall be attached to the driven shaft.

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Rule 741
Clutches (continued)

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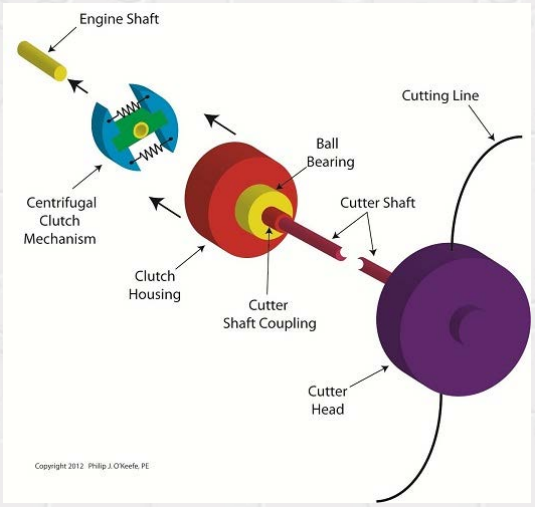
Rule 741
Clutches (continued)



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Rule 743 Belt Shifters

- A tight pulley and a loose pulley shall be equipped with a permanent belt shifter provided with mechanical means to prevent the belt from creeping from the loose to the tight pulley.
- A belt shifter and clutch handle shall be rounded and be located to prevent being exposed to contact, but within easy reach of the operator. If an overhead belt shifter is not directly located over a machine or bench, the handles shall be cut off **7 feet above** floor level.

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Rule 744 Belt Poles, Perches, and Fasteners

- If loose pulleys or idlers are not practicable, belt perches in the form of brackets and rollers shall be used to keep idle belts away from the shafts.
- Belts shifted by hand shall be glued or fastened with leather lacing.

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Rule 751 Design

- The design of a guard shall take into consideration:
  - The nature of protection required of the guard.
  - The possibility of guard failure.
  - The amount of maintenance required on the guard.

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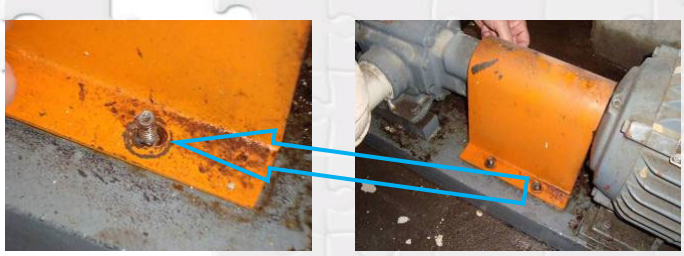
Rule 751
Design (continued)

- In a place where it is necessary to change belts, make adjustments, or apply oil or grease, a guard may have hinged sections or be of a removable design. A guard shall be closed or replaced after servicing.



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Rule 751
Design (continued)

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Rule 752 Construction

- A guard shall be practicable, durable, and effective, and it shall not introduce a new hazard, including, but not limited to, burrs and sharp edges.

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Rule 753 Materials

- Wood guards may be used if the presence of fumes or if manufacturing conditions cause rapid deterioration of metal guards, in construction work, and in locations outdoors if extreme cold or extreme heat makes metal guards and railings undesirable.
- Material sizes and clearances shall be pursuant to table A. See Figure 2, and Appendices A and B.

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Rule 753
Materials (continued)

- Table A reads as follows:

TABLE A
STANDARD MATERIALS AND DIMENSIONS FOR MACHINERY GUARDS

Material	Size and Clearance of Filler Materials: Clearance From Moving Part At All Points (Inches)	Largest Mesh or Opening Allowable B (Inches)	Minimum Gauge (U.S. Standard) Or Thickness
Woven Wire	Under 2 2-4 4-15	3/8 1/2 2	No. 16-1/8 In. No. 16-1/2 No. 12-2
Expanded Metal	Under 4 4-15	1/2 2	No. 18-1/2 In. No. 13-2
Perforated Metal	Under 4 4-15	1/2 2	No. 20-1/2 In. No. 14-2
Sheet Metal	Under 4 4-15	- - -	No. 22 No. 22
Wood Or Metal Strips Crossed	} Under 4 4-15	1/2 2	} 3/4 In. Wood Or No. 16 Metal
Wood Or Metal Strips Not Crossed	} Under 4 4-15	1/2 The Width One Width	
Plywood, Plastic Or Equivalent	Under 4 4-15	- - -	1/4 In. 1/4 In.
Standard Railing	Min. 15 Max. 20	- - -	- - -

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Rule 754 Frames

- If a guard has a frame, the material shall be securely fastened to it.
- The minimum dimensions of materials in the frame of a guard shall be of sufficient strength and rigidity to hold the filler material fastened to it and to give sufficient strength and rigidity in order to provide the desired protection.

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Rule 756 Disk Guards

- A disk guard shall be made of materials specified in table A of R 408.10753 and fastened securely to spokes of pulleys, flywheels or gears. If a possibility of contact with sharp edges of the disk exists, the edge shall be rolled. Lock nuts or washers shall be placed on the unexposed side of the wheel.

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Rule 765 Inspection and Care of Equipment…

- All power-transmission equipment shall be inspected at intervals **not exceeding 60 days** and be kept in good working condition at all times.
- Shafting shall be kept in alignment, free from rust and excess oil or grease.
- Where explosives, explosive dusts, flammable vapors, or flammable liquids exist, the hazard of static sparks from shafting shall be carefully considered.
- Bearings shall be kept in alignment and properly adjusted.

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Rule 765 Inspection and Care of Equipment… (continued)

- Hangers shall be inspected to make certain that all supporting bolts and screws are tight and that supports of hangers boxes are adjusted properly.
- Pulleys shall be kept in proper alignment to prevent belts from running off.
- Inspection shall be made of belts, lacings, and fasteners, and such equipment shall be kept in good repair.

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Case Studies

- Review slides to determine if a rule(s) violation exists.
- GI Part 7 Guards for Power Transmission may be used to determine which rule should be referenced.

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Assessment

- The purpose of this assessment is to validate the knowledge learned in class.
- Passing score of **70%** correct is required.
- Class reference materials/books are not allowed to be used during the assessment.
- Collaboration/discussion with others is not allowed during the assessment.
- Answers can be reviewed after everyone completes and submits their assessment.

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Thank you.

Don't Forget to Take the Survey

MIOSHA
Michigan Occupational Safety and Health Administration

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Part 7. Guards for Power Transmission

Student Resources

MIOSHA Standards:

Part 2. Walking-Working Surfaces

Part 7. Guards for Power Transmission

MIOSHA Instruction:

Horizontal or Vertical Standards – Determining Application

MIOSHA Training Institute (MTI) Resources:

www.michigan.gov/mti

MIOSHA Training Calendar:

www.michigan.gov/mioshatraining

MIOSHA Homepage:

www.michigan.gov/miosha

Michigan Department of Labor and Economic Opportunity
Michigan Occupational Safety and Health Administration
Consultation Education and Training Division
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