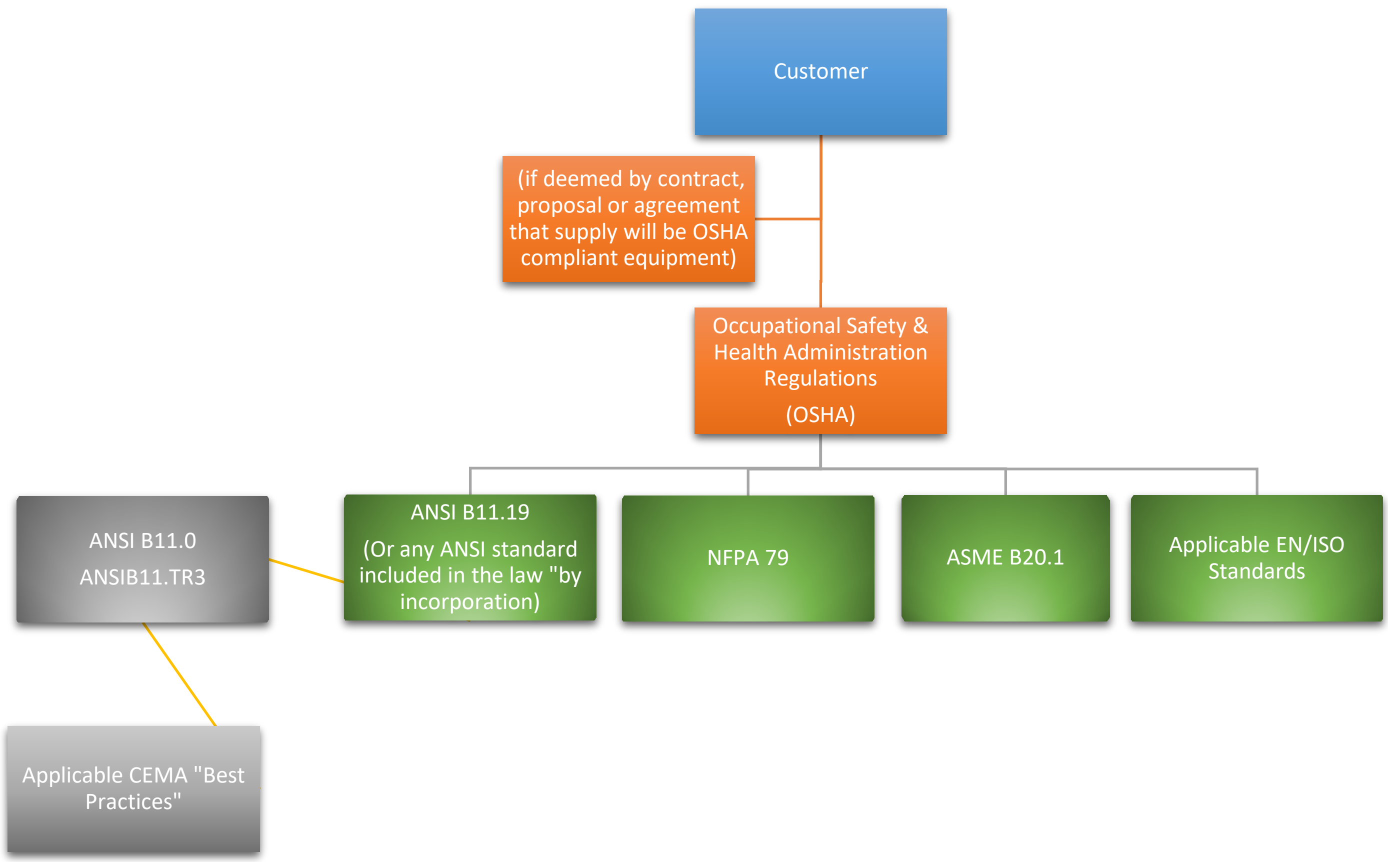
OHSA/ANSI Quick Reference



Contents

Who is Responsible?

The end-user (employer) is ultimately responsible for the safety of its workers and compliance with OSHA regulations. Typically the end user is solely responsible for operating safe machinery and equipment and for ensuring the equipment and machinery they employ meets the requirements of the OSHA Regulations.

If an agreement/contract between the supplier and end-user contains wording or guarantees of compliance to specific OSHA regulations, equipment/safeguarding standards or other, then contractually the supplier would be obligated to fulfill the requirements within the agreement/contract. However, the supplier could not be cited by OSHA for non-compliance on the equipment supplied to the end-user. The end-user would be cited for the infraction and they could then turn to the supplier of the equipment to make any corrections necessary to comply with the OSHA Regulations (dependent upon the agreement between the parties)

Clarification: While it is the case that the end user is responsible for OSHA requirements, in a products liability suit, the supplier, as a manufacturer, can be liable to both the end user and the harmed party if its design or construction of the product creates an unreasonably dangerous condition. Do not imply that the supplier has no liability if the contract with the customer does not indemnify the customer for failure to meet OSHA standards or if the contract is expired.

Relationship Between OSHA Regulations and ANSI (or other) Standards?

OSHA Regulations are the law and can be cited in orders/fines/convictions etc. ANSI standards are voluntary standards written such that they can be used and interpreted like regulations and laws. From the forward of ANSI B11.19:

> *American National Standards are promulgated through ANSI for voluntary use; their existence does not in any respect preclude anyone, whether they have approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards. However, users, distributors, regulatory bodies, certification agencies and others concerned may apply American National Standards as mandatory requirements in commerce and industry.*

The ANSI standard is written in a language that uses terms such as “should” and “shall” such that it can be read as law, and in many respects, particularly when referenced directly from OSHA etc., it can be construed as law. ANSI standards are internationally recognized and developed through a consensus process. Consensus is established when substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made toward resolution. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. The volunteers on these committees are typical made up of people that have a vested interest in the development of machine guarding standards and includes, engineers, end-users, equipment manufacturer's, labour unions, regulatory authorities and general interest.

Additionally, there are two items worth noting from OSHA that that lead you in the direction of using ANSI as compliance standards:

1) **OSHA Instruction CPL-03-00-0019 (Effective Date: 8/13/2015) – "National Emphasis Program on Amputations" (Link)**
   This document is a directive to reduce workplace machinery and equipment hazards National Emphasis Program on Amputations.
   The noted parts of this document are:
   - Appendix A: Machinery and Equipment (2012 (Table R-25*) Combined Amputation Sources - Sources of Amputations: Machinery and Equipment), where conveyors are listed.
   - Appendix B: RELATED ANSI /ASME STANDARDS

     > "OSHA recognizes the value of national consensus standards in terms of useful guidance for employers and employees attempting to comply with specific OSHA standards. OSHA's enforcement policy provides that a violation may be de minimis if an employer complies with a proposed standard or amendment or a consensus standard rather than with the standard in effect at the time of the inspection, and the employer's action clearly provides equal or greater employee protection"

2) **Interpretation Letter from 2003. (Link)**
   The question is as it relates to ISO/IEC standards but there is interesting commentary on ANSI:

   > "In instances where ANSI standards are incorporated into OSHA standards, compliance with the ANSI standard is enforced. However, if the ANSI standards are not part of specific OSHA standards, but compliance with the ANSI standard provides equal or greater employee protection, then complying with the ANSI standard while failing to comply with the specific OSHA regulations would be considered a de minimis violation. In some cases, special situations arise when a specification type OSHA standard is compared with a revised ANSI standard which, having undergone numerous update cycles, has evolved into a performance oriented type standard."

Here are a couple of articles that help to understanding the relationship between ANSI and OSHA:

> Safeguarding - Are ANSI Standards Really Voluntary - ANSI.docx
> Whats the difference between an OSAH Rule and an ANSI Standard - ASSE.doc

Relationship Between OSHA and ANSI Specifically

As noted above, the OSHA regulations are the law and they set out the **minimum** requirements that employers are obligated to meet to ensure the health and safety of their employees. For example, 1910.212(a)(1) – Machine Guarding - "*One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are—barrier guards, two-hand tripping devices, electronic safety devices, etc.*"

And specifically:

> **OSHA 1910.212(a)(3)(ii)**
>
> ***The point of operation of machines whose operation exposes an employee to injury, shall be guarded. The guarding device shall be in conformity with any appropriate standards therefor, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle.***

It does not state how you are to guard it, or specifically with what material etc…, nor does it cite how the guard is to perform. It does point to "guarding device shall be in conformity with any appropriate standards". This is where standards come in to play. ANSI B11.19-2010 – "Performance Requirements for Safeguarding" provides performance requirements for the design, construction, installation, operation and maintenance of the safeguarding (a) Guards; b) Safeguarding devices; c) Awareness devices; d) Safeguarding method) when applied to machines. The standard also provides performance requirements for complementary equipment and measures, safe work procedures, and safety functions.

Guarded by Location:

ANSI B11.19 dictates how to guard a hazard and also illustrates that if a hazard is of sufficient distance away from the person, "guarded by location", then additional guarding is not required. ANSI B11.19, Clause 10.4 – Safe-Location Safeguarding Method provides the means to evaluate whether the hazard is located at such a distance. Generally speaking, if a hazard is 2.5m

(8.2feet *) above the adjacent waking surface, the hazard is considered guarded by location and no additional guarding is required. – See ANSI B11.19, Clause 10.4 and Figure D.10. (starting on page 11 of this document)

** There is a conversion issue happening here. Many U.S. standards are starting to us metric in their documents since they are referenced from ISO. Therefore, we see 2.5m as approximately equivalent to 8 feet, whereas in reality it is not an exact equivalent.*

In short, OSHA requires a hazard to be guarded and ANSI B11.19 provides the minimum performance of a guard/safeguard, requirements for its application, and requirements for its installation.

Included at the end of this document are the direct reference for OSHA 1910.212 [Page 9 & 10] and specific items from ANSI B11.19 [Pages 11 – 17] as it relates to guarding.

Where does Risk Assessment Fit In?

The risk assessment is integral to the overall safety and hazard reduction of the equipment being designed/built/operated or assessed. As shown below, ANSI B11.19 explicitly calls out the need to perform a task based risk assessment to both document the hazards associated with a piece of equipment, and to analyze proposed guarding/safeguarding solutions to confirm an adequate level of risk reduction.

As highlighted in the ANSI B11.19 forward:

> *"A greater emphasis has been placed on risk assessment in an attempt to allow safety solutions other than those meeting requirements contained in clause 6.1 (control reliability). The intent is to maintain a high level of safety performance for safety related functions, but also allow safety solutions that can be reasonably justified through the process of a documented risk assessment that meets the required risk reduction."*

And within the Scope (Clause 1) of the standard:

> *…This standard does not provide the requirements for the selection of the safeguarding for a particular application.*
>
> *(Explanatory: See the appropriate ANSI B11 machine-specific standard or other related machinery safety standard(s) for the requirements for the selection of safeguarding based on specific applications.* ***Selection of the safeguarding requires task and hazard identification, and the application of documented risk assessment and risk reduction of the***

total production system. See ANSI B11.0 for additional information and guidance on risk assessment and risk reduction.)

It also allows for deviation from the requirements of the standard based on careful consideration and documented risk assessments:

> *Any deviation in conforming to a requirement of this standard shall be carefully considered and based on a documented risk assessment to achieve acceptable risk. The reasoning and information concerning any deviation shall be included in the information for operation and maintenance of the machinery.*
>
> *(Explanatory: Alternate safeguarding solutions or a combination of protective measures can provide a best practical solution for a specific application. The user should evaluate the reasoning and the information concerning the deviation to ensure acceptable risk for the specific application. See ANSI B11.0.)*

What About Other Standards?

There are other standards that may be applicable to safeguarding of equipment. These include other ANSI standards (machine specific, such as ANSI/RIA/ISO 10218 for Robots and Robot Systems), ASME Standards (e.g. ASME B20.1 for conveyors), and EN/ISO standards. All three organizations are internationally recognized "standard bodies" that typically administers and coordinates voluntary standards and conformity assessment systems.

In many cases, the individual standards may reference each other, or pull from one another. For instance, ANSI B11.19 references ANSI B11.0 for risk assessment which in turn references ANSI B11.TR3 (technical report) for more specific guidance. Additionally, ANSI B11.19 references a number of EN/ISO standards where information is directly referenced or guidance can be found.

Still, other standards, deal with very specific compliance items. For example, NFPA 79 provides safeguards for industrial machinery to protect operators, equipment, facilities, and work-in-progress from fire and electrical hazards. This standard is referenced in ANSI B11.19 as it pertains to electrical safety/controls etc.

Where does CEMA Fit into This?

CEMA, the Conveyor Equipment Manufacturer's Association, is a group specifically made up of conveyor equipment manufacturers. They publish Technical, Fact Sheets, Safety Information and Best Practices. My interpretation is that CEMA attempts to align the industry and standardize design content for things like roller dimensions, pull equations, etc… and product level designs, to maintain industry standards of design across all manufacturers and promote growth and interchangeability throughout the industry.

They publish a number of “Standard Best Practices”. These are "Industry" guides. There is good information in these Safety Best Practices for issues that may come up and to see what others in the industry are doing, however we would consider these has guidelines only. ANSI B11.19 and other as noted above would take precedence. In fact, in their document “Safety Best Practices Recommendation – CEMA SBP-004 (2015) – Supplemental Guarding for Unit Handling Conveyors”, they directly reference ANSI B11.19 – Performance Criteria for Safeguarding, and CEMA Technical Report 2015-01 “Recommended CEMA Risk Assessment Process (which in turn references ANSI B11.0 for risk assessments).

What is most telling to me is the Disclaimer at the beginning of their documents. This is CEMA’s stance on their position as it relates to conveyor safety

> *The information provided herein is advisory only.*
> *These recommendations provided by CEMA are general in nature and are not intended as a substitute for professional advice. Users should seek the advice, supervision and/or consultation of qualified engineers, safety consultants, and other qualified professionals.*
> *Any use of this publication, or any information contained herein, or any other CEMA publication is made with the agreement and understanding that the user and the user’s company assume full responsibility for the designs, safety, specifications, suitability and adequacy of any conveyor system, system component, mechanical or electrical device designed or manufactured using this information.*
> *The user and the user’s company understand and agree that CEMA, its member companies, its officers, agents and employees are not and shall not be liable in any manner under any theory of liability to anyone for reliance on or use of these recommendations. The user and the user’s companies agree to release, hold harmless and indemnify and defend CEMA, its member companies, successors, assigns, officers, agents and employees from any and all claims of liability, costs, fees (including attorney’s fees), or damages arising in any way out of the use of this information.*
> *CEMA and its member companies, successors, assigns, officers, agents and employees make no representations or warranties whatsoever, either expressed or implied, about the information contained herein, including, but not limited to, representations or warranties that the information and recommendations contained herein conform to any federal, state or local laws, regulations, guidelines or ordinances.*

OSHA 1910.212

- **Part Number:** 1910
- **Part Title:** Occupational Safety and Health Standards
- **Subpart:** O
- **Subpart Title:** Machinery and Machine Guarding
- **Standard Number:** 1910.212
- **Title:** General requirements for all machines.
- **GPO Source:** e-CFR

LINK: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9847&p_table=STANDARDS

Clause
1910.212(a) Machine guarding. **1910.212(a)(1)** Types of guarding. One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by point of operation, ingoing nip points, rotating parts, flying chips and sparks. Examples of guarding methods are-barrier guards, two-hand tripping devices, electronic safety devices, etc. **1910.212(a)(2)** General requirements for machine guards. Guards shall be affixed to the machine where possible and secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself. **1910.212(a)(3)** Point of operation guarding. **1910.212(a)(3)(i)** Point of operation is the area on a machine where work is actually performed upon the material being processed. **1910.212(a)(3)(ii)** The point of operation of machines whose operation exposes an employee to injury, shall be guarded. The guarding device shall be in conformity with any appropriate standards therefor, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle. **1910.212(a)(3)(iii)** Special handtools for placing and removing material shall be such as to permit easy handling of material without the operator placing a hand in the danger zone. Such tools shall not be in lieu of other guarding required by this section, but can only be used to supplement protection provided. **1910.212(a)(3)(iv)** The following are some of the machines which usually require point of operation guarding: **1910.212(a)(3)(iv)(a)**

Guillotine cutters.

1910.212(a)(3)(iv)(b)
Shears.

1910.212(a)(3)(iv)(c)
Alligator shears.

1910.212(a)(3)(iv)(d)
Power presses.

1910.212(a)(3)(iv)(e)
Milling machines.

1910.212(a)(3)(iv)(f)
Power saws.

1910.212(a)(3)(iv)(g)
Jointers.

..1910.212(a)(3)(iv)(h)
1910.212(a)(3)(iv)(h)
Portable power tools.

1910.212(a)(3)(iv)(i)
Forming rolls and calenders.

1910.212(a)(4)
Barrels, containers, and drums. Revolving drums, barrels, and containers shall be guarded by an enclosure which is interlocked with the drive mechanism, so that the barrel, drum, or container cannot revolve unless the guard enclosure is in place.

1910.212(a)(5)
Exposure of blades. When the periphery of the blades of a fan is less than seven (7) feet above the floor or working level, the blades shall be guarded. The guard shall have openings no larger than one-half (1/2) inch.

1910.212(b)
Anchoring fixed machinery. Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

ANSI B11.19, Clause 10.4 and Figure D.10.

LINK: This standard is available through your IHS subscription

Notes about the CLAUSE and EXPLANTORY INFORMATION:
The ANSI standards are constructed such that the left side is the requirement and the right side is explanatory information that has been provided for clarification, expansion etc of the requirement.

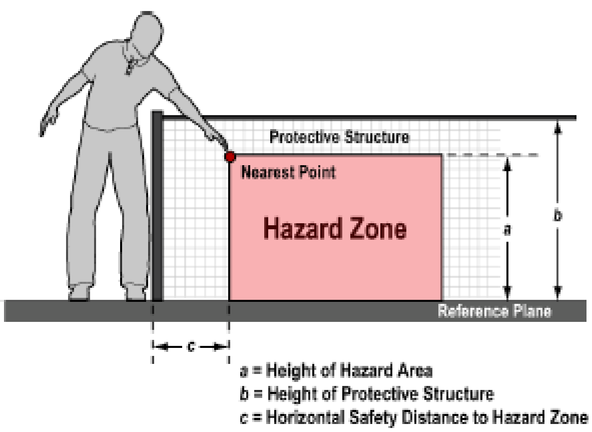
Clause	Explanatory Information
Clause 10.4 – Safe-Location Safeguarding Method Safe-location safeguarding shall meet the following requirements:	For the purposes of ANSI B11.19, safe-location safeguarding incorporates the requirements of the prior ANSI B15.1 clause 3 —Safe Distance‖ and —Safe Location.‖ See ANSI B11.0 for additional information and guidance on safeguarding Mechanical Power Transmission Apparatus. Note: The requirements of ANSI B15.1 have now been incorporated into ANSI B11.0 and ANSI B11.19. Individuals should be made aware of the nature and location of the hazards through the use of awareness device(s) in the vicinity of the hazard.
a) Inadvertent access from a walking or working surface to the hazard shall be prevented by: - vertical distance of sufficient height; - horizontal distance; or - the combination of vertical & horizontal distance. or:	The mechanical power transmission apparatus should be located at least the distance from personnel as that described in Figure D.10 (Annex D).
b) Access to the recognized hazard shall be limited by locating the hazard: - in a room, vault, or similar enclosure; - behind permanent, substantial partitions fencing/railing or screens that comply with appropriate requirements clause 7;	Access to mechanical power transmission apparatus in a vault, room, or closet, or in an area surrounded by a wall, screen or fence that is controlled by lock and key or other approved means is considered to be restricted access. A wall, screen, or fence less than the distances described in Figure D.10 is not considered adequate to prevent access unless other protective measures are provided.
- on an elevated platform where persons cannot come into accidental contact with the hazardous moving parts.	Access to these locations is restricted to trained personnel who are aware of the hazards. These areas are not workstations.

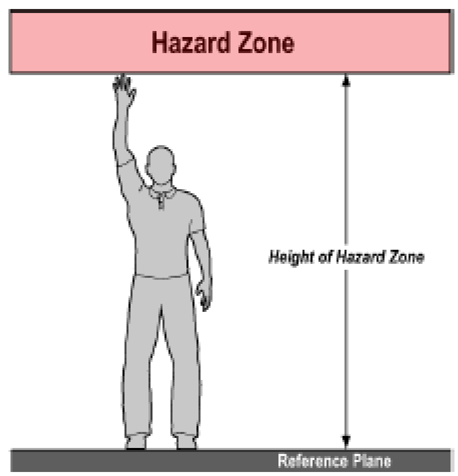
Figure D.10: Location of Guards vs. Distance from hazard in millimeters (inches)

The following values are considered to be minimum reach over distances and may reduce the probability of inadvertent access, but may not prevent intentional access to the hazard (see 9.1 on awareness barriers). Depending on a risk assessment, different set back (safe) distances or structure height may be required. Although the below tables start at a minimum height of a 1000 mm (39”), lower heights may be suitable for certain applications as determined by a risk assessment. See also ISO 13857.

A protective structure can be a guard, awareness barrier, or other physical obstruction (e.g., a part of a machine) which restricts or impedes the movement of an individual toward the hazard. These values are not intended to replace the Dpf values listed in Figures D.1, D.2 and D.3. The recommended distances in the below tables have been derived by making the following assumptions (from ISO 13857):

- the protective structures and any openings in them retain their shape and position;
- recommended distances are measured from the surface restricting the relevant part of the body;
- persons may force parts of the body over protective structures or through openings in an attempt to reach the hazard zone;
- the reference plane is a level at which persons would normally stand, but is not necessarily the floor (e.g., a working platform could be the reference plane);
- there is some contact with the reference plane (climbing and jumping are not included);
- no aids such as chairs or ladders are used to change the reference plane;
- no aids such as rods or tools are used to extend the natural reach of the upper limbs that may reach or become entangled with the hazard.





Reaching over protective structures — Low risk

Source ISO 13857 (2008) - Dimension in millimeters

Height of hazard Zone 2 a	Height of protective structure [1] b									
	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 500	2 700
	Horizontal safety distance to hazard zone c									
2 500	0	0	0	0	0	0	0	0	0	0
2 400	100	100	100	100	100	100	100	100	0	0
2 200	600	600	500	500	400	350	250	0	0	0
2 000	1 100	900	700	600	500	350	0	0	0	0
1 800	1 100	1 000	900	900	600	0	0	0	0	0
1 600	1 300	1 000	900	900	500	0	0	0	0	0
1 400	1 300	1 000	**900**	800	100	0	0	0	0	0
1 200	1 400	1 000	900	500	0	0	0	0	0	0
1 000	1 400	1 000	900	300	0	0	0	0	0	0
800	1 300	900	600	0	0	0	0	0	0	0
600	1 200	500	0	0	0	0	0	0	0	0
400	1 200	300	0	0	0	0	0	0	0	0
200	1 100	200	0	0	0	0	0	0	0	0
0	1 100	500	0	0	0	0	0	0	0	0

[1] Protective structures less than 1 000 mm (39") in height are not included because they do not sufficiently restrict movement of the body.

[2] For Safe Location Safeguarding (clause 10.4a) the hazard is 2500 mm or greater vertical distance above reference plan (e.g., floor).

Reaching over protective structures — High risk

Source ISO 13857 (2008) - Dimension in millimeters

Height of hazard Zone 2 a	Height of protective structure [1] b									
	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 500	2 700
	Horizontal safety distance to hazard zone c									
2 700	0	0	0	0	0	0	0	0	0	0
2 600	900	800	700	600	600	500	400	300	100	0
2 400	1 100	1 000	900	800	700	600	400	300	100	0
2 200	1 300	1 200	1 000	900	800	600	400	300	0	0
2 000	1 400	1 300	1 100	900	800	600	400	0	0	0
1 800	1 500	1 400	1 100	900	800	600	0	0	0	0
1 600	1 500	1 400	1 100	900	800	500	0	0	0	0
1 400	1 500	1 400	1 100	900	800	0	0	0	0	0
1 200	1 500	1 400	1 100	900	700	0	0	0	0	0
1 000	1 500	1 400	1 000	800	0	0	0	0	0	0
800	1 500	1 300	900	600	0	0	0	0	0	0
600	1 400	1 300	800	0	0	0	0	0	0	0
400	1 400	1 200	400	0	0	0	0	0	0	0
200	1 200	900	0	0	0	0	0	0	0	0
0	1 100	500	0	0	0	0	0	0	0	0

[1] Protective structures less than 1 000 mm (39") in height are not included because they do not sufficiently restrict movement of the body.
Protective structures lower than 1 400 mm (55") should not be used without additional safety measures.

[2] For Safe Location Safeguarding (clause 10.4a) the hazard is 2700 mm or greater vertical distance above reference plan (e.g., floor).

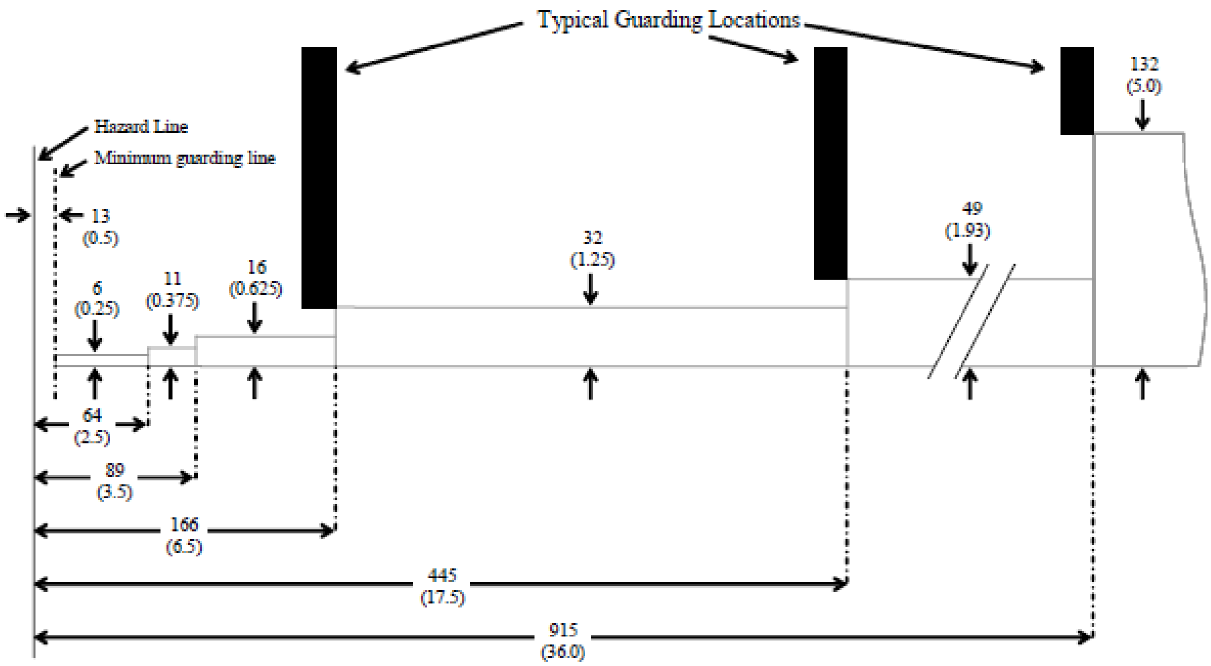
Clause	Explanatory Information
7 Guards: fixed, adjustable, and Interlocked Fixed, adjustable, and interlocked guards shall meet the applicable requirements of clause 6.	
7.1 Design and construction **7.1.1** Material used in the construction of guards shall be of such design and strength as to protect individuals from identified hazards.	***E7.1.1*** The selection of the guard material (transparent or opaque) should take into account both the operational/performance characteristics as well as the applicable environmental factors which may degrade its strength (including but not limited to chemicals, UV, temperature, radiation etc).
7.1.2 Guards shall be free of sharp edges, burrs, slag welds, fasteners, or other hazards that may injure individuals when handling, removing or using the guards or equipment.	
7.1.3 Handles placed on guards shall be secured to the guard so as not to create a pinch point between the handles and the guard, frame or machine.	
7.1.4 The design and construction of the guard shall ensure that individuals cannot reach the hazard by reaching over, under, around, or through the guard.	***E7.1.4*** Other guards, safeguarding devices or methods may be used in conjunction with guards to accomplish this requirement. The safeguarding supplier should provide instructions to the user for the proper installation and use of the guard. Guard openings should conform to Figure D.9 (Annex D). Additional methods might be used as determined by the supporting risk assessment documentation. See also ISO 13857.
7.1.5 Guards shall be designed and constructed so as to ensure ease of use.	***E7.1.5*** Guards that are burdensome (i.e., overly large, heavy or cumbersome) to personnel may discourage proper use.
7.1.6 The guard shall be designed and constructed to provide visibility of the hazard zone appropriate to the particular operation	***E7.1.5*** Where visibility of the operation is required, appropriate materials and color for the device should be selected. For example: • the perforated material or wire mesh should provide adequate open viewing area; • the color should be darker than the area observed to enhance visibility.
7.1.7 Transparent guards shall provide the appropriate level of protection as determined by the risk assessment.	Vision (viewing) panels, when used as safeguarding are considered to be transparent guards. The appropriate level of protection can be achieved by the same or equivalent level of protection as the rest of the guarding by: • meeting minimum strength expectations; or • using other techniques (e.g., mirrors or vision based monitors) to provide visibility of

Clause	Explanatory Information
	the application.
7.1.8 The supplier shall provide a maintenance or replacement schedule or criteria to determine transparent guard replacement in their information for use.	***E7.1.5.1*** Transparent guards may deteriorate over time. The rate of deterioration is influenced by a number of variables, including but not limited to: • use; • mass and velocity of chips / swarf; • exposure to chemicals; • ultraviolet light; • temperature; • material used; • incorrect installation; • age. See Annex E.
7.1.9 Interlocked guards shall be designed and constructed to meet the following additional requirements: a) Interlock devices used in conjunction with guards shall be specifically designed and constructed for use in safeguarding applications	***E7.1.6*** See 7.1.1. a) Some electrical interlock devices increase reliability of operation through the use of positive opening contacts that are forced open by the insertion or removal of the interlock actuator by nonresilient (non-spring) members. There are similar devices available for fluid power interlocking. The use of two interlock devices that are checked by electrical or fluid power circuits for proper operation can also greatly increase the reliability of the interlock function. See also, Annex C. Interlocks should be designed to discourage the capability to easily bypass the interlock with readily available items such as tape, pieces of metal, screws, tools, etc. Some interlock devices use special keys, trapped keys or actuators that make the interlock more difficult to bypass. There are also interlocking devices that physically obstruct or shield the interlock with the guard open, and others that use electrical, mechanical, magnetic, or optical coding. Guard locking devices have various holding (retention) force ratings and should be sized appropriately for the application.
b) Guard locking devices, when used, shall prevent the guard from being opened and shall prevent access to the hazard until the command has been given to release the guard. The risk assessment shall determine the need for a means to unlock the guard locking device or otherwise provide a means of egress from inside the safeguarded area.	There are two typical types of guard locking devices: • —Power (energy)-to-release‖ requires power (energy) during the unlock sequence. A loss of power will prevent these devices from opening, which may require a manual means to unlock the device. • —Power (energy)-to-lock‖ requires continuous power to lock the guard. These devices allow

Clause	Explanatory Information
c) Interlock blocking devices, when used, shall prevent energizing the safety related circuit by securing or locking in an open position. Components used as interlock blocking devices shall not allow the interlock guard to be secured or locked in a closed position.	immediate access if power (energy) is lost. This type is not typically used where the hazard is not immediately eliminated with the loss of power (energy) to the locking device. c) A mechanical device, capable of either being locked or otherwise secured in a position, used to physically block or hold the actuator of an interlock device to prevent its actuating or engaging the interlock device. This reduces the probability of an individual being trapped inside the hazardous area. Interlock blocking devices should not be confused with and are not intended to preclude the use of guard locking and trapped key devices. Interlock blocking devices can be used in conjunction with guard locking and trapped key devices.

Figure D.9a: Location of Guards vs Slotted Openings; Distance from hazard in millimeters (inches)

Figure D.9a: Location of Guards vs Slotted Openings; Distance from hazard in millimeters (inches)



Maximum Guard slotted openings vs. Distance from Hazard Zone in millimeters (inches)

As a function of gap size				As a function of distance			
Known Gap		Minimum Distance		Known Distance		Maximum Gap	
0 – 6	(0 – 0.250)	13	(0.5)	< 13	(< 0.5)	Not permitted	
6.1 – 11	(0.251 – 0.375)	64	(2.5)	13 – 63.9	(0.5 – 2.49)	6	(0.25)
11.1 – 16	(0.376 – 0.625)	89	(3.5)	64 – 88.9	(2.5 – 3.49)	11	(0.375)
16.1 – 32	(0.626 – 1.250)	166	(6.5)	89 – 165.9	(3.5 – 6.49)	16	(0.625)
32.1 – 49	(1.251 – 1.875)	445	(17.5)	166 – 444.9	(6.5 – 17.49)	32	(1.25)
49.1 – 132	(1.876 – 5.0)	915	(36.0)	445 – 914.9	(17.5 – 35.99)	49	(1.875)
> 132	(> 5.0)	See Note below		≥ 915	(≥ 36.0)	See Note below	

NOTE: For guard openings greater than 132mm (5.0"), a risk assessment must determine the appropriate distance from the hazard based on the guard design and human anthropometrics, or see Figure D-10 (reach over distance). These values are not intended to replace the Dpf values listed in Figures D.1, D.2 and D.3.

Based on data presented in *Applied Ergonomics*, Vol. 26, No 22, p.p. 141-145, *A Review of Machine-Guarding Recommendations*, Donald R. Vaillancourt & Stover H. Snook, The Liberty Mutual Research Center for Safety and Health; and Standard Drawing 2063-2, ©1998 Liberty Mutual Group. Used with permission.